DOCUMENT RESUME

ED 462 919	IR 021 074
TITLE	Pacific Telecommunications Council Annual Conference Proceedings (21st, Honolulu, Hawaii, January 18-20, 1999).
INSTITUTION	Pacific Telecommunications Council, Honolulu, HI.
PUB DATE	1999-01-00
NOTE	1545p.; For the 1998 proceedings, see ED 419 488. Some papers and abstracts are not available from ERIC. Some figures may not reproduce clearly.
AVAILABLE FROM	For full text: http://web.ptc.org/library/proceedings/PTC99/index.html.
PUB TYPE	Collected Works - Proceedings (021)
EDRS PRICE	MF13/PC62 Plus Postage.
DESCRIPTORS	Communications Satellites; *Computer Networks; Developing Nations; Distance Education; Foreign Countries; *Information Networks; *Information Services; *Information Technology; Policy Formation; Technological Advancement; *Telecommunications
IDENTIFIERS	Pacific Region; United States

ABSTRACT

This proceedings of the 1999 conference of the Pacific Telecommunications Council contains 134 papers divided into the following topical areas: (1) Internet, including business developments, telephony, commerce, country developments in the Asia-Pacific region, Internet deployment, and Internetworking technology; (2) policy/regulatory, including country studies, competition, and broadcast; (3) technology, including CDMA (Code Division Multiple Access), network planning, submarine cables, radio standards, transmission; (4) socio-economic issues, including strategies, rural issues, universal service, regional development, and country studies; (5) applications, including new technologies, tele-education, distance education, tele-medicine, the U.S. higher education market, and finance; and (6) satellites, including GMPCS (Global Mobile Personal Communications by Satellite), mobile satellites, technical issues, and new applications. A listing of papers by day or by author is also available. (Most papers contain references.) (MES)

Pacific Telecommunications Council Annual Conference Proceedings
(21st, Honolulu, Hawaii, January 18-20, 1999)

PTC'99

PTC99 Info

Welcome
Registration
- PTC99
- Hotel
- Travel Info
Registrants List
Sponsors
Proceedings
PTC Information

Meeting Events

Agenda At-A-Glance
Panels, Workshops, etc.
Plenary Sessions
Program by Author
Program by Day
Program by Topic
Super Sessions

Exhibit Details

PTC99 Exhibitors

Floorplans

Exhibit Area
Hilton Hawaiian Village

PTC99 Photos

Monday
Tuesday
Wednesday
Exhibitors

PTC98 Photos

Opening Plenary
Monday
Tuesday
Wednesday
Exhibitors

Contact Us
PTC home page

PLANET PTC

ORACLE

HUGHES SPACE & COMMUNICATIONS

GST HAWAII ONLINE

COMPAQ

PTC'99 Conference Proceedings

To view PTC'99 Proceedings, please click on the links below and then click on the paper's title.

- Proceedings by Topic
- Proceedings by Day
- Proceeding by Author

PTC'99 Delegates will automatically receive CD-ROM proceedings 6-8 weeks after the conference. CD-ROM proceedings may also be purchased by e-mailing an inquiry to ptc99@ptc.org

PTC'99 Concurrent Sessions Listing By Topic

Internet Policy/Regulatory Technology Socio/Economic Applications Satellites Search Proceedings

To view the proceedings, click on the author or topic.

Internet

M 1.1 Business Developments
Location: Tapa I
Chair: JAGDISH RAO, Consultant, USA

- **M.1.1.1**
  New Opportunities and Challenges To Electronic Commerce in The Cross Border Environment: Interconnection of Electronic Commerce Test-Beds Project in the Asia Pacific Region
  MUTSUYA ASANO, Chair of Executive Board of MultiMedia Pilot Project Consortium in the Telecom Services Association in Japan, Japan
- **M.1.1.2**
  Electronic Commerce in APEC: Taxes, Tariffs and Equity
  RICHARD D. TAYLOR, Palmer Chair of Telecom Studies, Pennsylvania State University, USA
- **M.1.1.3**
  From Broadening Bandwidth to Broadening the Imagination
  NEIL TAGARE, Chairman, CTR Group, USA
- **M.1.1.4**
  Internet Content Industry: Current Market Status & Strategies
  MIN-ZHEONG SONG, Korea Telecom, Republic of Korea

M 2.1 Telephony
Location: Tapa I
Chair: JAMES HEBERLE, Vice President, Sales and Marketing, MTT Inc., USA

- **M.2.1.1**
  Integrated Internet Digital Networks: The Post-Convergence, Pure-IP Network Model
  GEORGE E. DARBY, Registered Patent Attorney, President, Teleport Asia, USA
- **M.2.1.2**
  Network Telephony: The NSP Perspectives
  ROBERT W. HARBISON, Chief Technology Officer, StarVox Inc., USA
- **M.2.1.3**
  How a Carrier Can Offer Global IP Service Without Owning Equipment or Having Global Bi-lateral Agreements
  STEVEN OTT, Vice President of Global Sales, ITXC Corporation, USA
- **M.2.1.4**
  PSTN and Internet Convergence for Telephony: Market Opportunity for Carriers in the Asia Pacific Region
  HEIDI BERSIN, Vice President-Marketing, Clarent Corporation, USA

T 1.1 E-Commerce
Location: Tapa I
Chair: DAN WEDEMEYER, Professor, Department of Communications, University of Hawaii at Manoa, USA

- **T.1.1.1**
  The Use of Electronic Commerce by Small Business
  SUPRIYA SINGH, Senior Research Fellow, Center for International Research on Communication and Information Technologies (CIRCIT), Australia
- **T.1.1.2**
  The E-Commerce Hosting Opportunity: Building, Managing and Marketing a High-Quality E-Commerce Solution
  JEFF EDWARDS, E-Commerce Segment Manager, Compaq Computer Corporation, USA
- **T.1.1.3**
  Electronic Commerce Between Retailers & Suppliers: What Influences The Adoption & Use of Information Technologies?
  ALICE P. CHAN, Assistant Professor, Department of Communication, Cornell University, USA
- **T.1.1.4**
  Monopoly Infrastructure: A Trade Barrier to Electronic Commerce
  KEVIN HARTMAN, Deputy, International Communications Program, Center for Strategic and International Studies, USA

T 2.1 Internet Country Developments in Asia-Pacific
Location: Tapa I
Chair: KAZU YOZAWA, Vice President, NTT-America, Japan

- **T.2.1.1**
  Internet Coverage in Developing Countries of Asia
  GEOFF LONG, Ph.D Candidate, Southern Cross University, Australia
- **T.2.1.2**
  Internet Growth, Economic Development and Political Change in Malaysia, China, and Singapore
  JOSHUA GORDON, Degree Fellow; MEHEROO JUSSAWALLA, Emeritus Research Fellow, East-West Center; USA
- **T.2.1.3**
  Development of Internet Services in India
  YOGESHWAR LAL AGARWAL, Executive Director, HFCL Group International Division, India
- **T.2.1.4**
  Trends in Asia-Pacific Internet Communications
  MATTHEW P. DOVENS, Director, International Internet Marketing, Cable & Wireless, USA

W 1.1 Internet Deployment
Location: Tapa I
Chair: DAVID LASSNER, Director of Information Technology, Information Technology Services, University of Hawaii, USA

- **W.1.1.1**
  The Potential Regulatory and Universal Service Consequences of Internet Balkanization
  ROBERT M. FRIEDEN, Professor of Telecommunications, Pennsylvania State University, USA
- **W.1.1.2**
  Data Exchanges and Peering in an Age of Competition
  ERIC LEE, Public Policy Director, Commercial Internet Exchange, USA
- **W.1.1.3**
  Monitoring the Effective Use of Online Services
  JOHN BURKE, Director; ROSS KELSO; SARAH MILLER, Researcher; SUPRIYA SINGH, Senior Research Fellow; Centre for International Research on Communication and Information Technologies (CIRCIT), Australia
- **W.1.1.4**
  The Role of the Private Premium Network (Overnets) in the Emerging Global Infrastructure
  RON HIGGINS, Founder and Chairman, Digital Island, USA

W 2.1 Internetworking Technology

Location: Tapa I
Chair: PHILIP BOSSERT, President and Senior Consultant, Strategic Information Solutions Inc., USA

- **W.2.1.1**
  Separation of IP Routing and Forwarding via Tag Switching and MultiProtocol Label Switching
  TOM DOWNEY, Director of Product Marketing, Cisco Systems, Inc., USA
- **W.2.1.2**
  On Pricing Scheme and Traffic Monitoring Method in ATM Networks
  ATSUO HATONO, Public Sector Systems, Information Systems Division and TADASHI TAMAOKI, Telecommunications Division, Hitachi, Ltd., Japan
- **W.2.1.3**
  Environment Adaptive Service Using Dynamic Directory
  YASUNARI KISHIMOTO, Research Engineer; TERUHIRO KUBOTA, Senior Research Engineer, NTT Information and Communication Systems Laboratories, Japan
- **W.2.1.4**
  ACTIVE NETWORKS- The Integration of Directory Services with Networking for User-Centric Telecommunications
  KURT DAHM and ALAIN MIGNOT, Service Provider Ind. Manager , Cisco Systems Inc., Australia

---

Policy/Regulatory

M 1.2 Country Studies

Location: South Pacific I and II
Chair: TBA

- **M.1.2.1**
  The Demise of Local Loop Power in Australia?
  JANE FORSTER, Partner and CAROLINE LOVELL, Senior Solicitor, Clayton Utz, Australia
- **M.1.2.2**
  Convergence of Telecommunications Technologies and Its Impacts on Universal Service Policy in Taiwan
  CHUNG-CHUAN YANG, Associate Professor, Department of Marketing and Distribution Management, National Kaohsiung First University of Science and Technology, Taiwan
- **M.1.2.3**
  Foreign Ownership Regulation in Korean Telecom Market
  JAE-HO BYUN, Senior Researcher and PANG-RYONG KIM, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea
- **M.1.2.4**
  Taiwan's Telecommunications Liberalization and It's Current Status of Implementation
  POLI LIU, Taiwan Institute of Economic Research, Japan and TOSHIO KOSUGE, Professor, University of ElectroComms, Japan

M 2.2 Competition

Location: South Pacific I and II
Chair: JAMES G. SAVAGE, Vice President, Public Affairs—International, GTE Service Corporation, USA

- **M.2.2.1**
  Local Service Competition: Breaking the Bottleneck
  PETER FALSHAW, Director of Consulting and JIM HOLMES, Principal Consultant, Ovum Pty Ltd, Australia
- **M.2.2.2**
  The WTO Agreement on Basic Telecommunications Services: How is it Affecting the Pacific Rim?
  THOMAS K. CROWE, Attorney and ELIZABETH HOLOWINSKI, Associate, Law Offices of Thomas K. Crowe, USA M.
- **2.2.3**
  Can the Competitive Model of Telecommunications Governance Deliver the Goods?
  MICHAEL JANIGAN, Executive Director and General Counsel of Public Interest Advocacy Centre, Canada
- **M.2.2.4**
  Organisational Adaption Under Privatisation and Liberalisation
  STEFAN WEIGAND, Head of Strategy and Organisation Group, Detecon Gmbtt, Germany and ABDUL RAUF PARKER, Manager, Corporate Planning, Q-Tel, Qatar

T 1.2 Policy
Location: South Pacific I and II
Chair: SALLYE CLARK, Director, International and Government Affairs, Teledesic LLC, USA

- T.1.2.1
  The Information Policy Maze
  DIANNE NORTHFIELD, Research Fellow, Center for International Research on Communication and Information Technolgies-CIRCIT, Australia
- T.1.2.2
  New Governments throughout Asia Refocus Telecommunications Policy: The Quest to Overcome "Information Apartheid"
  CHARLES DODGSON, Editor, Telenews Asia, Australia
- T.1.2.3
  An Analysis of the Australian PCS Auction(s)
  REG COUTTS, Professor, Director, Centre for Telecommunications Information Networking (CTIN), University of Adelaide, Australia
- T.1.2.4
  Internet Connectivity: Open Competition in the Face of Commercial Expansion
  BERNADETTE JEW, Sr. Associate; ROB NICHOLLS, Consultant, Convergence Solutions; and MICHAEL REEDE, Partner, Gilbert & Tobin, Australia

W 1.2 Broadcast: Country Studies
Location: South Pacific I and II
Opening : ROBERT WU, Marketing Director, Associates and Wu, LLC, USA Chair and Speaker:

- **W.1.2.1**
  Development of Foreign Investment
  JAY HU, Managing Director, United States Information Technology Office (USITO), People's Republic of China
- **W.1.2.2**
  Business Strategies that work with China and Socially Responsible Telecom Business Practices
  RICHARD FIGUEROA, Chairman and Chief Executive Officer, Golden Thread Communications, USA
- **W.1.2.3**
  Opportunities for Telecommunication Companies in the Rapid Development of Chinese Internet and Regulatory Issues Regarding these Opportunities
  YUN TAO, Vice President, Cenpok InterCom Technology Company, People's Republic of China
- **W.1.2.4**
  Current Status of Chinese Telecommunications Markets and Technology and Regulatory Policies
  LI ZHENPING, General Manager, United Telecommunications Corporation Tianjin Branch, People's Republic of China

W 2.2 Policy-Regulatory
Location: South Pacific I and II
Chair: MICHAEL GERTLER, Legal and Regulatory Consultant, Australia

- **W.2.2.1**
  Anti-trust Considerations of Telecommunication Market in Korea
  KYUNG-HAN SOHN, Attorney at Law, Aram International Law Offices, Republic of Korea
- **W.2.2.2**
  The Philippine Information Infrastructure (PII): A Framework for Development
  Department of Transportation and Communications (DOTC), Republic of the Philippines and CD Castro Consultancy, Inc., Philippines
- **W.2.2.3**
  Fixed Network Market Opening: Taiwan's Catch-Up Plan for Telecom Liberalization
  LAWRENCE LIU, Counselor, Lee & Li Attorneys at Law, Taiwan

  Presented by: JONG WANG, Lee & Li Attorneys At Law, Taiwan

- **W.2.2.4**
  Direct Broadcast TV in Taiwan Whither Cable TV?
  DAVID MCNEILL, Commercial Officer, American Institute in Taiwan, Taiwan

---

Technology

M 1.3 CDMA
Location: Honolulu Suite
Chair: EIJI HAYASHI, Engineering Advisor, NEC Corporation, Japan

- **M.1.3.1**
  CDMA Network and Technoloby Evolution
  JAY HEMMADY, Technical Manager, Flexent MSC Architecture, AMPS/PCS Wireless Networks and JERRY E. ROG, Member of Technical Staff-Flexent MSC Architecture, AMPS/PCS Wireless Networks, Lucent Technologies, USA
- **M.1.3.2**
  The Configuration Management for the Cellular Networks
  KAP-DAE AHN, Associate Research Engineer; NAE-HEE KIM, Software Engineer; HYUNG-SUP KIM; and YOSUB KIM, Network Management Center, SK Telecom Central R&D Center, Republic of Korea
- **M.1.3.3**
  Interactive Services Using SMS in the CDMA Network
  Hyun-Wook Kim, Research Engineer; YEON-KYU KIM, Research Engineer, SUNG-BUM LEE, Research Engineer; SK Telecom Central R&D Center, Republic of Korea
- **M.1.3.4**
  Speech Quality Measurement in a CDMA Cellular Network
  KWANG-HOON KIM, Researcher; YOUNG-RUL KIM, Senior Researcher; SUNG-HEE SEO, Senior Researcher, JOO-WAN KIM, Master Researcher, SK Telecom Central R&D Center, Republic of Korea

M 2.3 Network Planning Panel
Location: Honolulu Suites
Chair: DUYCK VAN GORDER, President, Network Technologies International, USA

- **M.2.3.1**
  Netplan Software: Design and Optimization of the Intelligent Network for IN and AIN Services
  MARIO PIETROGRANDE, Consultant, NETPLAN, USA
- **M.2.3.2**
  Growing Impact of Data Communications on Public Networks
  MARCO BURGASSI, CSELT (Telecom Italia), Italy
- **M.2.3.3**
  Meeting Diverse Market Demands
  EMILY THATCHER, GCI, USA
- **M.2.3.4**
  International Network Planning
  PHIL MURPHY, Telstra, Australia

T 1.3 Submarine Cables I
Location: Honolulu Suites
Chair: RAYNALD LECONTE, Director, Submarine Systems, France Telecom, France

- **T.1.3.1**
  Prospects for the South Pacific Transit Undersea Cable
  EDUARDO SARAVIA, Director of International Fiber Optic Cables, CTC Mundo and ROBERTO COFRE, Head of Fibre Optic Section International, ENTEL Chile, Chile
- **T.1.3.2**
  Submarine Optical Fiber Cable Systems...Answering the Global Demands for Connectivity and Capacity Expansion...
  OSAMU HARADA, Senior Manager, Submarine Cable System Division and YASUHIRO AOKI, NEC Corporation, Japan
- **T.1.3.3**
  Beating The Bandwidth Bottleneck: How Subsea Cables can Support E-Commerce between Asia & Europe
  OWEN BEST, Vice President-Asia Pacific, FLAG Telecom, United Kingdom
- **T.1.3.4**
  The Submarine Cable Networks Industry Shifts Gears
  JEAN GODELUCK, Vice President, Marketing & Contracting, Alcatel Submarine Networks, United Kingdom

T 2.3 Submarine Cable II
Location: Honolulu Suites
Chair: DONALD J. SCHROEDER, President and CEO, Neptune Communications LLC, USA

- **T.2.3.1**
  Telecom Reform and the Resultant Evolution of New Product Offerings in the Undersea Cable Arena
  LISA S. DADOURIS, Director of Business Development, Global Crossing Development Co., USA
- **T.2.3.2**
  Southern Cross Cable Network- A Sponsor's Perspective
  CHARLES JARVIE, International Business Development Manager, Telecom Corporationof New Zealand, New Zealand
- **T.2.3.3**
  Terabit / sec Undersea Fiber Optic Cable Networks
  PATRICK R. TRISCHITTA, Director, Product Management and Technical Marketing, Tyco Submarine Systems Ltd., USA
- **T.2.3.4**
  Meeting the Challenge- The Installation, Repair and Maintenance of Undersea Fibre Optic Systems
  MALCOLM JOHNSTON, Sales & Marketing Director, Cable & Wireless Global Marine, United Kingdom

W 1.3 Radio Standards
Location: Honolulu Suites
Chair: EDWARD M. RONEY, Vice President and Director of Standards and Technology Transfer, Motorola, Inc. and Chairman of ANSI Third Generation Adhoc Committee, USA Standards are evolving from the current second generation cellular telephony standards GSM, CDMA, etc. to the next generation of wireless communications. The new "Third Generation" standards now being developed extend the capabilities further by increasing data speed by orders of magnitude, supporting multimedia and high-speed internet access. This session will examine how this important transition is being led by standards organizations throughout the world in a new paradigm of global telecommunications standards development.

- **W.1.3.1**
  AKIO SASAKI, Director of Association of Radio Industries and Businesses, Japan
- **W.1.3.2**
  KARL-HEINZ ROSENBROCK, Director of European Telecommunications Standards Institute, France
- **W.1.3.3**
  ESHWAR PITTAMPALLI, Technology Director, Lucent Technologies and Chairman of TIA TR-45 Standards Committee, USA
- **W.1.3.4**
  NOBUHIRO HORISAKI, Executive Managing Director, The Telecommunications Technology Committee (TTC), Japan
- **W.1.3.5**
  ASOK CHATTERJEE, Vice President, Technology of ADC Telecommunications and Chairman of Standards Committee T1P1, USA

W 2.3 Transmission
Location: Honolulu Suites
Chair: ED WALVICK, Senior Consultant, San Francisco Consulting Group, USA

- **W.2.3.1**
  Multimedia for the Masses Market, DSL Technology Maximizing the Existine Infrastructure
  JEFF WALDHUTER, Director, Technology and Engineering, Bell Atlantic, USA
- **W.2.3.2**
  Perspectives on the Communication Network for the ITS Service
  YEONGKWON KIM, Senior Member of Technical Staff; SOONG BOK LEE, Managing Director, Wireless Communications Research Laboratories, Korea Telecom, Republic of Korea
- **W.2.3.3**
  B-ISDN Field Trial in Thailand
  PANSAK ARPAKAJORN, Director, Switching Engineering Technic Division, Telephone Organization of Thailand, Thailand
- **W.2.3.4**
  A Practical View of Network Evolution
  GRANT LENAHAN, Executive Director, NGN Solution Architecture, Bellcore, USA

Socio/Economic

M 1.4 Strategies
Location: South Pacific III and IV
Chair: YASUHIKO KAWASUMI, General Manager, Corporate Planning Division, Japan Telecom Company, Ltd., Japan

- **M.1.4.1**
  Telecom Mergers & Acquisitions Following the Asian Financial Crisis
  GLENN S. GERSTELL, Partner, Milbank, Tweed, Hadley & McCloy, USA
- **M.1.4.2**
  A Compatibility Framework for Evaluating Communications Industry Strategic Alliances
  G. MICHAEL MCGRATH, Research Fellow and Deputy Director, JRCASE School of MPCE and ELIZABETH MORE, Deputy Director, Macquire University, Australia
- **M.1.4.3**
  The Globalization Strategies of World Major Telecos
  TAE-WOONG PARK, Senior Researcher, HOE II KANG, Senior Researcher, SUNG SOO HAN, Analyst, ETRI (Electronics and Telecommunications Research Institute), Republic of Korea
- **M.1.4.4**
  Comparative Analysis of Telecommunications Globalization
  YALE M. BRAUNSTEIN, Professor, Information Management & Systems, University of California, Berkeley; MEHEROO JUSSAWALLA, Senior Fellow Emerita, East-West Center; and STEPHEN MORRIS, Adjunct Professor, Information and Decision Sciences, McLaren School of Business, University of San Francisco, USA

M 2.4 Rural
Location: South Pacific III and IV
Chair: MARK HUKILL, Senior Lecturer, Division of Electronic and Broadcast Media, Nanyang Technological University, Singapore

- **M.2.4.1**
  The Role of Community TeleCenter (CTC) in Accelerating Educational (Community) Development in Indonesian Rural Area
  NASWIL IDRIS, Head of Communications, Universitas Terbuka, Indonesia; JOHN M. RENNER, Professor, Edith Cowan University, Australia
- **M.2.4.2**
  Attracting and Nurturing Small Businesses in Rural Areas: A Telecommunications Solution
  ALLAN B. KAMMAN, Executive Director, Vermont Telecommunications Application Center, USA and DUNCAN HOLADAY, Head, Division of Communication Research School of Communication Studies, Nanyang Technological University, Singapore
- **M.2.4.3**
  Solutions for Providing Telephony Services in Rural Areas of Less Developed Countries
  N.K. CHHIBBER, Director, India Resource Centre, India
- **M.2.4.4**
  Rural Information Infrastructure: Myths and Realities
  HEATHER E. HUDSON, Director, Evaluation and Learning Systems, Acacia Initiative, International Development Research Centre, & Professor and Director, Telecom Management and Policy Program, University of San Francisco, USA

T 1.4 Universal Service
Location: South Pacific III and IV
Chair: MICHAEL OGDEN, Assistant Professor, Department of Communication, University of Hawaii at Manoa, USA

- T.1.4.1
  Inverse Cross-Subsidization (Rural-Urban): Paradox and Evidence
  DARIO M. GOUSSAL, Research Coordinator, GTR-UNNE and MARIA SANDRA URDIZAR LEZCANO, Assistant Researcher, Northern University At Resistencia, Argentina
- T.1.4.2
  Insuring Universal Service: What's a PTO To Do?
  MIKE HELLER, Global Marketing Programs Manager, Service Provider Line of Business, Cisco Systems, Inc., USA
- T.1.4.3
  Global Access to Telecommunications: Toward an Informed Choice Model of Universal Service
  JORGE REINA SCHEMENT, Professor and Co-Director of the Institute for Information Policy, College of Communications and SCOTT C. FORBES, Ph.D. Candidate, College of Communications, Pennsylvannia State University, USA
- T.1.4.4
  Key Predictors of Adoption of New Media: A Report on Australia's Largest Diffusion Study
  MARK BALNAVES, Chair, Mass Communication and Multimedia, Murdoch University; PETER CAPUTI; PATRICK RAWSTORNE, Mass Communication Australia, Department of Psychology, University of Wollongong, Australia

T 2.4 Regional Development
Location: South Pacific III and IV
Chair: TBA

- T.2.4.1
  Opportunity out of Adversity
  BRETT K. WORRALL, Sales & Marketing Director, Tyco Submarine Systems, USA
- T.2.4.2
  China Closes the Door on Foreign Investment in Network Services
  KEN ZITA, Telecommunications Consultant, USA Discussants to be announced

W 1.4 Country Studies

Location: South Pacific III and IV
Chair: MICHAEL OGDEN, Assistant Professor, Department of Communications, University of Hawaii at Manoa, USA

- **W.1.4.1**
  The General Law for Telecommunications and the Development of a Competitive Market in Brazil
  MONICA MEDEIROS DE OLIVEIRA-GAJDYS, Ph.D. Candidate, Communication and Information Science Program, University of Hawaii, USA
- **W.1.4.2**
  Tele-Shastha-An Opportunity for Extension of Health Service in Bangladesh
  FAZLUR RAHMAN, Chairman, South Asia Multi Media, Bangladesh
- **W.1.4.3**
  Telecommunications in India and the Challenges Towards Growth
  SOWRI RAJAN KOMANDUR, Head Telecommunications Division, Department of Telecoms India, India

W 2.4 Country Studies

Location: South Pacific III and IV
Chair: Sturt Eastwood, Chief Executive Officer, Telecom Services Kiribati Ltd., Kiribati.

- **W.2.4.1**
  Pacific Islands Resolutions
  STURTDAVIES, Chief Executive Officer, Telecom Cook Islands, Cook Islands
- **W.2.4.2**
  Current Status of Telecommunications Development in Pacific Islands Countries
  PETER LOKO, Director, International, Telikom PNG, Papua New Guinea
- **W.2.4.3**
  GEFFRY SALMON, Directeur General, Office des Postes et Telecommunications, French Polynesia

---

Applications

M 1.5 New Technologies

Location: Tapa III
Chair: DALE ROGERS, Global Accounts Director, TCS-TeleCommunication Systems, USA

- **M.1.5.1**
  Advanced Services and IP Telephony
  SCOTT WHARTON, Director of Marketing, VocalTec Communications, Inc., USA
- **M.1.5.2**
  Switched Voice Moving to Packetized (IP) Voice: A Trickle or an Avalanche?
  JOHN E. KRZYWICKI, Chairman, Cambridge Strategic Management Group, USA
- **M.1.5.3**
  Study on the Characterization of Music and a Melody Retrieval Method Using Hummed Melody
  MASAYOSHI UMEDA, Research Engineer; YUICHI NISHIHARA, Researcher; SEIICHI KON'YA, Research Engineer; NOBUROU TANIGUCHI, Researcher; MASASHI YAMAMURO, Senior Research Engineer, KAZUHIKO KUSHIMA, Senior Research Engineer, NTT Information and Communication Systems Laboratories, Japan

M 2.5 Tele-Education I

Location: Tapa III
Chair: F. BARRY BROWN, Professor, University of Saskatchewan, College of Education, Canada

- **M.2.5.1**
  IntegratinWoodard_John/woodard_abstract.htmg FM Broadcast Stations in VSAT Networks for Distance Education in the Pacific Islands
  BRUCE BEST, Research Associate, University of Guam and JOHN M. WOODARD, University of Guam, USA
- **M.2.5.2**
  Data Transmission on the Japanese Inter-University Satellite Network
  KIKUO ASAI, Research Associate; NORITAKA OHSAWA, Associate Professor; ZENJI HAYASHI, Associate Professor; YUJI SUGIMOTO, Professor; KIMIO KONDO, Professor; KIYOHIRO YUKI, Professor; National Institute of Multimedia Education, Japan
- **M.2.5.3**
  Broadening Access Developmental Opportunities for Universities in the Asia-Pacific Region
  JOHN M. RENNER, Professor, Edith Cowan University, Australia; WEERAPONG PAIRSUWAN, Associate Professor, Suranaree University of Technology, Thailand and NASWIL IDRIS, Universitas Terbuka, Indonesia
- **M.2.5.4**
  Creating Transnational Distance Education Alliances
  TED J. CHRISTENSEN, Assistant Vice President, George Washington University, ARLENE KREBS, President, New Orbit Communications, Author, The Distance Learning Funding $ource Book, USA; and JOHN HINCHCLIFF, President, Auckland Institute of Technology, New Zealand

T 1.5 Distance-Education II

Location: Tapa III
Chair: VICKI KAJIOKA, Advanced Technology Specialist, Department of Education, State of Hawaii, USA

- **T.1.5.1**
  An Experiment of Virtual Space Distance Learning System
  NOBUYOSHI TERASHIMA, Professor; NOBUO TSUDA, Waseda University, Japan and JOHN TIFFIN, Emeritus, Victoria University, New Zealand
- **T.1.5.2**
  PREL Star Distance Learning in the Pacific Islands
  JAMES BANNAN and STEVE BAXENDALE, Distance Learning Education Specialist, Pacific Resources for Education and Learning (PREL), USA
- **T.1.5.3**
  The Virtual University—Higher Education as a Community Activity
  EWAN SUTHERLAND, Dean of the Faculty of Arts, University of Wales, Lampeter, United Kingdom
- **T.1.5.4**
  "Millions Online Residences & Enterprises(MORE)" Movement-Internet to the Families through the Tele-Homebook Experiment Program
  GARY GONG, Director, and PAULINE CHEN, Senior Manager, Information Technology Promotion Division, Institute for Information Industry (III), Taiwan

T 2.5 Tele-Medicine

Location: Tapa III
Chair: IFAY CHANG, Executive Director, PRIDE/Polytechnic Research, USA

- **T.2.5.1**
  Building Hawaii's Telehealth Framework: Will Policy & Planning Overcome Social Challenges
  JACOLYN PEEBLES, USA
- **T.2.5.2**
  Technical Support for Establishment of Telemedicine between Gomel, Belarus and Nagasaki, Japan
  IWATO ASAHARA, Chairman, BHN Association, Chairman, Information and Communication Research Inc.; TAKEO NOBUSAWA, Secretary General, Basic Association and MORIJI KUWABARA, Vice President, BHN Association, Japan
- **T.2.5.3**
  Rural Telemedicine in Indonesia: (An Approach to Selecting Proper Application)
  SAMUDRA PRASETIO, and ANDREAS W. YANUARDI, R&D Division, PT Telekomunikasi Indonesia, Indonesia

W 1.5 Making Sense of Today's U.S. Higher Education Market

Location: Tapa III
Chair: JOHN WITHERSPOON, Senior Advisor, Western Cooperative for Educational Telecommunications, USA Higher education in the U.S. is in the midst of a major evolution in its uses of the technologies, with long-term effects on everything from the forces of competition to the organization of institutions. The impact is seen in the explosive development of virtual institutions, in the applications of video and computing on traditional campuses, in reinventing libraries, and in changes in the decisionmaking structures of educational institutions. The panel will review the major forces, trends, and hot technologies, with attention to the ways in which real-world technology decisions are made.

- **W.1.5.1**
  Making Sense of Today's U.S. Higher Education Market: The National Trends
  SALLY M. JOHNSTONE, Director, Western Cooperative for Educational Telecommunications, USA
- **W.1.5.2**
  Learning with Laptops
  ELLEN EARLE CHAFFEE, President, Valley City State University and Mayville State University, USA
- **W.1.5.3**
  The State System Perspective
  STEVEN SMITH, Chief Information Officer, University of Alaska System, US

W 2.5 Finance

Location: Tapa III
Chair: ANTHONY GARDINER, Kensar Communications, Canada

- **W.2.5.1**
  Broadening Information Access by Designing a Network Security Infrastructure
  ALAIN BISSONNETTE, Vice President and ROY K. NG, Senior Consultant, CGI Information Systems Management Consultants Inc., Canada
- **W.2.5.2**
  Universal Service Funding Mechanism Compatible to Competition and Convergence-Universal Service Cost Embedded in Interconnection Charges
  MYUNGJA YANG, Researcher; DONGWON LEE, Researcher and WHAJOON CHO, Senior Researcher, Interconnection Pricing and Tariffs Team, Korea Telecom, Republic of Korea
- **W.2.5.3**
  MSS: Financing and Investor Return
  MANISH THAKUR, Chief Financial Officer, Ellipso, Inc., USA

Satellite

M 1.6 First 100 Days of GMPCS
Location: Tapa II
Chair: EDWARD SLACK, Director, International Services, COMSAT, USA

- **M.1.6.1**
  Global Enterprises: The Early Days OF GMPCS
  MARY FROST, Vice President and Regional General Manager, ICO Global Communications-North America, USA
- **M.1.6.2**
  GMPCS-After The First 100 Days
  DOUGLAS G. DWYRE, President, Globalstar L.P., USA
- **M.1.6.3**
  Impact of Licensing Delays
  DAVID CASTIEL, President and Chief Executive Officer, Mobile Communications Holdings, USA
- **M.1.6.4**
  Iridium-Around the World in 80 Days
  CARLTON R. JENNINGS, CEO and Managing Director, Iridium South Pacific Ltd., Australia

Presenter: CHRIS PEARCE, Director, Sales and Marketing, Iridium South Pacific, Australia

M 2.6 Satellite Applications
Location: Tapa II
Chair: EUI KOH, Managing Director, INTELSAT-Asia Pacific

- **Digital Satellite Business Communications**
  SUSAN J. IRWIN, President, Irwin Communications, Inc., USA
- **M.2.6.2**
  Satellite Communications of Telephone Organization of Thailand (TOT)
  KUSOLMONGKOL SUVARNKUDHT, Engineer, Telephone Organization of Thailand, Thailand
- **M.2.6.3**
  Satellite TV Broadcast Market in China
  LIN SUN, Managing Director, China Telecom Resources, USA
- **M.2.6.4**
  System Signaling Seven (SS7) Deployment in Canada's Remote Territory Using Satellite based SCPC DAMA Architecture
  MICHAEL MARTIN, Director Buiness Development-Telesat Canada and PETER SMITH, Manager Carrier Engineering-Telesat Canada, Canada

T 1.6 Mobile Satellites
Location: Tapa II
Chair: GEORGE NOVELLI, Vice President, Marketing, Inmarsat

- **T.1.6.1**
  Broadband Access to Interactive Multimedia Services Via Satellite
  FRANCOIS BRUN, Vice President, Business Development, Skybridge, France
- **T.1.6.2**
  Roaming Between Satellite and Terrestrial Systems-New Concepts and New Commercial Issues
  MICHAEL E. DAVIS, Partner, Ward & Partners Lawyers, Australia
- **T.1.6.3**
  Market Prospects in Asia for Satellite Mobile Services
  BRUCE S. MIDDLETON, Managing Director, Asia Pacific Aerospace Consultants Pty Ltd, Australia
- **T.1.6.4**
  Beyond Space: Challenges of Operating a Global Communications Company
  JULIE COONS, Director, Asia-Pacific, Global Gateway Management, Iridium, USA

T 2.6 Mobile Satellites II
Location: Tapa II
Chair and Panelists: PAUL BERMINGHAM, Principal Financial Analyst, Telecommunications and Informatics Division, The World Bank, USA

- **T.2.6.1**
  JAMES G. BEITCHMAN, President, Lockheed Martin Intersputnik, United Kingdom
- **T.2.6.2**
  ZHOUZEHE, President, China Telecommunications Broadcast Satellite Co., People's Republic of China
- **T.2.6.3**
  MING LOUIE, Vice President, Asia Pacific Region, Globalstar, USA
- **T.2.6.4**
  RICHARD DALBELLO, Vice President of Government Affairs, ICO Global Communications, USA
- **T.2.6.5**
  TUOMO RATANEN, Executive Director of Service Development, Iridium LLC, USA
- **T.2.6.6**
  TAL MEIZON, Product Manager of Rural Telephony, Gilat Satellite Networks, Israel

W 1.6 Satellite Technical Issues
Location: Tapa II
Chair: GEORGE LISSANDRELLO, Senior Vice President, Sales and Marketing, AVIRNEX Communications Group, USA

- **W.1.6.1**
  Increasing Ku Band Broadcast Satellite System Availability by the Use of Dynamic, Adaptive Input Data Bufering
  LARRY LEVY, Senior Member Technical Staff; RICHARD WARREN, GTE Government Systems Division, USA
- **W.1.6.2**
  New Standards and Solutions for Satellite Communication Modulation and Error Correction
  ERIC JACOBSEN, Principal Member of Technical Staff, EFData Corporation, USA
- **W.1.6.3**
  NGSO/GSO Satellite Sharing Issues
  MICHAEL FITCH, Vice President, Regulatory Affairs and Spectrum Management, Hughes Communications Inc., USA
- **W.1.6.4**
  Study on High-Speed FTP for Multimedia Interactive Satellite Communications System
  KATSUTOSHI NIDAIRA, Research Engineer, NTT Wireless Systems Laboratories; SHUICHI YOSHINO, Submanage, NTT Multimedia Business Development and MASAYOSHI NAKAYAMA, Sr. Research Engineer, NTT Wireless Systems Laboratories, Japan

W 2.6 New Satellite Applications

Location: Tapa II
Chair: GREGG DAFFNER, Senior Vice President and Chief, Strategic Planning, Lockheed Martin Intersputnik, United Kingdom

- **W.2.6.1**
  Trends in Satellite Based Applications
  ROGER T. NAFF, Senior Vice President, Marketing & Business Development, Hughes Space & Communications International, Inc., USA
- **W.2.6.2**
  Link One: An Advanced Satellite Network Service
  JOHN W. KOPINSKI, Director, Adv. Services Dev., COMSAT World Systems, USA
- **W.2.6.3**
  The Future is Here: New Satellite Ventures
  PAUL DYKEWICZ, Senior Analyst, Editor, Satellite News Group, Phillips Business Information, Inc., USA

NEW OPPORTUNITIES AND CHALLENGES TO

ELECTRONIC COMMERCE IN THE CROSS-BORDER ENVIRONMENT

Interconnection of Electronic Commerce Test-Beds Project in the Asia Pacific Region

Mutsuya Asano

Chair of Executive Board of Multimedia Pilot Project Consortium
in the Telecom Services Association in Japan

ABSTRACT

A number of Electronic Commerce projects are under way at the field trial stage mostly focussing on the home market. However, distrust against each other between consumers and merchants is one of major inhibitors for electronic commerce to prevail over the insecure Internet. The mutual distrust keenly surfaces particularly over the cross border environment. This paper examines the way how to solve EC-relevant issues with an utmost emphasis on user trust and confidence through the international interconnection of EC test beds among APEC member economies.

View Full-text

NEW OPPORTUNITIES AND CHALLENGES TO ELECTRONIC COMMERCE IN THE CROSS-BORDER ENVIRONMENT

Interconnection of Electronic Commerce Test-Beds Project in the Asia Pacific Region

INTRODUCTION

With the fast and exponential growing increase in Internet users, a number of electronic commence projects have been launched in the Asia Pacific region on either purely commercial or field trial basis. The Telecom Services Association of Japan (TELESA), non-profit organization of approximately four hundred member companies offering Value-Added network services

established a consortium to conduct a field trial of electronic commerce initiatives with a

participation of thirty Japanese companies with the objective of studying business opportunities and identifying the EC-relevant issues. Electronic commerce over the Internet was something different from the usual practice of selling and purchasing behaviour because of its characteristics of invisibility through the network.

In terms of a merchant, he or she wishes to sell the goods but becomes uncertain about how to ensure collection of bills. On the other hand, in therms of a consumer, he or she is not certain if the goods ordered never fails to be delivered. Additionally, concerns are expressed if the merchant really exist, if secure mechanism is well maintained to protect the confidential information like transaction data and if proper protection is considered for privacy. This situation is confronted particularly in the cross-border environment.

INTERCONNECTION OF EC TEST-BEDS PROJECT

The consortium went into the 15th APEC Telecommunications Working Group Meeting at Mexico in March 1997 and proposed the international interconnection of Electronic Commerce

Test-Beds in APEC member economies. The project is called INGECEP(Integrated next Generation of Electronic Commerce Environment Project), a collaborative APEC initiative to identify the EC-relevant issues in the cross-border environment with an utmost emphasis on user trust and confidence and to contribute APEC-wide EC policy making with the outcome of the project. The emphasis on user trust and confidence is based on the consortium's conviction that global electronic commerce will never prevail without its proper consideration.

TEST-BED OF TELESA

The TELESA's test bed consists of MALL, Payment Gateway and Certificate Authority servers based on SET(Secure Electronic Transaction) protocol. The electronic debit payment is adopted with a linkage between the Payment Gateway and the banking systems through the financial EDI services as shown below.

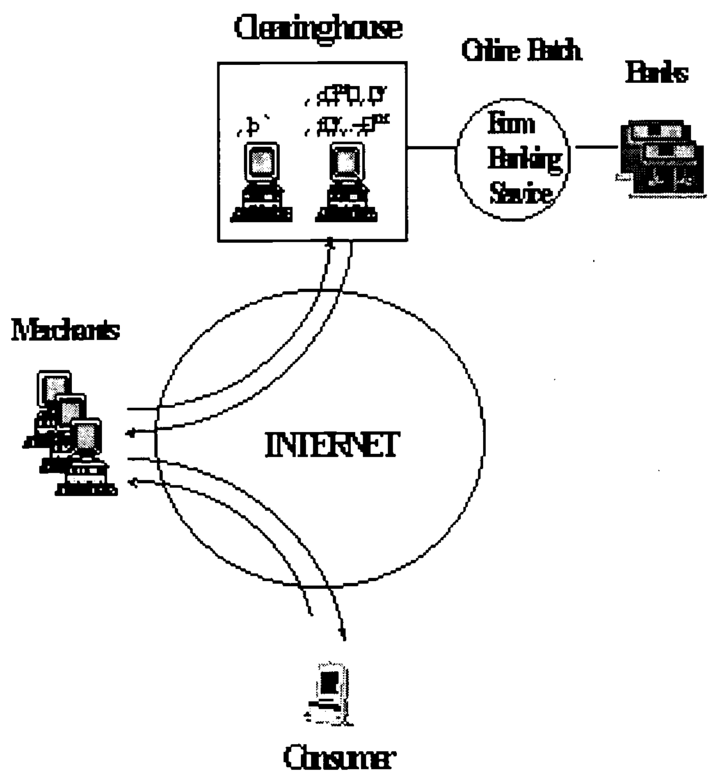


Figure 1. TELESA's Test-bed and e-debit pay settlement

TELESA's Test-bed has the following clearing house functions.

1) Issue digital certificates to consumers and merchants

With the CA server in operation as Certificate Authority, the digital certificate is issued to merchants and consumers. For a consumer, the digital certificate is provided when he or she submitted to the TELESA a signed document of direct debit agreement with an endorsement by his or her bank that the bank will transfer the funds from the consumer's bank account to the TELESA's bank account.

2) Authorize payment instructions

With the Payment Gateway server in operation, payment instruction is authorized in the following manner.

- A consumer places an order for purchase of the specific goods

- A merchant forwards the payment instruction to the payment gateway for authorization

- The payment gateway will return a reply to the request for authorization to the merchant

- The merchant will indicate the acceptance of the order to the consumer

3) Collection of payments

With the payment instructions being authorized, TELESA will pull payment from the bank account of the consumer through the financial EDI. After getting confirmation of pull-payment from the bank, TELESA notifies the mall that payment was successfully collected and the mall

instructs the merchant to ship the goods. With the delivery confirmation to the consumer, payment is transferred to the merchant's bank account.

The transaction flow in conjunction with the TELESA's clearing house functions is indicated below for reference.

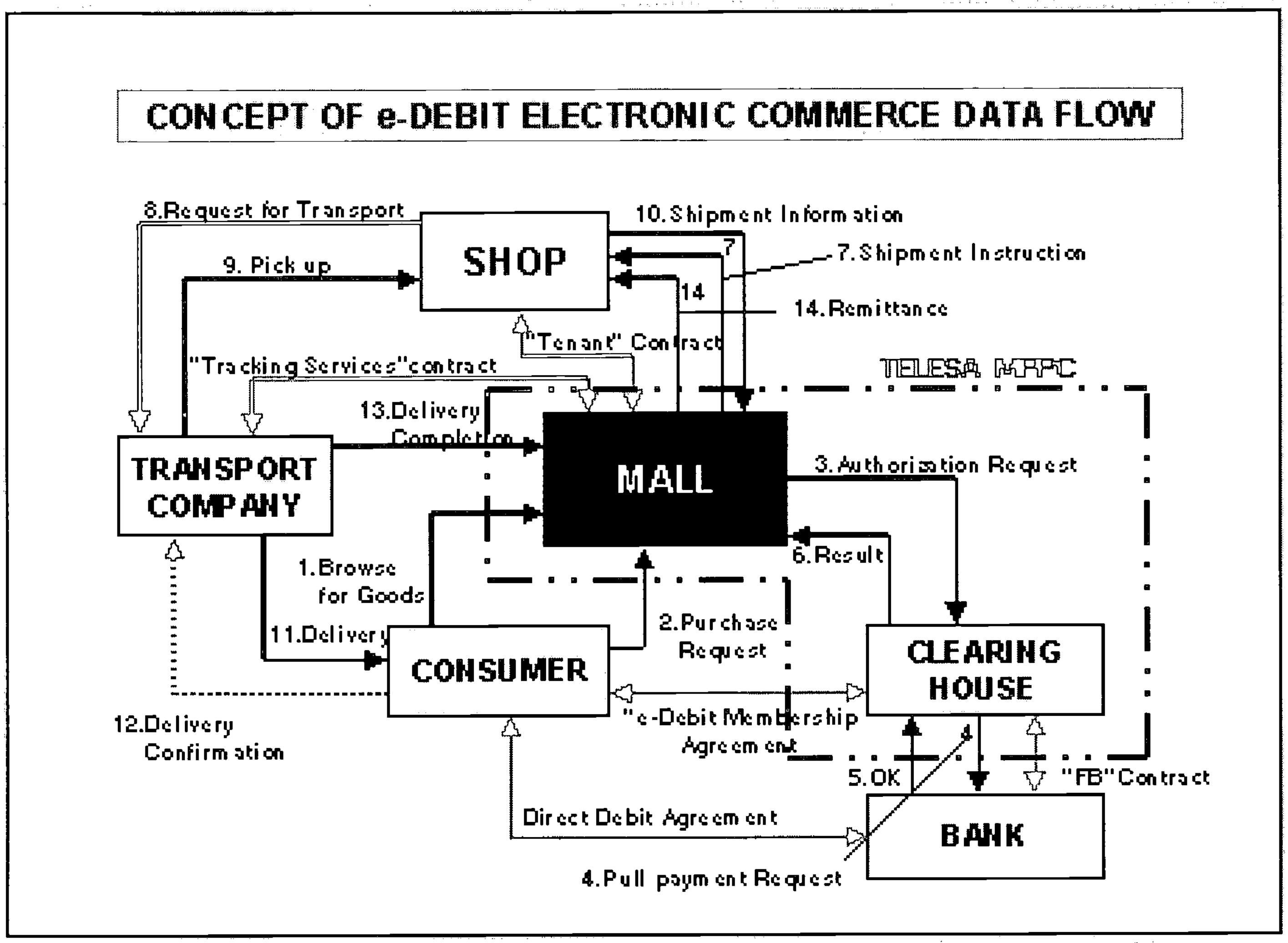


Figure 2. Transaction flow and TELESA's Clearing house functions

INTERNATIONAL INTERCONNECTION MODEL

The international interconnection of EC test-beds is defined as follows depending on the nature of a consumer vs a merchant country. The Consumer country is supposed to have the clearing house functions with Payment Gateway and CA server with thousand's of digital certificate Internet users and the merchant country is to run the mall server linked with consumer country's Payment Gateway and CA server. Its role is interchangeable to function either as the consumer or merchant country.

Here is a list of responsibilities in either the consumer or merchant country. The list does not contain all responsibilities but some of major ones for successful implementation of international interconnection of EC test-beds.

A) Consumer country's responsibility

1) Publicity and awareness programs

The consumer country has to make the foreign mall or goods known to its consumers. Otherwise, the foreign merchants are not motivated to sell goods.

2) Build-up enough population of consumers with e-Wallet

The consumer country has to actively build up potential buyers with the e-Wallet. TELESA has a target of more than 10,000 consumer participants in the project.

3) Provide the following information to the merchant country

- Sales tax and duty tax ratio

- Import regulation

- Price information for competitive analysis

4) Minimize a risk of exposure to the change of exchange rate

The merchant country's currency is recommended for use so that no risk is involved at the merchant side. The consumer country uses the daily exchange rate for pay settlement and the clearing house functions of the consumer country has to absorb the risk of exchange rate under fluctuation.

B) Merchant country's responsibility

1) Reliable shops and attractive goods

It goes without saying that goods should be attractive and appealing to the consumer country.

2) In line with the consumer country's guidelines of business conduct

The merchant country has to take into account the consumer country's practice of doing business or to respect the consumer country's principles for user care. Those are privacy protection rules, terms and conditions including cancellation and availability of tracking information on logistics.

3) Logistics

It is highly recommended to use the transportation services of tracking information available to the consumers and to make them feel comfortable. With the interconnection with Singapore, postal parcel services(EMS) are being used to make tracking information available to the consumers.

USER TRUST AND CONFIDENCE

"User trust and confidence" is a key word for INGECEP project. A number of concerns were addressed from the consumers when they are asked to participate in the project. The concerns are primarily relevant to security over the insecure Internet, proper privacy protection, updated status

information of the transaction being processed and cancellation procedures. A high priority is given to the following user care to make the consumers as much comfortable as possible in the on-line shopping in the cross-border environment.

1) Use of SET protocol

SET(Secure Electronic Transaction) protocol is adopted in the test-bed system to ensure the secure transaction over the Internet.

2) Sales tax, duty tax and transportation fees

In terms of users, the total amount of money to be paid is indicated in addition to the price of

the goods itself including the sales tax, duty tax and transportation fees.

3) Tracking information

The consumer is informed of the tracking information of the ordered goods when it is shipped. With the tracking information, the consumer is able to know where the ordered goods is being

transported.

4) Privacy Protection

- The privacy protection guidelines adopted in the project is indicated to the consumer. The consumer is ensured that his or her name, mailing address, telephone number and etc. are used for no other purpose than shipment of the goods.

5) Cancellation

The consumer is informed of the allowed time periods of 8 days at maximum to cancel the order without any reason after delivery of the goods. The consumer has to absorb the domestic transportation fees to return the goods to the consortium.

EXPERIENCE IN THE INTERCONNECTION OF THE TEST-BED WITH SINGAPORE

TELESA's test bed was linked with Mediaworks of Singapore with Japan assuming as the consumer or importing country and with Singapore as the merchant or exporting country since October in 1998.

It is a very small step forward as an attempt to go into global in the electronic commerce age. There are not much transaction yet between Singapore and Japan because the goods appealing to Japanese consumers remain to be seen. In a sense, both Japanese consumers and the Singaporean merchants are cautious against each other. With the successful test run of test-beds between the two countries, it is planned to put as many goods as possible on sale over the Internet in a very large scale from April, 1999 and to see the Japanese consumers' reaction.

Now that the electronic commerce platform through the interconnection of the test-beds is well established in place, it is getting more and more important for both the consumer and merchant country sides to go into the market jointly with more-focussed and business-oriented approach.

With the experience in the interconnection of test bed with Singapore, the following open issues come up for consideration in the future. The following list does not indicate all issues but shows some of typical examples for reference to the readers.

1) Dispute settlement

Pending is a place where the trial should be held in case of a lawsuit and under which country's jurisdiction to be applied.

2) Product liability

Product liability rules assumes that a manufacturer or distributor is subject to legal process in the jurisdiction where the goods are on sale. In case of electronic commerce, this assumption does not hold, leaving the injured consumer without any avenue for redress.

3) Refund for tax and duty

If there is a defect in the goods, the consumer is ensured to return the goods free of charge. However, the consumer must go to the Customs to get the tax and duty refund. This burdensome procedure outweighs amount of refund.

4) National language support

It is much better to use the national language of the consumer country. However, it is expensive for the merchant to make content in a foreign language and to keep the content up to date.

PLAN IN THE FUTURE

The INGECEP project was funded by Ministry of Posts and Telecommunications in Japan for TELESA's test-bed to go until March 1999. However, there are more and more parties getting interested in the project. CommerceNet Korea(CNK) is running the electronic commerce test

bed in Korea with the Korean government's assistance. CNK and TELESA exchanged a memorandum of understanding to jointly go into feasibility study of interconnecting the two test beds between Korea and Japan. The feasibility study is scheduled to a completion in March, 1999. Consequently, the next step is to implement an actual interconnection of the test beds.

Electronic Commerce Business Association(ECBA) in Taiwan also got interested in the project. The meeting took place twice between ECBA and TELESA last year. Hong Kong, Malaysia and Thailand also expressed their interests in the project in the 18th APEC TEL working group meeting at Papua New Guinea. In addition, Mediaworks in Singapore wants to extend the trial

period beyond March 1999 with a plan of full scale operation from April 1999. With this increasing interests, TELESA asked MPT to let the INGECEP project go beyond March 1999 for a year. It is highly possible to extend the INGECEP project for one more year and to conduct

the interconnection of the test-beds with as many countries as possible in the Pacific region.

CONCLUSION

There are discussions going on at OECD, APEC and the national level regarding the policy-relevant Electronic Commerce issues. The INGECEP approach is more or less a bottom-up initiative to identify issues in the cross border environment with an utmost focus on user trust and confidence.

With the experience built-up in the interconnection of test-beds, the project results hopefully could contribute to the current debates of EC policy issues from the different perspective.

Return to Top   View Full-screen

Electronic Commerce In APEC: Taxes, Tariffs And Equity

Richard D. Taylor

Pennsylvania State University, U.S.A

ABSTRACT

Electronic commerce appears to be the most rapidly growing area of commerce globally. For this reason, it has attracted the attention of both national and multi-lateral organizations. One of the key issues under discussion is the treatment of taxes and tariffs. The U.S. has proposed and is aggressively promoting a policy of no new and/or discriminatory taxes and tariffs. All of the implications of adopting such a policy are not yet clear, but there are already some aspects which raise concerns about equity and "*who benefits*". As APEC proceeds to consider its position in this regard, it may be useful to take a cautious approach, and be conscious of what may be lost if a total "*hands off*" policy is adopted.

View Full Text

Electronic Commerce In APEC: Taxes, Tariffs And Equity

I. INTRODUCTION

Electronic commerce appears to be the most rapidly growing area of commerce globally. For this reason, it has attracted the attention of both national and multi-lateral organizations. One of the key issues under discussion is the treatment of taxes and tariffs. The U.S. has proposed and is aggressively promoting a policy of no new and/or discriminatory taxes and tariffs. All of the implications of adopting such a policy are not yet clear, but there are already some aspects which raise concerns about equity and "who benefits". As APEC proceeds to consider its position in this regard, it may be useful to take a cautious approach, and be conscious of what may be lost if a total "hands off" policy is adopted.

II. THE U.S POSITION - - "HANDS OFF" ELECTRONIC COMMERCE

On July 1, 1997, the Clinton Administration released its proposal, "A Framework for Global Electronic Commerce," recommending that the nations of the world refrain from all types of regulation of commerce conducted over the Internet, including the imposition of new taxes and tariffs. The "Framework" notes the potentially significant economic impact of the Internet on global trade in services, and says it wishes to see this potential develop unretarded by regulatory and economic burdens. It sets forth five principles and raises and discusses nine issues. It identifies potential areas of problematic regulation including taxes and duties, restrictions on the type of information transmitted, control over standards development, and public utility forms of regulation on services offered. Preempting such harmful actions before they take root is the motivation for the strategy outlined in the Paper.

On April 18, 1998, U.S. Secretary of Commerce William M. Daley released "The Emerging Digital Economy Report", which continues the work initiated in the "Framework", setting forth their vision of the future of electronic commerce and the increasingly important role it will play in the global economy.

According to the Report, because the Internet is new and its uses are developing very rapidly, reliable economy-wide statistics are hard to find. By the end of 1997, more than 100 million people were using the Internet. If the trends suggested by preliminary analysis continue, IT and electronic commerce can be expected to drive economic growth for many years to come. By 2002, the Internet may be used for more than $300 billion worth of commerce between businesses, and some experts believe that as many as one billion people may be connected to the Internet by 2005.

The Report notes that businesses have raised three potential inhibitors to the widespread adoption of Internet commerce: the lack of a predictable legal environment, concerns that governments will overtax the Internet, and uncertainty about the Internet's performance reliability and security. The U.S. Government says it believes that no new discriminatory taxes should be imposed on Internet commerce. It also believes that no customs duties should be imposed on electronic transmissions. The application of existing taxation on commerce conducted over the Internet should be consistent with the established principles of international taxation, should be neutral with respect to other forms of commerce, should avoid inconsistent national tax jurisdictions and double taxation, and should be simple to administer and easy to understand.

These views are also encapsulated in U.S. domestic legislation, the Internet Tax Freedom Act, which was approved by the U.S. Congress on October 15, 1998. Sec. 1203 provides that:

> *"It is the sense of Congress that the President should seek bilateral, regional, and multilateral agreements to remove barriers to global electronic commerce through the World Trade Organization, the Organization for Economic Cooperation and Development, the Trans-Atlantic Economic Partnership, the Asia Pacific Economic Cooperation forum, the Free Trade Area of the Americas, the North American Free Trade Agreement, and other appropriate venues. The negotiating objectives of the United States shall be—(1) to assure that electronic commerce is free from (A) tariff and nontariff barriers; (B) burdensome and discriminatory regulation and standards; and (C) discriminatory taxation."*

III. INTERNATIONAL REGULATION OF ELECTRONIC COMMERCE I

The emergence of the potential for international electronic commerce over the Internet has, in a short time, attracted the attention of numerous international and regional organizations. Global or multi-lateral institutions currently addressing issues of electronic commerce include the following:

1. ***The World Trade Organization (WTO)***

The WTO has asserted that electronic commerce falls under its jurisdiction. In March it issued its first policy document on electronic commerce entitled, "Special Studies: Electronic Commerce and the Role of the WTO." More recently, the WTO agreed on a one-year standstill on existing electronic commerce trade practices in order to prevent countries levying duties on transmissions

2. ***The Organization for Economic Cooperation and Development (OECD)***

In November, 1997, the OECD released a Report on the "Emergence of Electronic Commerce" and sponsored a conference in Turku, Finland on "Dismantling the Barriers to Global Electronic Commerce". This is part of the preparatory work for the next OECD Ministerial conference, "A Borderless World – Realizing the Potential of Global Electronic Commerce" which was held in Ottawa, Canada, October 7-9, 1998, and addressed numerous aspects of electronic commerce, including taxation.

3. ***The G-8***

The G-8 has an ongoing policy working group on electronic commerce called the Global Marketplace for Small and Medium Enterprises. This group is developing underlying policy recommendations for facilitation of global electronic commerce, especially for small and medium enterprises.

4. ***The International Telecommunications Union (ITU)***

The ITU has been supporting the WTO's move towards open and competitive markets. Its World Telecommunications Policy Forum in Geneva in March, 1998 addressed issues around opening telecommunications markets in developing countries. This was followed by the second World Telecommunications Development Conference, which ended April 1, in Malta, at which delegates adopted the "Valetta Declaration and Action Plan" which covers many issues of electronic commerce.

5. ***The European Union (EU)***

The EU has been among the most active of all international organizations in developing directives and policies regarding electronic commerce. In 1997, Dr. Martin Bangemann of the European Commission issued a call for an "International

Communications Charter". The EU endorsed this proposal and EC officials are promoting it to industry and government leadership around the world, and have asked the WTO to take it up. There was a joint EU-US Statement on Electronic Commerce on Dec. 5, 1997, which highlights areas of agreement, but disagreements on privacy, encryption, content regulation and Internet management remain.

6. *The United Nations (UN)*

UNCITRAL adopted the "Model Law on Electronic Commerce" in 1996. In early 1998, the United Nations supported the idea of a basic "Right to Communicate". UNESCO held a conference addressing the "Ethical, Legal and Society Aspects of Digital Information" in March 1997. UNCTAD will be sponsoring a major conference on electronic commerce in November 1998 in Lyons, France.

7. *Other Organizations*

The World Bank, the World Intellectual Property Organization (WIPO), the International Organization for Standardization (ISO), the International Chamber of Commerce, the Transatlantic Business Dialogue, the Global Information Infrastructure Commission, the US-Japan Business Council, and the Asia Business Advisory Council are among the other organizations studying issues related to electronic commerce.

IV. APEC AND ELECTRONIC COMMERCE

The APEC Economic Leaders Declaration following its Vancouver Meeting in November 1997 included the following statement:

> *"We agree that electronic commerce is one of the most important technological breakthroughs of this decade. We direct Ministers to undertake a work program on electronic commerce in the region, taking into account relevant activities of other international fora, and to report to us in Kuala Lumpur. This initiative should recognize the leading role of the business sector and promote a predictable and consistent legal and regulatory environment that enables all APEC economies to reap the benefits of electronic commerce."*

APEC Senior Officials, in Spring, 1998, established an ad hoc Task Force to manage the work of the program on electronic commerce. At the same meeting, Senior Officials decided to address electronic commerce on the basis of a two-stage work program. Stage one is based on information exchange and analysis of the issues relevant to electronic commerce. Stage two will build on the results of stage one, moving on to more substantive action-focused work. It will develop common principles for promoting the use of electronic commerce in the APEC region, identify areas for technical cooperation to assist those economies whose capacity for electronic commerce is still low, and whose consideration of the issues is at a relatively early stage, and look at ways that APEC can most effectively contribute to the wider development of global electronic commerce, including through contributions in other international fora.

The intention is that by the end of 1998 APEC economies will have a better shared understanding of the broad implications of electronic commerce and will have identified ways to continue to improve this understanding, to expand the use of electronic commerce in the region, and to position APEC to play a strong role in the global development of electronic commerce.

The Electronic Commerce Task Force met in Penang to discuss implementation of the first stage of the work program. Fifteen member economies and members-designate, as well as the APEC Secretariat, the Pacific Economic Cooperation Council (PECC) and the South Pacific Forum attended the meeting. Also of interest is the APEC Telecommunications Working Group (TEL-WG), which sponsored a seminar in Brunei March 9-10 on the impact of electronic commerce for the Asian region for private industry and government representatives.

As a further part of its response to the Ministers' instruction, APEC held a joint meeting with the PECC in Brunei, March 10-13, 1998, on Electronic Commerce. At that meeting, it was suggested that there are two particularly important roles that TEL-WG can play: provide information on the extent of the obstacles and how they are being solved within each economy, and help ensure that specific remedial steps have a high priority on the ministerial and policy agenda in each member economy. Action steps were suggested in the following areas: analysis of regional regulatory barriers and access and compliance with WTO obligations, harmonization of policies and laws, dispute resolution issues, "best practices', cryptography, taxation, privacy, advertising, intellectual property and regional "codes of conduct" (identifying culturally sensitive matters).

It has also been suggested that APEC could undertake to increase the level of consumer trust in electronic commerce; widen the dialogue process by seeking consumer input in the formulation of policy on electronic commerce; increase consumers' comfort by working with other regional bodies for a clear statement of customers' rights, liabilities and redress in a world of borderless commerce; and, set up a regional online ombudsman as a visual representation of governments and business caring for customers.

Following the Brunei meeting, the APEC Business Advisory Committee (ABAC) organized a Roundtable in Hong Kong on April 28th, to examine the regulatory and business parameters of electronic commerce and how APEC governments might deal with it. APEC and ABAC have both established task forces to give recommendations to the APEC Trade Ministers on the role of APEC governments in creating the kind of E-Commerce environment in which business will flourish.

The APEC Ministers Meeting was held June 3-4 in Singapore. According to reports, the "Ministers welcomed the report of the Task Force on Electronic Commerce and noted the progress of work in both the Task Force and other APEC sub-fora" and "endorsed the second stage of the work program which would include possible development of principles and practical cooperative activities for promoting the use of electronic commerce in the region." The Ministers requested the Task Force to take into account the views of the private sector, differing levels of development of member economies, and the need to avoid duplication of work in both APEC and the international fora. Subsequent meetings of the Task Force were held June 12-13 in Kuching, Malaysia; September 4 in Singapore, and October 20-21 in Kuala Lumpur.

A related development is the planned implementation of APECNET - the Asia-Pacific Electronic Commerce Network, a consortium of research groups, business associations, and government offices dedicated to the advancement of the networked society in APEC.

V. ELECTRONIC COMMERCE -- TAXES AND TARIFFS

The Internet, while a conduit for burgeoning electronic commerce, is a headache for tax and exchange control authorities. The Internet allows you to buy a book from the Australia or a T-shirt in Bogota from your PC. Such transactions may engage a complex array of servers, data transport facilities, and offices and warehouses in numerous venues. What may be circumvented in this process, however, are taxes – sales, use and Value Added, as well as import and export duties and exchange controls. Issues arise with respect to both indirect and direct (income) taxation, as well as with tariffs.

The main consumption/production tax levied in many countries outside the U.S. is the Value Added Tax ("VAT"). The VAT taxes goods and services at their various points of production and value added creation. A VAT-system is ideal in the case of material goods or services being produced. The "value added" contributions of the various intermediary inputs are relatively easily quantifiable, the value of the final good or service consisting in a relatively straightforward manner of the amalgamation of these various inputs. However, VAT is not as easily applied to electronic commerce. A "value added" system of taxation is ill-suited to an information economy, because in the case of services or intangibles it can be extremely difficult to determine when, where and how much "value" is added at different stages of production.

In practice, the reality of not adjusting a nation's tax basis for electronic commerce would automatically imply a non-neutrality of different distribution or communication systems; the newest communication systems avoiding, either by accident or by design, the prevailing tax levying system. In the U.S. it is expected that electronic distribution will erode local sales taxes; in Europe it is the levying of VAT on services which will be avoided because of the global access and relocation possibilities of service providers through the Internet. At the same time, providers of goods and services using traditional means become less competitive since they must pay taxes on their visible and easily traceable goods or services.

1. *Indirect Taxation - VAT, Sales, Use and Consumption Taxes*

A major challenge for U.S. policymakers interested in keeping the Internet free from burdensome taxation will be stopping the aggressive application by foreign governments of "value added taxes" to Internet commerce. Currently, 27 of the 29 countries that belong to the OECD have value added taxes. (The U.S. and Australia are the only two OECD countries that do not have a VAT.) There is reason to be concerned that these OECD countries might seek to aggressively apply the VAT to electronic commerce sent from the United States.

The issue of the character of online digital transactions is critical to their taxability under many worldwide tax systems. Under the Value Added Tax (VAT) system employed in the EU the place of supply (i.e., the place at which tax applies) for services is different from the place of supply of goods. Under U.S. international income tax law, sales of products are usually taxed in the country where the sale is made, whereas services are taxed where the services are performed. For sale and use tax in the U.S., most services are not subject to tax, whereas most tangible personal property is taxable.

On June 17, 1998, the European Commission published a report urging its member countries to levy VAT on all software, services, or products ordered and delivered over the Net – even if ordered from countries like the U.S. which have no VAT. "The absence of such taxation would lead to unfair competition for EU operators who already have to tax their supplies of services for private consumption within the EU," the EC report concludes.

So far we have only raised taxation issues arising from products delivered via the Internet. What about a fee charged for playing a video game or downloading an article? What about information transmitted by e-mail or found on a bulletin board? What about advertiser revenues? Commissions on transactions? Might elaborate barter systems emerge in which people trade information as a form of on-line currency? Many multinational organizations, recognizing the potential problems and revenue concerns, have been seized with these issues.

a. *The WTO*

On May 28, 1998, Ministers from the 132 members of the WTO agreed to continue their current practice of keeping cyberspace free of new taxes and duties for one year, despite dissent from emerging countries. The decision, which came after much haggling between Washington and several emerging market economies led by Pakistan, was a partial success for the United States, which had pushed for a permanent e-commerce tariff ban.

The Americans argue that trans-border information flow, in the form of voice traffic, fax messages, e-mail or computer data links on telephone lines, does not presently attract tariffs. Imposing new taxes on software and information that cross borders electronically would discriminate against the nascent e-commerce industry, they say. But some countries asked whether this could raise more questions than it answers. Would it mean that an electronic plane ticket would be tariff free, but one printed on paper would not? Would the sale of actual CDs or packaged software be handled differently than music or software that could be purchased and downloaded directly from a Web site? Nor does it cover the exchange of "hard goods," meaning any products that are ordered online but are delivered across physical borders.

The World Trade Organization (WTO) also agreed to adopt a comprehensive work program to assess "all trade related issues relating to global electronic commerce" for the next WTO Ministerial meeting in 1999. This work program will take into account work done in other international fora and will result in the creation of recommendations for further action by the WTO. In the coming year, the U.S. Administration also is expected to press for the current standstill on customs duties to be converted to a binding commitment through the inclusion of commitments to zero duties on electronic transmission in countries' WTO schedules of commitments.

b. *The OECD*

OECD member countries believe that the best way to achieve tax neutrality is to apply existing taxes to income from Internet business and to avoid the imposition of special Internet taxes. The biggest challenge is to find an acceptable means of implementation. For this reason, taxes are an important issue for OECD technical experts. They hint that future computer programs that provide enough security for consumers to reveal credit card details might also be programmed to tip off tax authorities. The availability, reliability and completeness of commercial records generated in an electronic commerce environment, including those from electronic payment systems, are also of concern where such records must be relied upon to ensure that taxation and tariffs have been appropriately and fairly applied.

Furthermore, the OECD understands it is necessary to decide where electronic transactions should be seen to originate – the address of a consumer, a marketer or internet service provider. Other pending issues include how to deal with sales tax rates that differ among nations and how to differentiate taxation on digital products such as software which can be delivered on the network and conventional goods. Finally, they are concerned that the use of electronic commerce technologies, in the form of intranets, by multinationals and collaborative groups, may tend to increase the prevalence of transfer pricing and increase the difficulty of detecting such behavior.

These concerns are discussed at some length in a series of documents released in connection with the Ottawa Ministerial Conference on "A Borderless World" in October, 1998. These were supported by a "Joint Declaration" and an endorsement by the Ministersof an ambitious future work program.

c. *The European Union*

As noted above, the European Commission has recently declared that European consumers who buy and receive products or services over the Internet should pay VAT on them, even if they order from a foreign supplier. The June EC Policy Paper said that all Internet transactions should be taxed as services, marking a significant change in EC tax practice. At present, private individuals or businesses inside the EU who buy services from outside the EU do not now usually have to pay VAT – a consumption tax that is applied at varying rates in each of the 15 constituent EU countries and can reach 20 percent of the price. Even online transactions within the EU and within the purchaser's country typically escape VAT currently for lack of enforcement. The Paper proposed seven guidelines for applying indirect taxation to electronic commerce.

This is not seen as inconsistent with the OECD position, as it is advanced that this is not the imposition of "new" taxes, but merely the application of existing taxes to electronic commerce. The EC's position is that purchases sent directly to a PC that escape VAT and import duties are unfair. Those purchases would attract VAT if they were bought in a box off a shelf locally or in another EU Member State. The Commission acknowledges that the changes in the tax system will be difficult to implement practically, but the EC has committed itself to a round of consultation with national governments and business working groups to find a way to make it work.

Separately, the German Finance Ministry has been seeking a world-wide agreement to force software manufacturers to create a method to track Internet sales so that consumption taxes are automatically transferred to the appropriate governments. Germany's proposal is one of a number of ideas being considered by governments to ensure that a consumption tax is applied and enforced on Internet sales.

2. *Direct Taxation (Income or Revenue)*

a. *Double (or Multiple) Taxation*

Most countries, including the US, exercise jurisdiction to tax based upon the concepts of "residence" and "source". This means that most countries tax their residents on their worldwide income and nonresidents on income sourced to the taxing country. Each country develops and incorporates into law its own interpretation and definitions of source and residence. Because many countries, including the U.S., tax on these bases, there is a significant possibility that foreign-source income will be taxed by the country of residence as well as the country in which the income was earned. Transactions occurring in cyberspace have an even greater potential to be taxed by several jurisdictions. The method of transmission as well as the path that the information travels make it difficult to determine which jurisdictions are party to transactions in cyberspace. Cross-border transactions may run the risk that countries will claim inconsistent taxing jurisdictions, and that taxpayers will be subject to quixotic taxation.

b. *Tax Treaties*

Fundamental concepts incorporated into tax treaties, such as "permanent establishment" may be significantly affected by electronic commerce. The concept of permanent establishment is the primary mechanism for allocating tax jurisdiction. Electronic commerce makes it difficult to determine whether a permanent establishment exists, or what the character of the income earned is. The preservation of the ability of tax treaties to mitigate double taxation and the appropriate allocation of taxing jurisdiction needs to be extended into the age of electronic commerce.

In November 1996, the U.S. Department of the Treasury issued a paper entitled, "Selected Tax Policy Implications of Global Electronic Commerce", which states that "these technological developments dictate that the Internal Revenue Code and generally accepted principles of international tax policy be reexamined." Since the Treasury Paper was issued, several countries (e.g., Australia, New Zealand, the Netherlands, Canada, Germany and France), in addition to several international organizations, (e.g. the OECD), have issued drafts or discussion papers on this topic.

c. *Tax Avoidance, Tax Evasion, and Tax Havens*

Tax avoidance and evasion cause many problems. Governments lose revenues, and so taxes on those who do not escape the tax net must rise to plug the gap. Countries where tax compliance is highest lose out as trade flows are diverted elsewhere. Electronic commerce via the Internet provides major opportunities for multinationals to illicitly reduce their overseas taxes. However, this situation may be short lived. The potential for erosion of the tax base is substantial and countermeasures by governments are likely to come.

The U.K.'s Inland Revenue has already recommended that an international task force should be set up, drawn from the G8 leading industrialized nations, which would investigate multinational companies suspected of tax evasion. The initiative would be linked to similar work in the European Union and the Organization for Economic Co-Operation and Development. Part of the G8 initiative would be to concentrate on transfer pricing – the way multinational companies allocate profit to the different jurisdictions in which they operate.

Vito Tanzi, the Director of the International Monetary Fund's fiscal affairs department, has argued that some sort of global tax organization, along the lines of the WTO, may be necessary to enable systematic thinking on the need for international cooperation. Another course might be for regional organizations such as the APEC, ASEAN, MERCOSUR and others to pay greater attention to tax and fiscal policy issues.

The OECD has issued a separate paper on the issue of "tax havens". It addresses the harmful tax practices in the form of tax havens and harmful preferential tax regimes in OECD countries and non-member countries and focuses on geographically mobile activities, such as financial and other service activities. The Report makes 19 Recommendations to identify and isolate such "havens". The governments of Switzerland and Luxembourg objected to these recommendations, noting the presence of countries with low taxes "discourages governments from adopting confiscatory regimes, which hamper entrepreneurial sprit and hurt the economy, and avoids alignment of tax burdens at the highest level. This results in unacceptable protection of countries with high levels of taxation, which is, moreover, contrary to the economic philosophy of the OECD."

d. *The Bit Tax*

In 1996, a report of an independent group of experts to the European Commission recommended the EC investigate the possibility of a "bit tax" on the transmission of information to underwrite social programs, as a substitute for a Value Added Tax. The number of bits or bytes is considered a representative unit to indicate the "intensity" of a transmission. It is acknowledged that this would not directly relate to the actual "value" of the transmission – the amount paid would only be based on the number of bits transmitted. The rate would be "very low", perhaps .000001 cent per bit. Using traffic in Belgium as an example, this is said to raise some $10 billion per year. It is also proposed that this will reduce "information pollution and congestion".

This recommendation was not accepted by the OECD, and has received scathing criticism from a number of quarters, including the United States. It is perceived as a potential disaster for electronic commerce. Critics point out that, even at the "very low" rate of 1 cent per megabit, downloading a two-hour movie with a transfer rate of two megabytes per second would cost the user $144 in bit taxes. Critics so far have not been inclined to see any benefit in this concept, at any price point. However, as governments continue to see value slipping away from their tax nets, it may be revisited by some.

VI. ISSUES OF EQUITY

The American vision of an Internet free of new and "discriminatory" taxes and tariffs sounds, on its face, like a fair one. However, like many such ideas, it is "fair" only when the stakeholders are more or less equal in power at the outset. And on the Internet, and in electronic commerce, some are far more equal than others. A "hands off" electronic commerce tax policy raises substantial questions about the equity of its effects.

1. *Will such a policy exacerbate the problems for developing nations already inherent in globalization?*

Globalization is one of the great economic events of the 20th century. But globalization has also raised challenges for governments: how to distribute the cost of structural adjustments required to reap the benefits of globalization; how to provide the necessary shelter to the weaker segments of society; how to ensure that governments maintain sufficient sovereignty to determine the revenue and expenditure structure that is best suited to their political, institutional and social conditions.

By making it more difficult to tax the full range of economic activities (due, in part, to the increased mobility of capital), globalization is making it much more difficult to attain fiscal sustainability. To be sustainable, budgetary revenue and expenditure should be consistent with the macro-economic objectives of high employment, low inflation and the desired exchange rate. The burden of such adjustment is increasingly falling on the social sector and on government's capital and infrastructure expenditure at the time when the need for both is great. As tax and trade laws change, there is a need to address the transition costs when people lose their jobs and marginal firms close.

With growing inequalities and economic insecurity within and among nations (exemplified by the current Asian economic malaise), and with historically high unemployment rates in certain regions and aging populations in many parts of the world, there is an increasing need to spend more on social programs; but the actual trend and ideological momentum is in the other direction, including the American "hands off" proposal. Is this a wise as well as a fair policy?

2. *Will such a policy eliminate the option of a legitimate potential source of revenue for economies that need it most, while further undermining the concept of sovereignty in the economic sphere?*

Many nations are concerned that electronic commerce will not only not be a source of new, incremental tax revenues, but that it will drain tax revenues they are currently receiving. Resistance to the American push for a "standstill" in the WTO was reportedly led by Pakistan, but included APEC members Malaysia, the Philippines and Mexico. These concerns are not restricted to developing countries: Germany, France, Italy and the United Kingdom have all expressed a desire to keep their tax and tariff options open.

3. *Will such a policy disproportionately benefit the United States and American companies?*

When judging the merits of a "hands off" tax and tariff policy on the Internet, is it fair to ask, "Who benefits?"

The Internet was, arguably, born "American", with the U.S. government playing a major role, and English as its "native language". It is still largely American or North American, with the U.S. currently estimated to account for 75 percent of users (Canada 9 percent), 86 percent of e-commerce (Canada 7 percent) and 66 percent of "hosts" (U.S. and Canada combined). (While the United States' relative percent of all hosts has been declining, the shift has largely been to the other developed countries, with the Organization for Economic Cooperation and Development (OECD) countries estimated to account for 96 percent of all "hosts".

A global free trade zone on the Internet will have immediate and enduring advantages for the United States. The United States excels in the information and media services that preponderate on the Internet. In 1995, U.S. exports associated with licensing fees and royalties earned more than $25 billion, while U.S. imports totaled only $6.5 billion in the same categories. This represented the United States' largest net surplus among all categories of goods and services offered.

Making the Internet duty-free will do more than just help American companies and workers who sell services and goods around the world. It will also benefit American consumers buying goods from abroad. One reason this is so is that more Americans use the Internet than citizens of any other nation. Since such a high percentage of people currently using the Internet are Americans, keeping tariffs off the Internet will disproportionately benefit the American consumer.

4. *Does such a policy favor the affluent, while increasing taxes on small businesses and individuals?*

To take advantage of electronic commerce, it is necessary to have access to the Internet, typically obtained through a computer. In less wealthy countries, with low penetrations of telephones and computers, only a small percentage (the wealthy) of the population are likely to have access to the Internet, and reap any tax benefits on purchases. Also, electronic commerce is likely to further accelerate the move from progressive income taxes to regressive consumption taxes to make up lost revenues. Those with the least ability to pay will pay the highest percentage of their income.

5. *As more money is spent, and transactions conducted, with overseas (largely American) suppliers, what will be the effects on local employment?*

While conditions will vary from country to country, and there may be opportunities created by electronic commerce to offset losses, it is possible that a major shift to electronic transactions will have adverse impacts on employment in less developed countries. Often, the problem is not just the actual job losses, but a significant shift towards less permanent employment which provide few social security and health care benefits. If ignored, social conflict and discontent can undermine aggregate economic gains. Would it make sense to surrender the opportunity to offset some of these costs through revenue derived from electronic commerce?

VII. APEC – TAXES, TARIFFS AND EQUITY - - THE ROAD AHEAD

In light of the foregoing, what direction and/or actions should APEC and its member economies take? It is clear that APEC is already taking a measured and sophisticated approach to issues of electronic commerce in general, and its members are active in multilateral fora discussing these topics.

It is clear that the issue of treatment of taxes and tariffs on electronic commerce is not a trivial one, and it is also clear that there are divergent opinions on its treatment. However, at this point, the American position seems to have enormous momentum and it will be very hard to resist its being embodied in upcoming OECD and WTO agreements.

In addressing these issues, it is suggested that APEC should consider the following approach:

- Survey its member economies on their current policies on direct and indirect taxes in this area, and their future plans, if any;
- Evaluate the likely impact on each member economy, over time, as there impacts may be quite disparate with respect to revenue flows and employment;
- Study all of the proposed policy and technological approaches to this issue, which is still in flux;
- Seek a uniform and balanced regional approach (since it is likely most e-commerce will be done in the same country or region, due to habit, convenience, language and culture) which acknowledges the costs of

globalization and meeting real social needs;

- Keep as many options open as possible, including any future versions of government revenue generation, including transaction fees

Clearly, there are many impressive arguments to be made about the benefits to all participants of electronic commerce. However, it is also possible that not everyone will be a "winner", and not all "winners" will win equally, or at the same time. It is important for the APEC economies to carefully evaluate who the net winners and net losers (by country and region) are likely to be from various proposed tax policies for electronic commerce, to argue forcefully to protect their interests, and to keep their options open for a future which involves a new area which is still rapidly evolving in ways that are hard to predict.

Return to Top View Full-screen

From Broadening Bandwidth to Broadening the Imagination

Neil Tagare

The CTR Group, U.S.A

ABSTRACT

For most of the history of telecommunications, the main limit on the applications carriers could offer has been an infrastructural limit: The restricted amount of bandwidth available, and its resultant high cost. We are now entering an era in which new technology and business models are lowering the cost of circuits to the point where it is hard to justify charging anything at all for voice calls. In such a world, the only way carriers will be able to make money is to create such imaginative and compelling applications and services that customers would rather pay for them and perhaps, make voice phone calls for free. The cost of bandwidth will fall so low that it will not be worth billing end users for it. That means a fundamental shift in the carriers' view of the world from one in which the most important limitation is physical, to one where the only limitation is imagination.

View Full Text

From Broadening Bandwidth to Broadening the Imagination

I. INTRODUCTION

FOR MOST OF THE HISTORY OF TELECOMMUNICATIONS, THE MAIN LIMIT ON THE APPLICATIONS CARRIERS COULD OFFER HAS BEEN AN INFRASTRUCTURAL LIMIT: THE RESTRICTED AMOUNT OF BANDWIDTH AVAILABLE, AND ITS RESULTANT HIGH COST.

WE ARE NOW ENTERING AN ERA IN WHICH NEW TECHNOLOGY AND BUSINESS MODELS ARE LOWERING THE COST OF CIRCUITS TO THE POINT WHERE IT IS HARD TO JUSTIFY CHARGING ANYTHING AT ALL FOR VOICE CALLS. IN SUCH A WORLD, THE ONLY WAY CARRIERS WILL BE ABLE TO MAKE MONEY IS TO CREATE SUCH IMAGINATIVE AND COMPELLING APPLICATIONS AND SERVICES THAT CUSTOMERS WOULD RATHER PAY FOR THEM AND, PERHAPS, MAKE VOICE PHONE CALLS FOR FREE. THE COST OF BANDWIDTH WILL FALL SO LOW THAT IT WILL NOT BE WORTH BILLING END USERS FOR IT. THAT MEANS A FUNDAMENTAL SHIFT IN CARRIERS' WORLD VIEWS, FROM ONE IN WHICH THE MOST IMPORTANT LIMITATION IS PHYSICAL, TO ONE WHERE THE ONLY LIMITATION IS THEIR IMAGINATION.

IN ITS APRIL COVER STORY: "THE INTERNET: CHANGING THE FACE OF COMMUNICATIONS," EDITOR-IN-CHIEF WAYNE WALLEY DESCRIBES THIS ERA OF COMMUNICATIONS AS " . . EXPLODING THE ECONOMIC MODELS THAT HAVE GOVERNED TELECOS FOR DECADES AND MORPHING THE INDUSTRY INTO A FORM OF TELECOMMUNICATIONS ABLE TO ACCEPT THE INEVITABLE EVOLUTION FROM THE CIRCUIT-SWITCHED WORLD TO A PACKET-SWITCHED FUTURE BY DEVELOPING LUCRATIVE NEW MARKETS AND APPLICATIONS."

THE INTENT OF THIS PAPER IS TO GIVE YOU A GLIMPSE OF THAT WORLD AND THE CHALLENGES PTTS MUST MEET IN ORDER TO PARTICIPATE IN IT.

II. THE WORLD TODAY

IT IS ALMOST USELESS TO DESCRIBE THE WORLD TODAY: CHANGE IS SO PERVASIVE THAT THE MOMENT I BEGIN TO DESCRIBE IT, IT WILL BE OBSOLETE. THERE ARE, HOWEVER, SOME GENERALITIES WHICH ARE FAIRLY DEPENDABLE:

FIRST, THE MOST RADICAL CHANGE THE TELECOMMUNICATIONS INDUSTRY HAS UNDERGONE IN THE MORE THAN 100 YEARS SINCE ITS BEGINNING IS UNDERWAY RIGHT NOW!

THE SERVICE THAT HAS BEEN THE VERY FOUNDATION OF ITS BUSINESS – VOICE TELEPHONY – IS LOSING ITS PROFITABILITY, ALONG WITH FAX, ANOTHER CRUCIAL SOURCE OF REVENUE.

YOU HAVE ONLY TO LOOK AT YOUR OWN TYPICAL WORKDAY – AND THINK ABOUT IT FOR A MOMENT – TO REALIZE HOW DRASTICALLY DIFFERENT ARE THE WAYS IN WHICH WE COMMUNICATE TODAY. WHEN YOU GET TO YOUR WORKPLACE, WHAT DO YOU DO FIRST? ONCE, JUST A FEW YEARS AGO, YOU PROBABLY CHECKED FOR "WHILE YOU WERE OUT" PAPER MESSAGES TO TELL YOU WHO HAD CALLED. A LITTLE MORE RECENTLY, YOU CHECKED YOUR VOICE MAIL AND LOOKED FOR FAXES. TODAY, YOU CHECK YOUR E-MAIL.

LET'S TAKE THIS THOUGHT A LITTLE FURTHER: HOW DO YOU RESPOND TO YOUR MESSAGES? FOR MOST OF US TODAY, THE ANSWER IS THAT YOU EITHER REPLY OR FORWARD THE E-MAIL.

YOU THEN BEGIN YOUR WORK AND YOU NEED INFORMATION. WHERE DO YOU FIND IT? YOU FIND IT ON THE INTERNET. AND, TODAY, THE INTERNET NOT ONLY PROVIDES YOU ANSWERS. INCREASINGLY, IT CARRIES YOUR FAX AND VOICE TRAFFIC.

A SECOND GENERALITY THAT IS TRUE OF THE COMMUNICATIONS INDUSTRY TODAY IS THAT EVERYONE SEEMS TO BE GETTING INTO IT. CARRIERS, CABLE TELEVISION COMPANIES, RAILROADS, ENTERTAINMENT COMPANIES, COMPUTER COMPANIES, INERNET SERVICE PROVIDERS, ET CETERA, ET CETERA, ET CETERA – EVERYONE IS PROVIDING YOU WITH COMMUNICATIONS TOOLS. PRIVATIZATION, DEREGULATION AND COMPETITION ARE INCREASING WORLDWIDE.

AS BARRIERS TO COMPETITION ARE LOWERED, THE POTENTIAL FOR PROFITABILITY IN THE INDUSTRY HAS ATTRACTED THE ATTENTION OF THOSE WHO WERE NEVER ALLOWED IN PREVIOUSLY. IN MANY CASES,

THEY ARE MUCH MORE ACCUSTOMED IN THE WAYS OF COMPETING THAN THE TRADITIONAL, REGULATION-INHIBITED OPERATING COMPANY. IN ADDITION, SUCH DEVELOPMENTS AS THE FEDERAL COMMUNICATIONS COMMISSION'S EFFORTS TO UNILATERALLY LOWER INTERNAIONAL ACCOUNTING RATES ARE SETTING THE STAGE FOR A MAJOR UPHEAVAL IN THE INDUSTRY.

ALL THIS CHANGE PUTS TRADITIONAL PTT'S IN JEOPARDY. IT EVEN RAISES THE POSSIBILITY THAT, UNLESS THEY THEMSELVES MAKE SOME MAJOR CHANGES, THE PTT'S WILL BECOME OBSOLETE, LIKE THE TELEGRAPH COMPANIES OF THE PAST. SOME MIGHT EVEN GO OUT OF BUSINESS.

SOME MIGHT ARGUE THAT THE UNRESPONSIVE PTT MIGHT DESERVE TO GO OUT OF BUSINESS. THIS IS NOT THE ANSWER. ALTHOUGH TRADITIONAL PTT'S ARE OFTEN UNPOPULAR WITH THEIR USERS, IT WOULD NOT NECESSARILY BE GOOD FOR EITHER THE INDUSTRY OR THE END USER FOR THEM TO COLLAPSE OR BECOME SIGNIFICANTLY CRIPPLED.

WHEN CARRIERS ARE OUT OF BUSINESS OR DO NOT MAKE MONEY, THEY STOP INVESTING IN INFRASTRUCTURE. ALTHOUGH END USERS MAY GET FREE INTERNET PHONE SERVICE, THE QUALITY MAY LEAVE MUCH TO BE DESIRED. ALSO, WITHOUT CARRIERS, THE GOAL OF UNIVERSAL SERVICE WILL NOT BE ATTAINABLE.

III. THE CHALLENGE TO PTT'S TODAY

HOW CAN THE PTT'S MEET THE NEW WORLD IN WHICH VOICE DOES NOT PREVAIL? HOW CAN THEY SURVIVE – AND THRIVE – IN THIS NEW ERA OF COMPETITION AND LIBERALIZATION.

I BELIEVE THAT THE ANSWER IS THAT THEY MUST DEVELOP AN ENTIRELY NEW BUSINESS MODEL. THE ANSWER, TO ME, IS SIMPLE. THE ACHIEVEMENT OF IT IS ARDUOUS.

THE CHALLENGE IS FOR THE PTT, AN ENTITY THAT HAS BEEN DESCIBED AS AN ORGANIZATION USED TO MAKING PLANS BASED ON EXTRAPOLATING FROM THE PREVIOUS 40 YEARS, TO CHANGE INTO AN ENTITY THAT CAN CHANGE AS CHANGE IS HAPPENING. ITS TRADITIONAL PRACTICE OF METHODICALLY PLANNING BASED ON TRADITIONAL MODELS WILL NOT "FLY" IN TODAY'S REALISTIC MODEL OF CHANGE. THE WORLD DOES NOT

WORK THE SAME WAY ANYMORE. THE GROWING AVAILABILITY OF BANDWIDTH WILL MAKE THE "GATEKEEPING" MENTALITY THAT HAS GUIDED PTTS FOR SO LONG OBSOLETE.

IT IS NOT IMPOSSIBLE. SOME TELECOS ARE MAKING THIS TRANSITION RIGHT NOW: LOOK AT WORLDCOM AND ITS PURCHASE OF UUNET AND MFS AND MCI. DEUTSCHE TELEKOM HAS PURCHASED A SIGNIFICANT SHARE OF VOCALTEC, AN ISRAELI COMPANY WHICH IS A LEADING DEVELOPER OF INTERNET TELEPHONY TECHNOLOGIES.

IV. HOW TO MEET THE CHALLENGE OF TOMORROW

VOICE TRAFFIC AND THE WAYS TO KEEP IT FLOWING HAVE HELD PTTS CAPTIVE FOR YEARS. VOICE TRAFFIC HAS ALSO BEEN AT THE BASE OF REGULATION.

THIS HAS TO CHANGE AND PTTS MUST HIRE NEW THINKERS AND THEN THINK HARD ABOUT WAYS TO RESHAPE THEIR BUSINESS PLANS. I THINK WE ALL KNOW THAT. THE DIFFICULTY FOR PTTS IS TO CHANGE – QUICKLY AND EFFECTIVELY TODAY – WHAT HAS BEEN THE NORM FOR OVER ONE CENTURY.

THE EVIDENCE THAT COMPELS CHANGE IS ALL THERE. IT IS THE ACTION TO MEET THE CHALLENGE OF CHANGE THAT IS DIFFICULT.

AT THE FIRST INFORMATION MEETING FOR PROJECT OXYGEN, WE WERE HONORED TO HAVE PEKKA TARJANNE AS THE KEYNOTE SPEAKER. HE MADE SOME INTERESTING POINTS.

HE CITED STATISTICS THAT HIGHLIGHTED THE IMPACT THE INTERNET HAS HAD ON OUR INDUSTRY – STATISTICS THAT, ONCE AGAIN, POINT TO THE DEMISE OF TRADITIONAL VOICE TRAFFIC AS A MAJOR SOURCE OF REVENUE. FOR EXAMPLE, ON THE BUSY US-UK ROUTE THE PRECENTAGE OF AVAILABLE CIRCUITS DEDICATED TO INTERNATIONAL PRIVATE LINES, PRIMARILY FOR INTERNET USE, INCREASED FROM 15% TO 45% BETWEEN 1995 AND 1996. ALONG THE PACIFIC RIM, OPERATORS SUCH AS JAPAN'S KDD AND TELSTRA OF AUSTRALIA ARE REPORTING THAT THE CAPACITY SET ASIDE FOR THE INTERNET NOW EXCEEDS THEIR VOICE CAPACITY ON THE ROUTE TO THE U. S. AND, ITU FORECASTS SHOW THAT THE NUMBER OF INTERNET HOST COMPUTERS WILL EXCEED 120 MILLION BY EARLY IN THE

NEXT CENTURY.

OF COURSE, CHANGE ON THE PART OF PTTS CANNOT BE ACCOMPLISHED WITHOUT CHANGE ON THE PART OF REGULATORS. IN HIS SPEECH, DR. TARJANNE ALSO NOTED THAT THE MOST LIBERAL MARKET, SUCH AS THE UNITED STATES AND THE UNITED KINGDOM, ARE GATHERING A GROWING SHARE OF THE INTERNATIONAL TRAFFIC MARKET.

V. THE FUTURE: BROADENED BANDWIDTH AND BROADENED IMAGINATION

WHAT WILL OUR WORLD LOOK LIKE TOMORROW? EVENTS OF TODAY GIVE US THE TOOLS TO PREDICT THE FUTURE.

IT IS ALMOST CERTAIN THAT THERE WILL BE A GLUT OF BANDWIDTH. BANDWIDTH IS APPEARING EVERYWHERE – IN COPPER WIRES, WHERE VOICE TRAFFIC USES ONLY ONE PERCENT OF IT BANDWIDTH CAPACITY – VIA SATELLITES THAT BEAM IT STRAIGHT INTO OUR HOMES – VIA FIBEROPIC UNDERSEA CABLES, HELPED BY WAVE DIVISION MULTIPLEXING. WE CAN EVEN RENT IT WHEN WE NEED IT! I PREDICT THAT ACCESS – OR BANDWIDTH - WILL BE FURNISHED FREE BY THE ENLIGHTENED PTT.

AND, WHAT WILL WE BE DOING WITH ALL THAT BANDWIDTH? WE WILL BE FAXING ON IT AND PHONING ON IT. I PREDICT THAT VOICE QUALITY VIA THE INTERNET WILL SOON BE AS GOOD AS VOICE QUALITY PROVIDED OVER TRADITIONAL NETWORKS. A RECENT FROST & SULLIVAN STUDY PREDICTS THE INTERNET TELEPHONY MARKET WILL REACH $1.89 BILLION BY THE END OF 2001. THAT IS HARDLY A FIGURE TO CHALLENGE THE ANNUAL REVENUES OF MOST PTT'S, BUT IT IS IMPRESSIVE AND SURELY WILL GROW QUICKLY AND SIGNIFICANTLY.

WE WILL ALSO BE SHOPPING ON IT, WATCHING MOVIES ON IT, ELECTONICALLY IMMIGRATING ON IT AND LEARNING ON IT. THINK OF THE ULTIMATE POSSIBILITIES: WORKING AT HOME CAN ERASE MORNING AND EVENING RUSH HOURS – AND YOU CAN WORK IN SAN FRANCISCO FROM YOU HOME IN BANGKOK! SHOPPING AT HOME CAN ERASE RUNNING ERRANDS ON THE WEEKEND. THE GOODS YOU BUY CAN BE MAILED TO YOU OR PICKED UP BY YOU FROM A CENTRAL DISTRIBUTION CENTER. DEPARTMENT STORE WILL NOT EXIST ON THE INFORMATION HIGHWAY INSTEAD OF AT THE MALL.

AND, THE TRUTH OF THE MATTER IS THAT THE INTERNET, AS WE KNOW IT TODAY, MAY SOON BECOME OBSOLETE ITSELF!

ENGINEERS ARE NOW WORKING ON AN ALTERNATIVE INTERNET FOR THE ACADEMIC COMMUNITY CALLED INTERNET TWO. IT IS BEING DESIGNED FOR USE BY SCIENTISTS, ENGINEERS, AND RESEARCHERS AND IT WILL BE FASTER THAN TODAY'S INTERNET.

HAVE YOU HEARD OF THE OVERNET? IT OFFERS GREAT POTENTIAL TO COMPANIES WITH LARGE AMOUNTS OF INTERNATIONAL DATA FLOW. ITS HUB IS RIGHT HERE IN HAWAII, WHERE IT CAN TAKE ADVANTAGE OF THE LARGE AMOUNT OF BANDWIDTH PROVIDED MAINLY BECAUSE OF THE MILITARY. BY DETOURING TRAFFIC AWAY FROM THE OVERCROWDED INTERNET AND ONTO A PRIVATE NETWORK, IT SHORTENS THE ROUTE DATA TRAVELS AND CUTS DOWNLOADING TIME, MAINLY BY ELIMINATING TRANSFEW TO US-BASED NETWORK ACCESS POINTS. ITS RESULTS ARE IMPRESSIVE.

NATIONAL SEMINCONDUCTOR INVESTED $400,000 INTO DIGITAL ISLAND'S OVERNET PRODUCT, AND SAVED $4MILLIONIN ISP CHARGES, SERVER HANDWARE, AND SOFTWARE LICENSES*

THERE ARE THOSE, OTHER THAN ME, WHO CONSIDER PROJECT OXYGEN ANOTHER PROJECT WHICH GOES BEYOND THE INTERNET. LET ME QUOTE GRAHAM FINNIE, A RESEARCH DIRECTOR AT THE YANKEE GROUP EUROPE: "YOU COULD AMOST CALL IT BREATHTAKING," HE SAYS, "PROJECT OXYGEN IS A GLOBAL CALBE SYSTEM OF ALMOST INCONCEIVABLE SCALE AND AUDACITY. . . . IT WILL TRANSFORM INTERNATIONAL TELECOMMUNICATIONS MORE RAPIDLY AND MORE COMPLETELY THAN ANY PREVIOUS INNOVATION IN THE FIELD.

MANY BEIEVE ITS SCOPE – COVERING OVER 90,000 MILES, OR 158,000 KILOMETERS, REACHING OVER 70 COUNTRIES, AND OFFERING CITY-TO-CITY CIRCUITS – WILL MAKE DISTANCE AND GEOGRAPHY IRRELEVANT IN TERMS OF COSTS.

THIS IS WHY CARRIERS MUST USE THEIR IMAGINATION. THEY MUST MOVE BEYOND VOICE TO VIDEO AND DATA TRAFFIC. THEY MUST THINK IN TERMS OF OFFERING APPLICATIONS SUCH AS TELEMEDICINE AND TELEDUCATION. WE'VE BEEN TALKING ABOUT THIS FOR A LONG TIME. NOW, IT'S TIME FOR SOMEONE TO REALLY DO IT. THEY MUST HELP TO CREATE GLOBAL TOWNSHIPS – COLLECTIONS OF BUSINESSES AND

INSTITUTIONS BUILT AROUND GLOBAL COMMUNICATIONS. THEY MUST BECOME CENTERS FOR VIDEO-CONFERENCING AND THREE-DIMENSIONAL VIDEOCONFERENCING!

I HAVE BEEN DESCRIBED AS A VISIONARY, AND PREDICTING THE FUTURE IS SOMETHING I LIKE TO DO. MY CLOSING PREDICTING IS ONE THAT I CAN STATE WITH CERTAINTY: THERE ARE NO LIMITS TO OUR GROWTH EXCEPT OUR IMAGINATIONS. THE BASICS ARE THERE JUST WAITING FOR APPLICATIONS AND SERVICES. THE BANDWIDTH IS BROAD AND PLENTIFUL. CAN PTTS MEET THE CHALLENGE?

Return to Top View Full-screen

Internet Content Industry:

Current Market Status & Strategies

Min-Zheong Song

Korea Telecom, Korea

ABSTRACT

The purpose of this report is to redefine electronic publishing in the Internet environment with regard to competitiveness and economics. Internet publishing has 10 myths in the near future: Bandwidth will increase, while costs decrease. The prime audience is an untapped generation of non-readers. Online readers demand rich audio-visual presentation. Online publisher has to live with ads at the top of pages. Search engines are stealing all the advertising (poor performance of ads placed in the middle of an informational transaction). It's tough to audit hits, impressions, clicks and users. The more hits the better (for advertiser). Readers want interaction with information providers. Community builds loyalty. Internet publishing demands greater technical skills than print publishing.

View Full Text

Internet Content Industry:

Current market status & strategies

I. INTRODUCTION

The purpose of this report is to redefine electronic publishing in the environment of Internet with regard to competitiveness and economics. Internet publishing has 10 Myths in near future : Bandwidth will increase, while costs decrease. The prime audience is an untapped generation of non-readers. Online readers demand rich audio-visual presentation. Online publisher has to live with ads at the top of pages onlines. Search engines are stealing all the advertising(poor performance of ads placed in the middle of an informational transaction). It's tough to audit hits, impressions, clicks and users. The more hits the better (for advertiser). Readers want interaction with information providers. Community builds loyalty. Internet publishing demands greater technical skills than print publishing.

Digital content is the key driver in this Internet publishing industry. Digital content means *a targeted bundle of information, communication and transaction services in the paradigm of the convergence of the computer and telecommunications industries.* However, strategies to create attractive digital content will build on traditional media content and add communication and commerce facilities. In addition, content providers now must think in terms of providing services. At the center of the digital content industry lies the competence of companies to build communities of users, who need to address the needs of highly specific groups by integrating content, communication and commerce services. This includes joining traditional contents with content-related advertising, information from other content providers and a wide range of new services, such as opportunities for customer interaction through chat-lines, discussion forums, bill-boards & consultation, governmental services & online financial transactions etc.

The Internet publisher needs satisfactory technical solutions in the areas of media integration, secure transaction systems, user-oriented interfaces and high speed network access at reasonable prices.

Due to the economies of online publishing (high "first copy" costs, but low marginal costs), companies have a strong interest in content published in multiple media by exploiting the opportunities of digital media. The importance of the cross publishing, i.e. repackaging content for distribution is increasing. Technical solutions to overcome impediments to electronic commerce are the second important area for online service market in near future. The key will be to provide secure payment systems. Regarding the security, only trusted brands will be successful in launching electronic commerce services(Electronic commerce is excluded in this report). Anyway, online publishing together with e-commerce will be a most important revenue source in the online service market. The Internet will be the driving force for commercially viable business applications.

Content is the most valuable asset for Internet publishing. Therefore, content competition in the value chain (creation & aggregation) will be increasing. The convergence of industries is understood in terms of convergence of infrastructure and content driven function. Internet publisher enters the market as Internet access providers in order to improve their customer ownership and to broaden the marketing base for their online services.

Generally speaking, online media user activity in general is quite different from traditional reception behavior. Internet use behavior combines active and passive forms of use and implies a convergence of reading and looking behavior. Online media requires greater audience involvement, combining point to point with group communication and mass reception. It allows interactivity and offers an altogether new dimension of combining reading and looking activities.

In this paper, the Internet publishing, one of the most important revenue source in the online service market is considered.

II. CONTENT TRENDS: OFFLINE VS ONLINE

Electronic publishing (EP) is defined as "any non-print media material that is published in digitized form to an identifiable public." The EP includes offline as well as online.

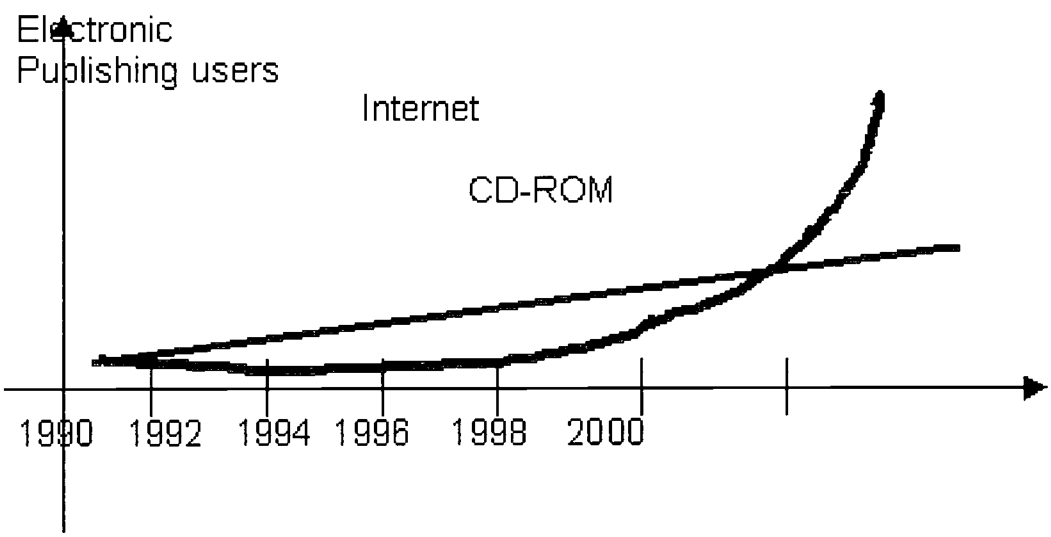
Offline supports which can be read on personal computers (CD-ROM, CD-I, DVD-ROM), and also adapted to game consoles.

Online services are used on computers, especially for Internet connections. Some unusual examples of a terminal is the Minitel in France, Hitel in South-Korea. Those are video text service actually and now tend to be integrated in the Internet. In effect, online services can be devided into 2 categories : asynchronous applications (such as e-mail, FTP, News, WWW) and synchronous applications (Net-phone and videophone on the Internet).

The electronic publishing market is currently going through a transitional phase, as the use of online technologies is going to be greater than that of CD-ROM: A wider use of online technologies is encouraged by improved telecommunications performances such as high speed access, price decrease etc. As of 1997, online connections rise about 70% while CD-ROM sales are expected to increase by about 30%. This tendency leads to a market configuration in which online products will be clearly predominant. After 2000, most electronic publishing services will be supplied mostly online.

Harnad (1991) in "Post-Gutenberg Galaxy: The Fourth Revolution in the Means of Production of Knowledge" took a long view of the communication history and listed four stages as: 1) the development of human language, 2) the advent of writing, 3) the Gutenberg revolution, and 4) the advent of electronic and digitized communication. In his view, the fourth revolution, based particularly on networked communication, has not yet been completely established.

Figure 2.1: On-line and off-line electronic publishing



Source: IDATE

Despite its rapid growth and globalization of the technologies, the electronic publishing markets are still various among the countries. Nevertheless, the equipment gap is lessening. As regards to PC households rate with an Internet connection in the USA, European countries, and South-Korea, the difference is narrower. Under these conditions, the gap in online publishing technologies will become increasingly narrow.

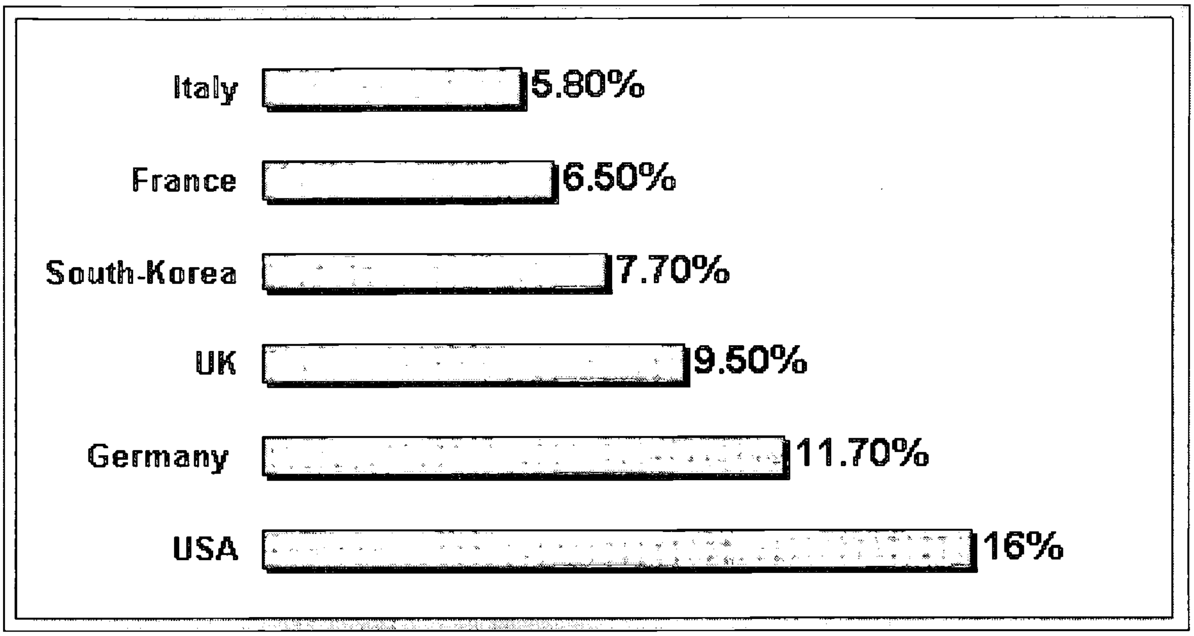


Figure 2.2: PC households with Internet access (1997)

Source: Datamonitor & International Data Corporation / Korea Information Culture Center(1997)

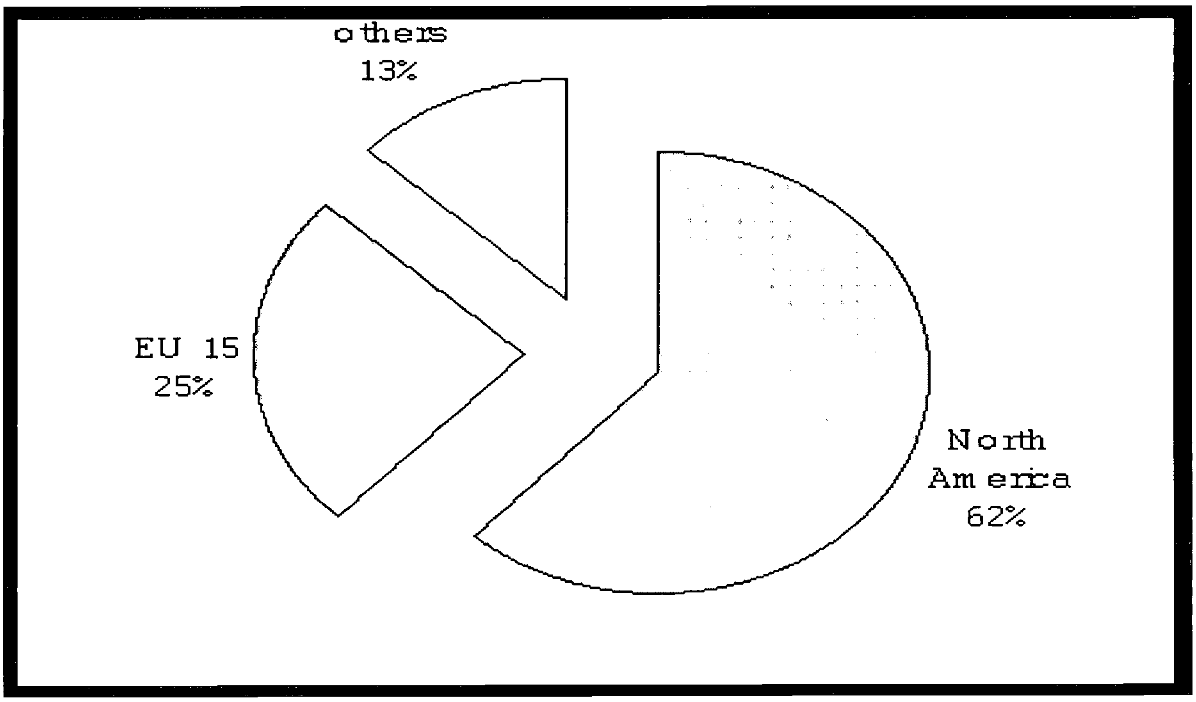


Figure 2.3: Internet connections - (1996 - % by area)

Source: Aftel

The configuration of world online households will display an important change during a few next years. The share held by the USA and Canada will be clearly reduced, on account of Europe. The share of the four major EU countries (Germany, UK, Italy & France) is expected to grow to 22 % of total on-line households around the world in 2000.

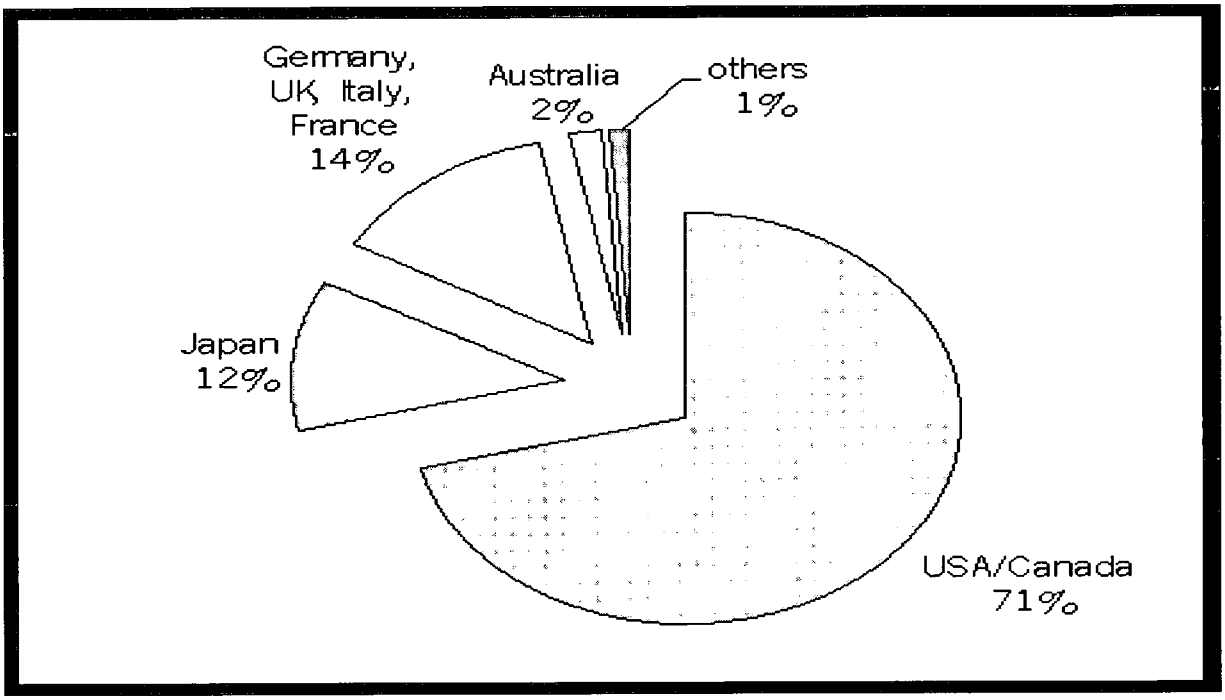


Figure 2.4: Online household forecasts in the World (1996)

Source: Jupiter Communication

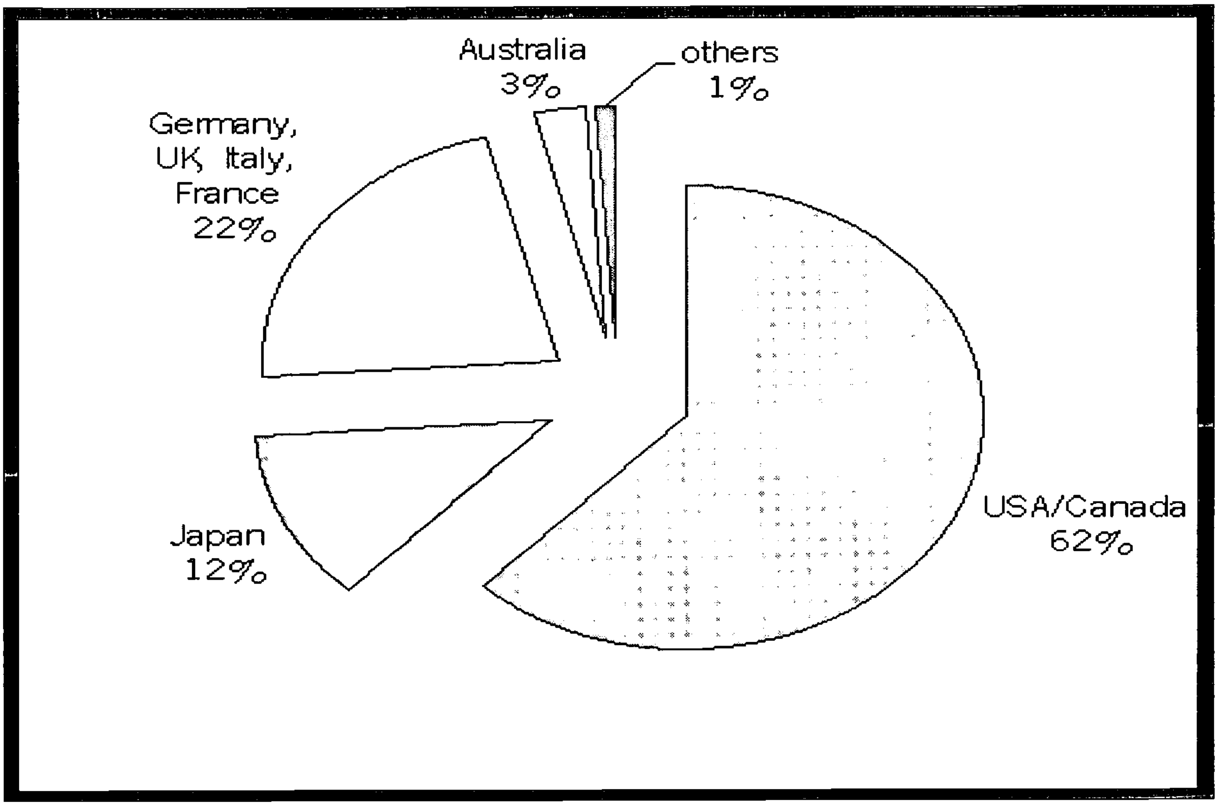


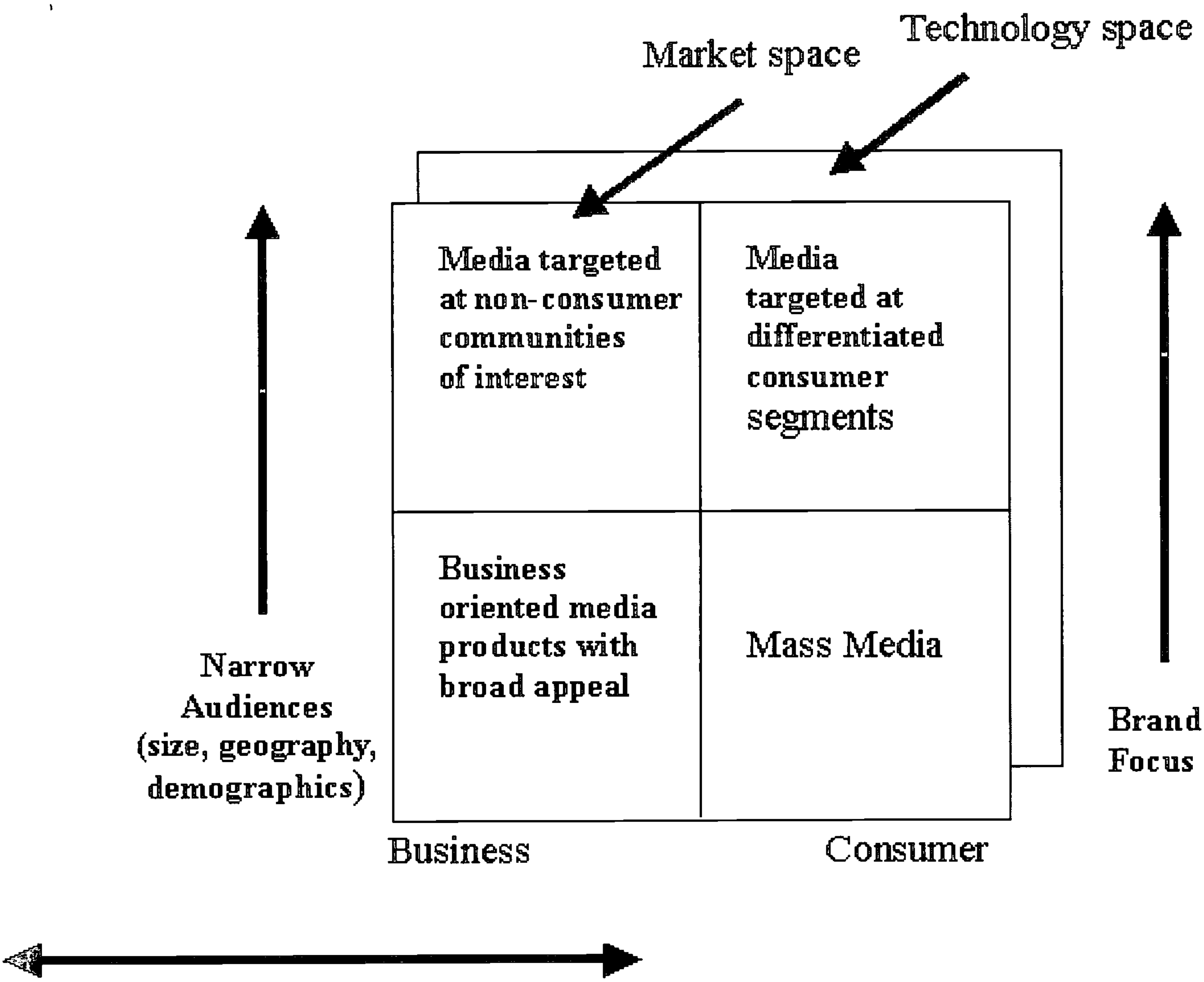
Figure 2.5: Online household forecasts in the World (2000)

Source: Jupiter Communication

III. TYPES OF INTERNET CONTENT

In N. Negroponte's view, about 1 billion people would be connected by the year 2000. The driving factor of Internet publishing would be the interactivity which will encompass content, service and transaction and the biggest change is likely to be in the advent of network-centric user interfaces. Internet is global and defined as network of networks which work to Internet-type protocols, not just the World Wide Web. This technology has reached surprising levels of relative maturity very quickly, but will continue to develop significantly over the next few years.

Figure 3.1 New Framework for the Media Marketplace

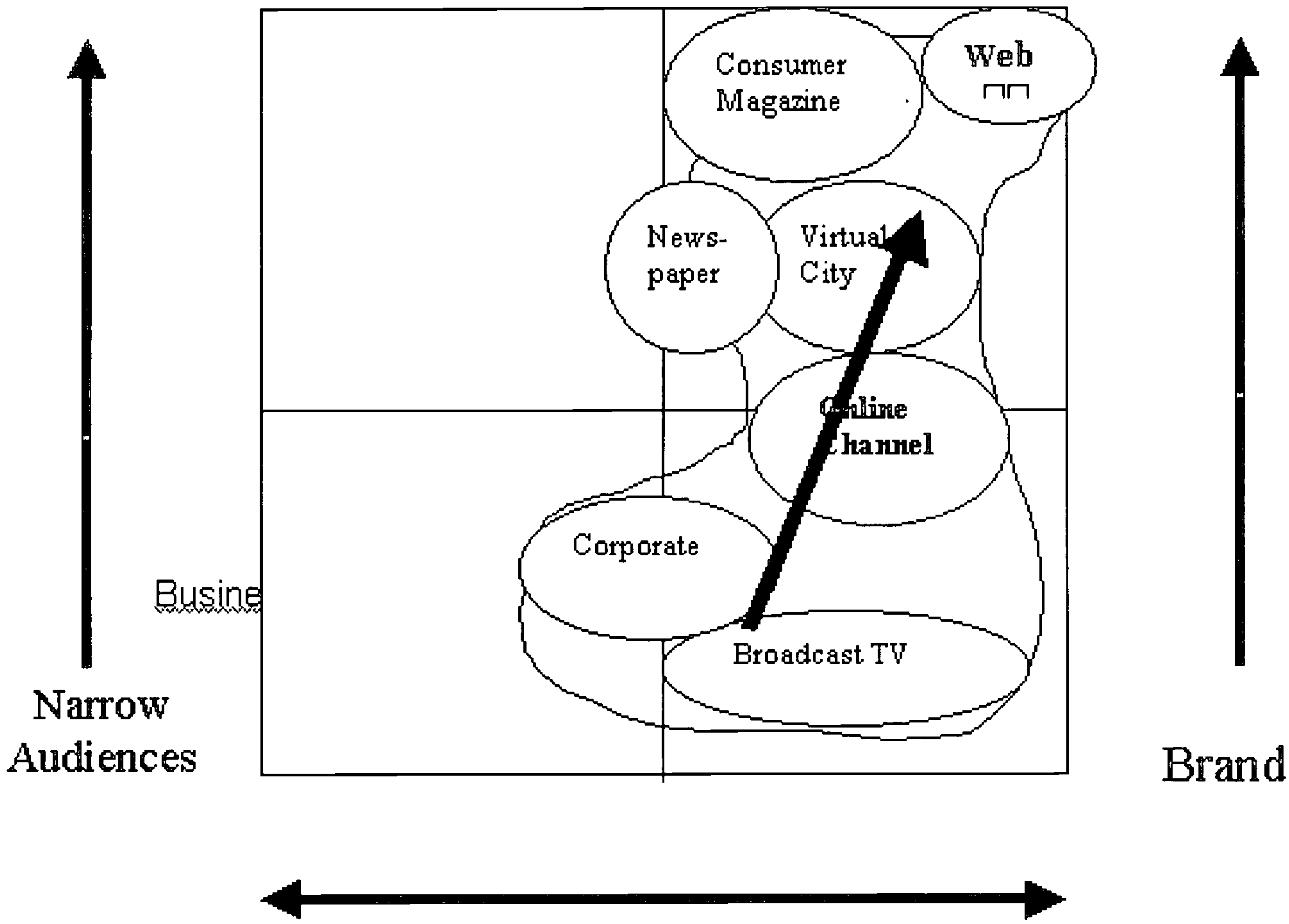


Source : European Commission(DGXIII/E, 1997)

The new online landscape needs a new way of examining the market. The new market should not be considered in isolation from the technology space, but the two can be mapped onto each other (Figure 3.1). Recent studies and research have shown that there is a prevailing movement towards targeting products and services to clearly differentiated audiences, and the vertical axes therefore provide to illustrate this. The horizontal axis plots the customer focus of the products and services from business at one end, to consumer at the other.

Actually, there are 2 different types of media content in terms of user segmentation, namely consumer media and business media content. In addition, knowledge user type could be added to those in mezzo zone. Products and services that apply to each of these 3 types of use are extracted, and the general trend of movement is shown.

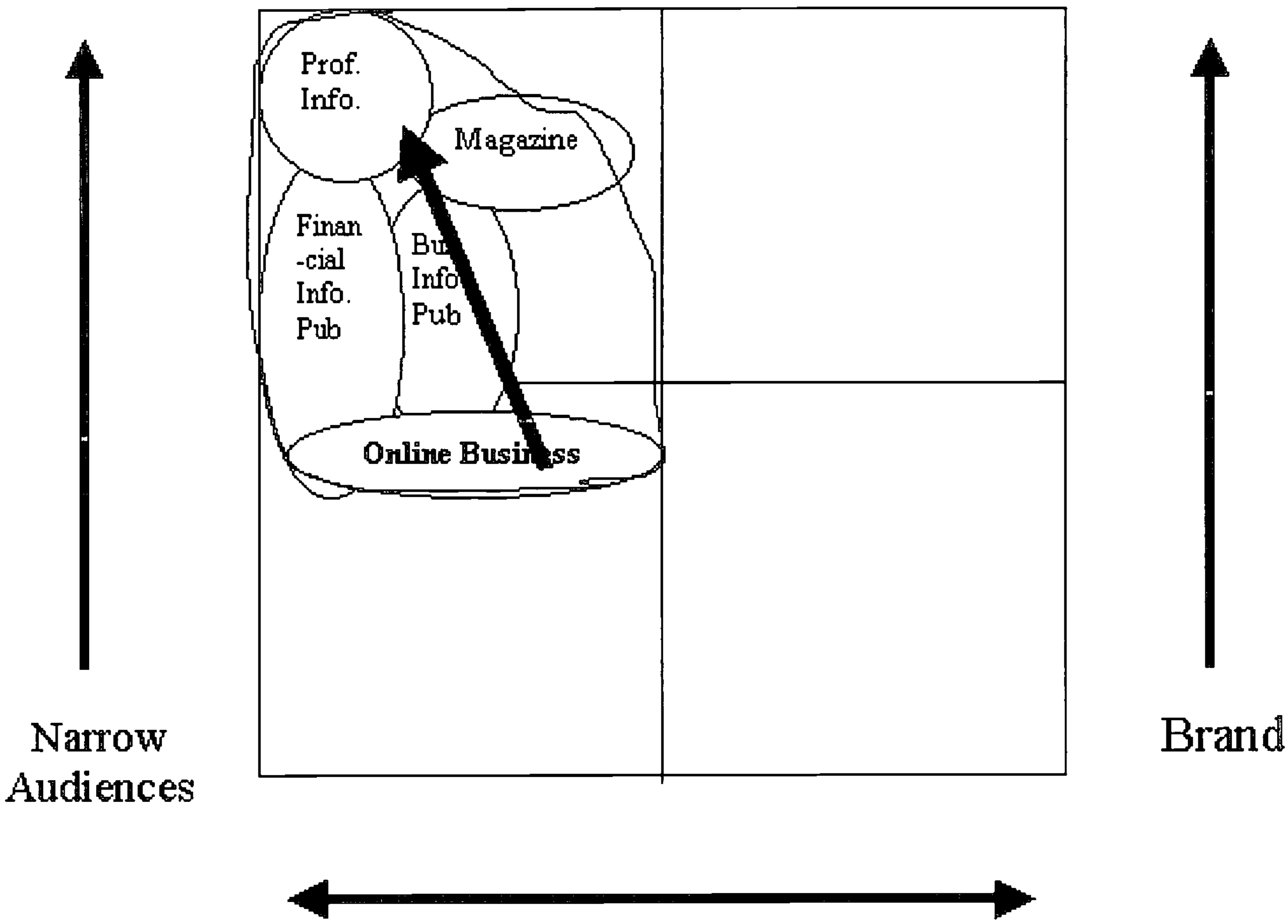
Figure 3.2 Market Focus: Consumer Media Content



Source: European Commission(DGXIII/E, 1997)

1. ***Consumer media content:*** The movement within the consumer area is seen to be narrowing in terms of audience targeting and brand focus, as shown by the direction of the arrow (Figure 3.2). The consumer media content includes broadcasting, film, and online and offline communications platforms, traditional newspaper, book and magazine publishing too. Consumer media can be aimed at consumer segments of any size, in any place, and with interactivity. The difference will be the degree of interaction empowered, and the ability of consumers to become much more committed to an in-depth and long relationship with the media provider.

Figure 3.4 Market Focus: Business Media

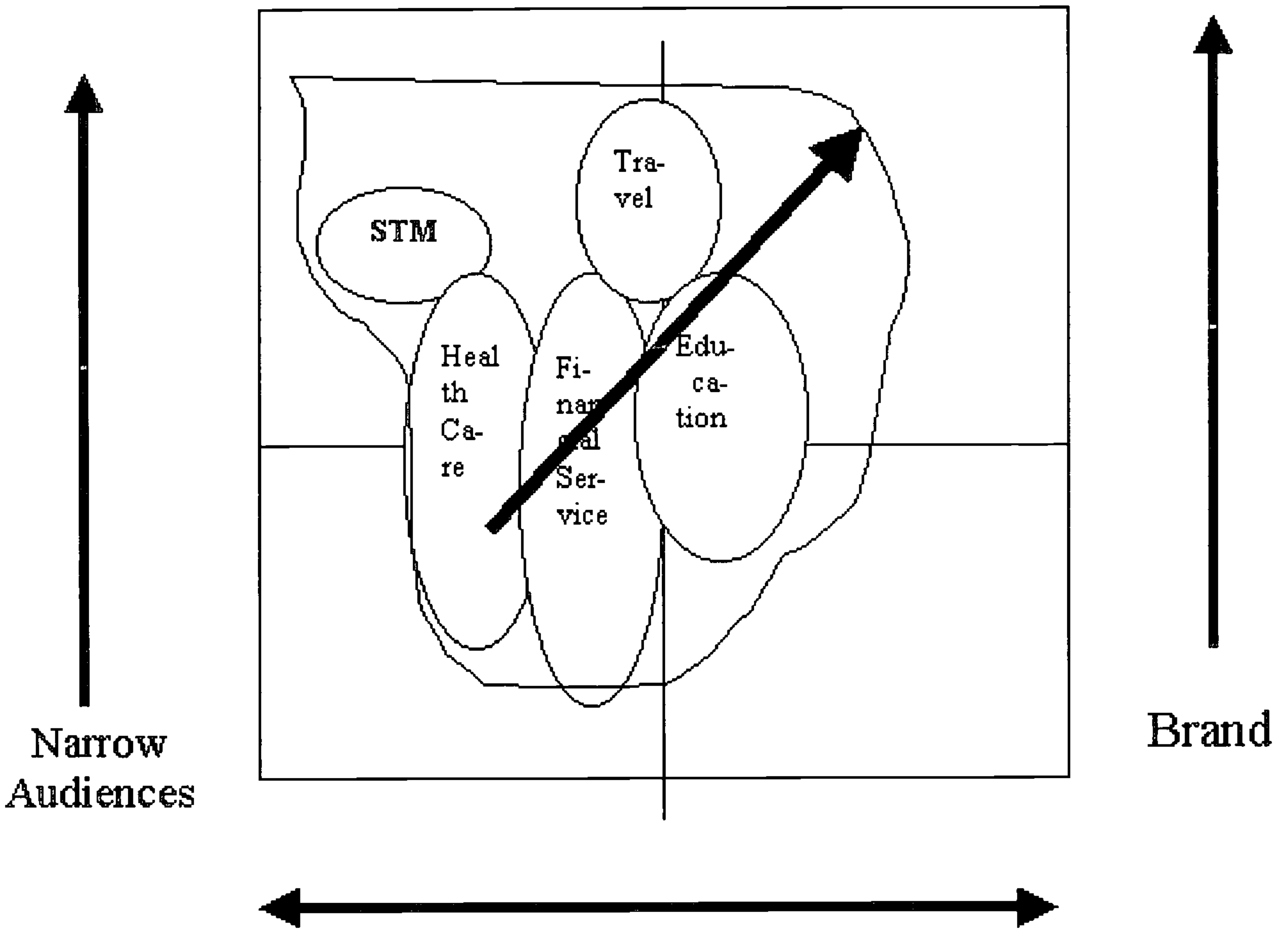


Source : European Commission(DGXIII/E, 1997)

2. ***Business media content:*** In general, business media are those channels which are deployed directly by the corporation to enable communication - usually about a corporation's operations, goods and services - via print or online, with customers, suppliers and distributors. This can be business-to-business or business-to-consumer. It also includes any other media content which to inform decision making, such as online business information services, trade magazines. Corporate media are driven by the business model and supply chain relationships of the particular vertical market in which that business operates. In the corporate business-to-business online service, it is somewhat easier to segment users into particular groups of customers who are seeking specific and defined products and services.

Companies access the Web's information to keep abreast of news affecting investments, currency obligations, transportation blockages and other events or trends that could affect their business on a daily or long-term basis. Some Web businesses integrate news feeds, stock tickers, trusted third-party company ratings and analyses directly into products and services which they offer to their customers online as well as into their internal business processes.

Figure 3.5 Market Focus: Knowledge Media



Source : European Commission(DGXIII/E, 1997)

3. ***Knowledge media content:*** The knowledge media content is that which delivers information specially to the education and research communities on consumer as well as corporate use. With the publishing technology, and with real-time methods of online distribution, the power-base moves towards the creation and editing community, away from the traditional media corporations that have played a powerful role in disseminating learning material and information.

The migration from business users (with largely pre-ordained budgets) to consumers (with discretionary, if smaller, budgets) within the knowledge media domain (see Figure 3.5) will demand significant changes in packaging and pricing. Automation and personalization of use, where customers require ever more specific information, may alter the whole charging paradigm towards micro-transactions in this domain. Packaging of content and service (which may embody search agents and other value-added features) may become a strong differentiator. Media companies supplying news and technically based information into corporate knowledge environments are already finding it difficult to construct a pricing proposition which is acceptable to the clients, based around buying an undifferentiated package of content. Users here want to pay for what they deem to be of value, but may have trouble declaring this profile in advance. In STM, technology is breaking down the barriers to entry. Major business challenges for knowledge media organizations include finding ways to build customer loyalty. Building communities of interest will become critical. Community owners will require billing and activity measurement technologies, enabling them to migrate from current flat-rate subscription models, to new business models in which content owners earn commission-based revenues by charging for metered access to specific content.

IV. CURRENT MARKET STATUS OF INTERNET CONTENT INDUSTRY

1. *USA*

As of the end of 1997, 90% of US citizen use the Internet to get information. Pathfinder, Warner Brothers, CNN, CNET, USA Today, Disney, ABC and HotWired rank among the 20 most popular Web sites. The Internet offers a range of information retrieval services. Web sites in almost every industry (companies representing all 4-digit SIC codes except soybean farming can be found on the Net) drives a "search engines" industries (Yahoo!, Excite, WebCrawler, Infoseek, Lycos and AltaVista. Directories of individuals and businesses, WhoWhere? and Four11). Over 25 million U.S. adults use Yahoo!. They can get stock quotes, read press releases, and find out the current movie program. In effect, the distinction between daily newspapers and weekly or monthly magazines is blurring. These media compete for the same viewers. Book publishing industry remains apart, but it has a strong online presence to promote and supplement its traditional retail business.

A reader can get news on the Internet, usually free of charge, from any of all newspapers. The Editor & Publisher Company's online newspaper database lists more than 2,700 newspapers have online businesses in the world, of which over 60% are U.S.-based. The top 25 daily newspapers all have Web businesses, featuring the day's stories from the paper, some special Web-only sections, searchable online archives, as well as reviews of books or movies. A few work in partnership with other local businesses to highlight a given city, in addition to the general news. The most popular daily newspaper, *Wall Street Journal*, launched its Interactive Edition in April 1996. The Interactive Journal's coverage includes politics, economics, technology news, marketing, in-depth sports reporting and features, an extended editorial page, and weather. The New York Times on the Web offers readers the day's print stories online, along with AP Breaking News and AP radio, book reviews, online forums, health, sports and special in-depth features etc. Readers do not pay anything for general access, but small fees are charged for crosswords and archived news stories.

Even if Internet newspapers get a few profit, they remain committed to the Internet. Knight-Ridder, a publisher with newspaper holdings across the country, invested $27 million in its 32 Web sites in 1997 while generating just $11 million in revenue. The Tribune Company, owner of the *Chicago Tribune* among many other newspaper and broadcasting businesses, lost about $30 million on its Web activities in 1997 and expects to lose $40 million in 1998. The New York Times Interactive Edition 1997 revenues grew 66% over 1996, but the company's online ventures lost between $12-15 million for the year.

Most of today's Internet content is drawn from content prepared for the print brand. Publishers do not believe this is enough to ensure success with their online audiences. Instead, they believe that content needs to be developed and presented in a format compelling enough to encourage repeat visits.

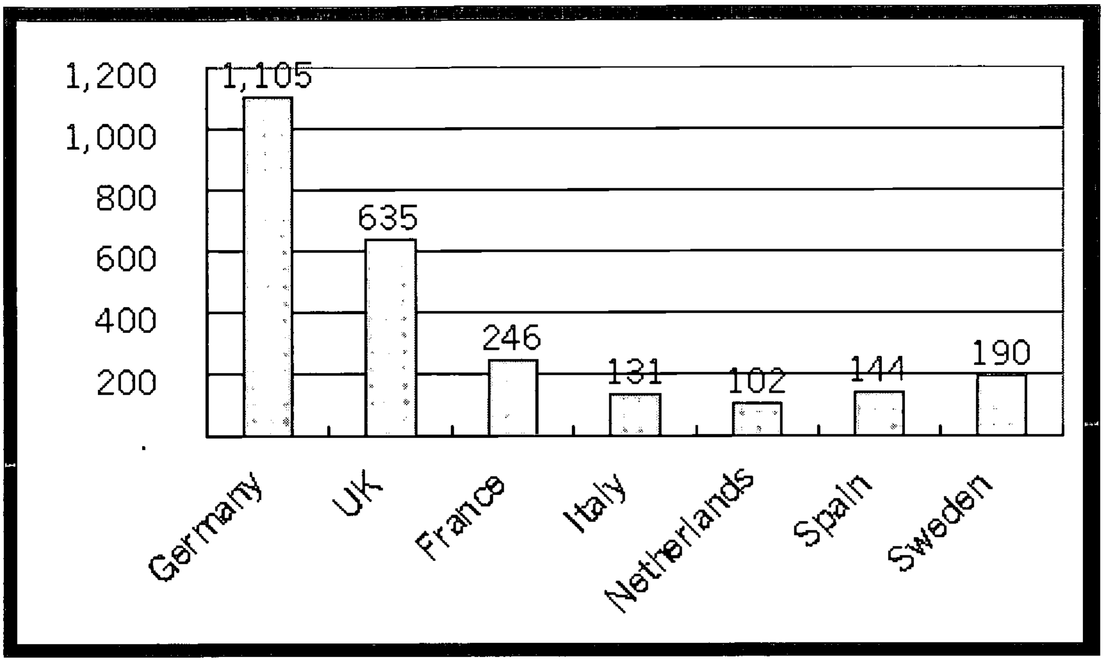
The book industry uses the Internet primarily to market and sell products. Amazon.com established a virtual bookstore in 1995, and Barnes & Noble and a host of specialty booksellers offer readers a choice of sites from which to buy books. Readers can find book reviews in a variety of places: Internet bookstores, newspapers, and magazines bring readers together to critique and discuss authors and their works.

McGraw-Hill, the leading publisher of K-12 and college textbooks, sees the Internet as an extension of its printed materials. The company has been working with universities to develop an online study resource combining presentation materials, e-mail and discussion groups that students can use to further their study. McGraw-Hill also sees the Internet as a way to provide its scientific and research audiences with more up-to-date articles in its reference publications.

2. *Europe*

The online and Internet market in Europe is dominated mainly by Germany, France and the UK, which account for the main part of supplies and revenues. They will continue to receive about the half of electronic publishing revenues in Europe over next few years.

Figure 4.1: European households online at the beginning of 1997 (000's)



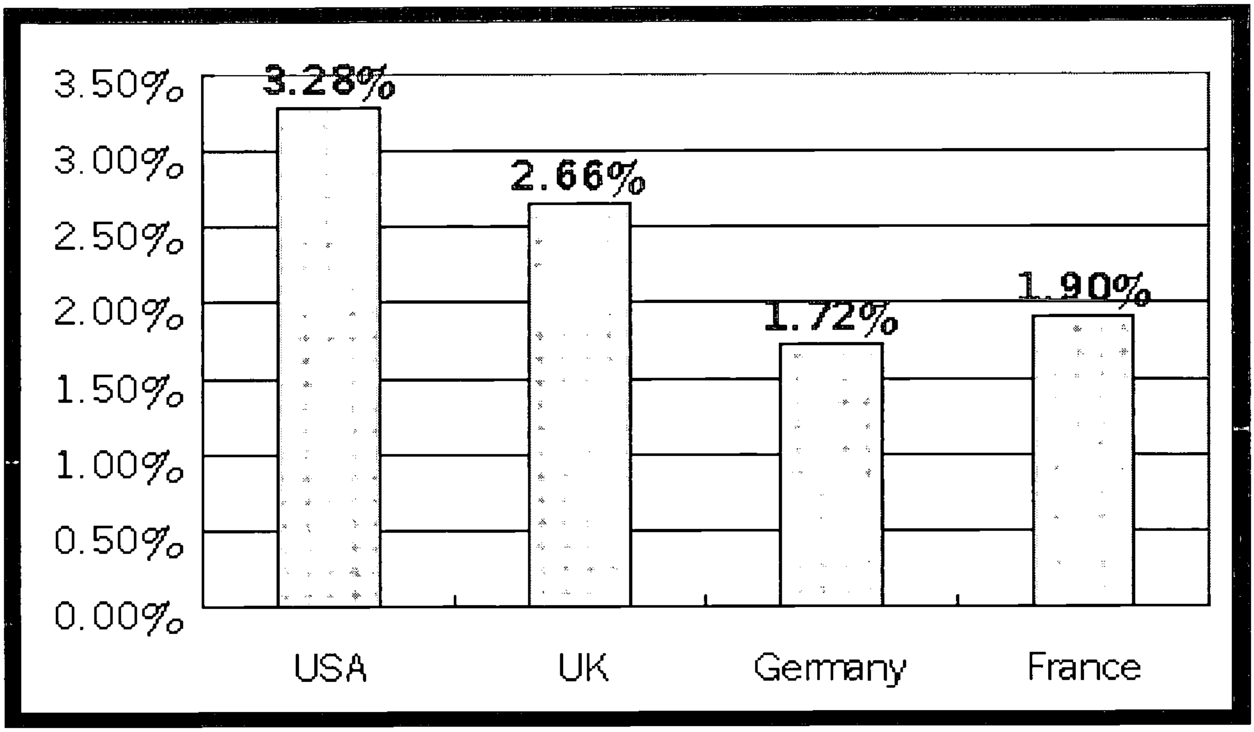
Source : Datamonitor

The European online markets took off, with a growth rate of nearly 100%. Germany appears in first place in the use of online services. The UK and France are keeping up, but Spain is clearly behind the pack. In the beginning of 1997, Germany had more than 1,100.000 online household, or nearly twice the number in the UK. In regard to online households in each European country, it is possible to consider 3 kinds of situation : the leading position of Germany, the intermediate level of the UK and France, and a group of countries (including Italy, the Netherlands, Spain and Sweden) far behind with fewer than 160 000 online households.

The European market is still behind the USA. The main reasons are a) lower investments in IT, b) higher access costs than in the USA. The followings are in details:

a. ***Differences in investment***: The gap between European countries and the USA can be explained not only by the advance of American people and enterprises in using electronic services, but also by higher total expenditure on information technologies : Investments in information technologies represent 3.3 % of GNP in the USA, while they represent only between 1.8 % and 2.7 % of GNP in France, Germany and the UK.

Figure 4.2 : Investment in Information Technologies - (% of GNP) – 1996



Source: Microsoft

b. ***Higher access costs than in the USA:*** The wider use of Internet publishing in the USA is also due to advantages in terms of costs. In Canada and the USA, Internet users spend about half as much as users in the main European countries (Spain, France, UK and Germany). This cost difference has a very appreciable impact on the growth of the online market in North America and Europe. In the coming years, access provision and phone costs in Europe will have to come down rapidly if the market is to expand.

3. *South-Korea*

There are 2 ways of online content services in Korea : PC-online as closed access and Internet as open access, but the boundaries are now blurring. For example, KoreaPCTelecom, a subsidiary of Korea Telecom is offering the Hitel service with free computer monitor (so called "PC-Telecommunication") and Korea Telecom also has the hitel site on the Internet (http://miraetel.kornet.nm.kr).

In terms of the PC-online publishing marketplace(on the Internet or not), interactive media encompass telecommunication service such as chating, e-mail, information service like data base, and transaction service like homebanking etc. As of 1998, there are 4 providers (Hitel, Cheolian, Nownuri, and Yunitel) who have about 3 million subscribers.

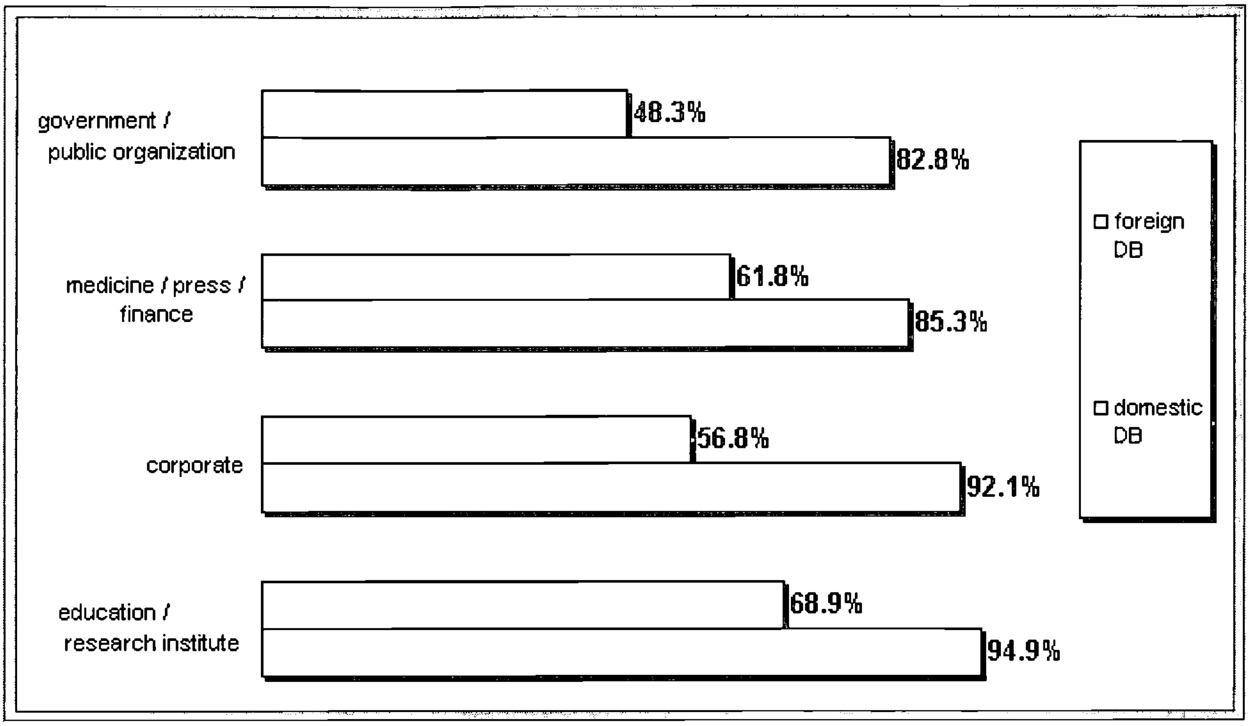
Most ISPs in Korea now focus on the Internet access of the business customer and value-added service. In consumer media sector, network game prevails for the time being. For the corporate use is being activated

For the consumer use, Internet service are travel guide, job hunting (200 sites), cyber-law information, education sites (Edunet.nmc.nm.kr; supported by the ministry of Education, about 28,000 subscriber in 1998 school students 31%, university students 25%, school teacher 20%), health information, online news, home-shopping (customized PC), economic information, game site, Network Play http://www.bungie.net http://battle.net). The example of corporate use is Export brokerage. As of Apr. 1998 there are ca. 15 web magazines in Korea.

According to the PC index (number of the sample households : 4,500) offered by the Korean Gallup Research Institute, the PC equipment rate as of March 1998 is 43.7%. Over 60% of the PC-Online use in Korea (including Internet) for getting information. And Korea Research Company announced that the most popular service in PC-Online is "open archive" (41%), followed by Internet (24%), E-mail (23%), information about the daily life (17%), discussion (17%), entertainment (17%), etc.

Korean spends approximately 72,628Won per month per household for online service use. The number of computer user is consistently increasing and the PC households with PC-Online access in 1997 accounts for 13.7% and PC household with Internet access accounts for 7.7%. The average computer use time is 56 minute per day at home, 99 minute at work or at school.

Figure 4.3 : The usage rate of CD-ROM & Online Database (1996)

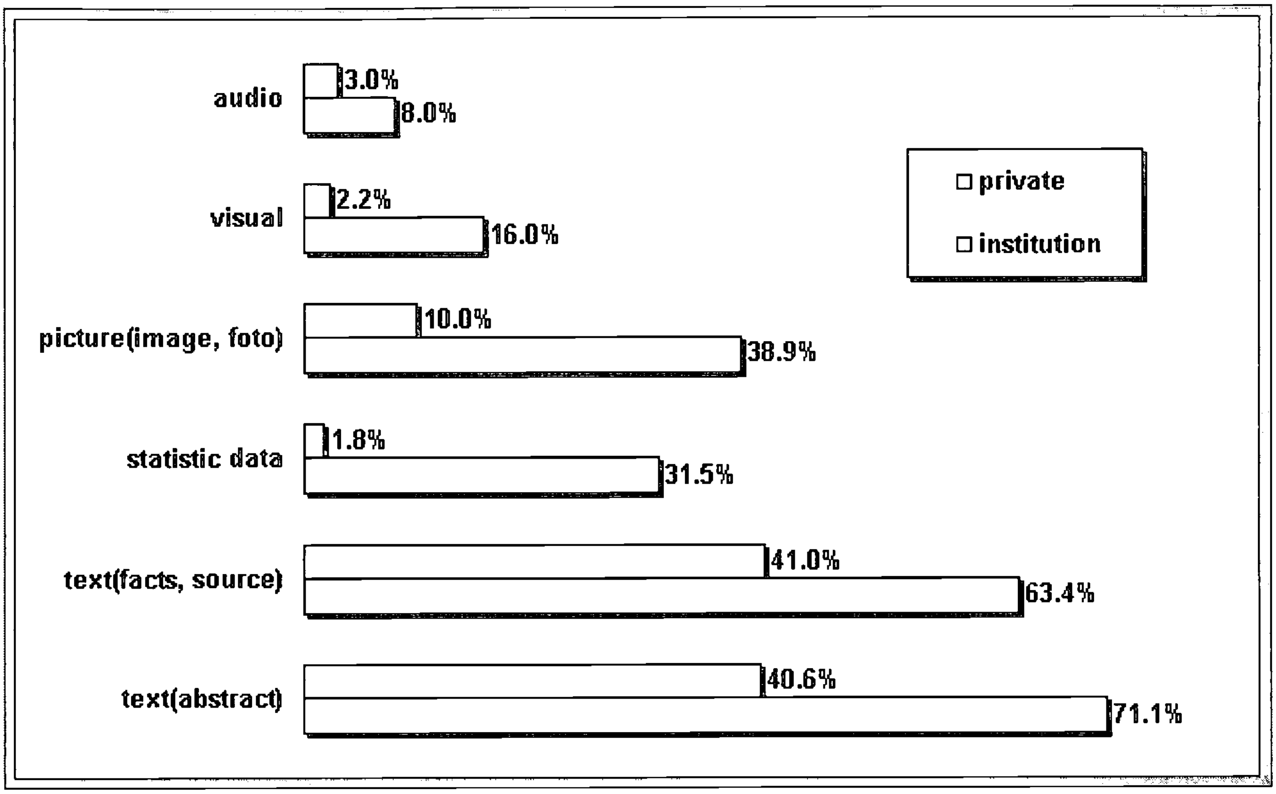


Source : Korean Database Promotion Center, "The report about the information demand research & the database usage," 1997, p.36

In terms of the usage of data base service, Korean Database Promotion Center surveyed the DB usage rate by person (1,526 people) and by institution(1,001 samples) 5 weeks long from Sep. 17, 1996 and once again during the same period from Oct. 14. The findings are following: The education or research institutes are using the most active user of the database service offline as well as online (figure 4.3).

The often used presentation types of media on Internet are drawn as figure 4.4. And the most often used media type of Internet content is the text now, but about 49% of Institution and 41.3% of the private user will definitely prefer visual content to text in near future in comparison to the current rate (2.2% for the private use and 16% for institutional use).

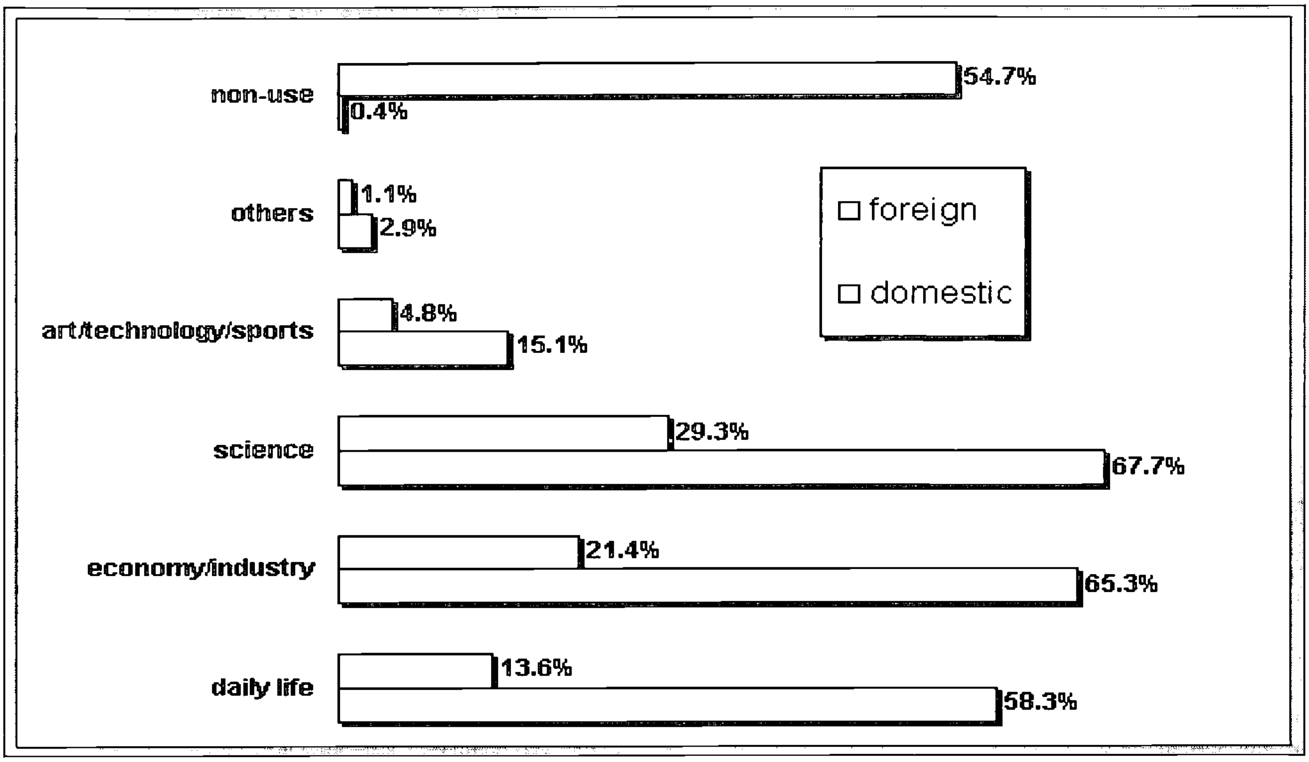
Figure 4.4: The often used presentation type of media on Internet (1996)



Source: Korean Database Promotion Center, "The report about the information demand research & the database usage," 1997, p.36

In general, about 83.3% of the corporate user are using the consumer online information service, while 73.5% of the education and research institution users, about 70% of the medicine, press, financial institution, 54.4% of the government, public organization users are using it. The most popularly used types of content are STM(science, technology, medicine) and economy & industry sector. 54.7% of the surveyed do not use foreign data base service on Internet.

Figure 4.5: The often used content sector on the Internet (1996)



Source: Korean Database Promotion Center, "The report about the information demand research & the database usage," 1997, p.36

V. ECONOMICS OF INTERNET PUBLISHING

There are two ways to make money in Internet publishing: Priced content thru subscription or non-priced, advertising-backed content. Advertisers are still experimenting with new online media, and the percentage of their total advertising expenditure devoted to online media is still very small. With the potential for fragmenting audiences in any Internet publishing, there will be a need to investigate the dynamics of measuring response to interactive advertising on the Internet and to start actively profiling and managing the communication of messages to target groups. Advertisers on the Web are already demanding and receiving details of user behavior.

The second source of the revenue is payment management including pay-per-fee and transaction. Technology for trading and payment management has a head-start due to the large infrastructures for clearance and settlement already constructed by many of the leading financial players. However, few of these systems have, until now, had to contend with the issues of real-time authorisation and transaction execution across multiple networks. The issues of standards, security, multi-currency settlement, authentication, certification and authorisation across multiple merchants and millions of users need to be resolved if electronic transaction is commercialized. A variety of techniques have emerged over the past few years but as yet there is no clear winner(Internet Commerce is not handled in this report).

Service providers such as online book retailer Amazon (http://www.Amazon.com), together with its product distributor, act as intermediaries between the publisher and the customer.

The content industry can be regarded as an offspring of the converging telecommunications and media industries. Its development and growth have far reaching economic implications.

The Internet publishing market is in a transition phase because of a gap in supply and demand. While technological development permits a fast progress in supplied services, households do not seem ready to integrate this new dimension.

Some aspects which are the main factors to promote the Internet publishing are to consider in the economic context.

1. *Price decrease for Internet access*

For business-to-business communications, robust networks in the corporate environment (virtual private, Extranet, Intranet, etc), linking operations along the business supply chain, are becoming increasingly prevalent. It is expected that the major global reductions in communications tariffs and expansion of bandwidth will drive forward investment in high-performance processing platform technology at all points on the supply chain. Sufficient infrastructure to support all forms of advanced interactive corporate media will therefore come to be taken for granted.

Future price cuts will lead to easier financial access for households by the year 2000, and are expected to encourage the development of a mass market. Competitive pressure will probably lead a decrease in price of hybrid optical fiber networks and coaxial cable, while production rationalization and the development of cheaper displays will enable the costs of services to be reduced. Moreover, the progress of modem networks will make for lower costs in the use of cable network with two-way transmission. ISDN prices will also profit from the competition in telecommunications resulting from deregulation. These price developments are expected to lead to Internet publishing services available to all households. (And the more people using new information technologies, the greater the decrease in prices). It remains to be seen whether this trend will be sufficient to lead to the development of a mass market for Internet publishing.

Figure 5.1 : Price decrease to an acceptable level for consumers

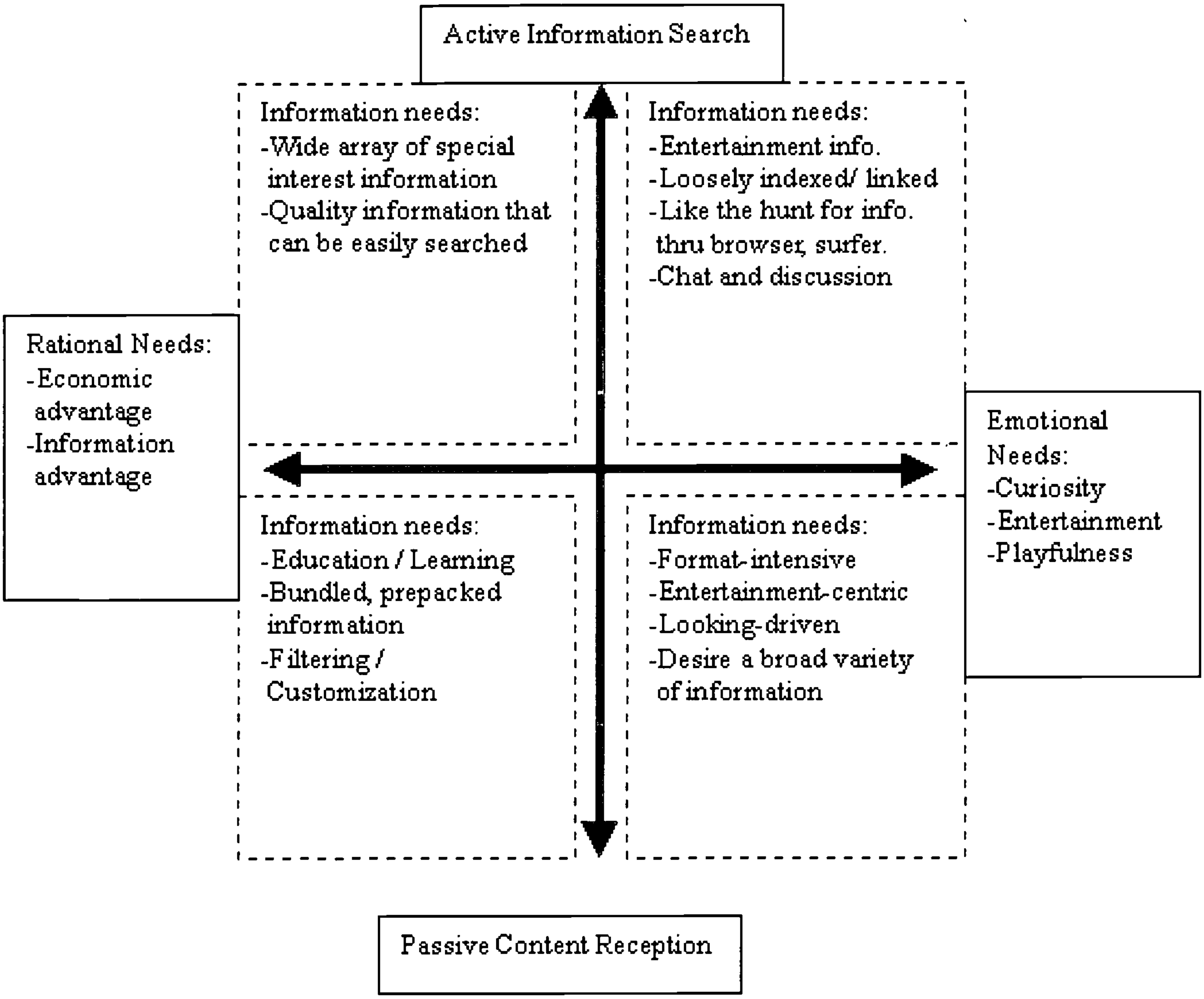
Average Price Decrease	Fiber to the Curb	ADS	Cable Modem	Adapter DVB	Modem	ISDN	Internet Adapter to TV	Internet-ready mobile phone
1990-99	15%	24%	23%	19%	4%	16%	20%	23%
1999-2003	15%	18%	21%	16%	5%	19%	14%	28%

Source: Andersen Consulting

2. *User demand: Convergence of reading and looking behavior*

The use of Internet publishing is "rational". Rational users can display an active attitude to Internet publishing services (they search actively for the information they want), or a passive one (which is comparable to passive consumption in front of the TV).

Figure 5.2: Content user's behavior



Source: Arthur Andersen

In considering different demand behaviors, we can identify 4 kinds of user : knowledge workers (professionals in information seeking) ; PC enthusiasts who use information technologies for private and professional interests ; time constrained users such as consultants, lawyers, judges, etc. ; and leisure seekers .Theoretically, for these 4 kinds of user, behavior can take the form of either active or passive consumption. But today, it is virtually always a case of active use.

The paradigm shift that has occurred in the media and communication industries is not only a shift in terms of technical convergence. Although digitization technologies are the "enabler", they are not necessarily the main drivers within the digital media markets. The current market development shows, that the markets for digital information and communication services tend to be more and more demand driven. User demand can be encouraged, but not be pushed. This is a lesson that is still to be learned by many players in this industry.

People want content to affordable price. In order to exploit the market opportunities, the companies need new skills in producing high quality Internet content that meets exactly the requirement of users. The paradigm shift for suppliers in the transition towards an Internet economy is from a product oriented to a service oriented view. Compared to the traditional media industries, the new information services are still only small businesses, and in many ways they are not operating in viable and profitable markets yet. Only when they succeed in offering a value added to the customer will the new markets become profitable.

Online services of newspaper publishers may illustrate this paradigm shift from "product" to "service". In the traditional print markets, publishing companies produce one or several "newspapers" or "magazines" and deliver these to their customers. But in Internet publishing, new concepts of readership community needs are emerging. Audiences are defining themselves as members of a group of individuals with similar interests who can interact online. This trend id already seen in the explosion of niche and lifestyle print magazines. But Internet service providers deliver a package of individual service offers rather than a mass product. These services fulfil the needs of such groups by integrating content, communication and commerce services.

A new stage has been reached in this development, and there are indications that consumer demand will determine the future development -- rather than technology --, as applications and content become more important.

Ironically, while the use of electronic publishing services is essentially active today, the most attractive market is on the side of passive applications: Today, 80 % of electronic publishing users have an active behavior. Most of them are knowledge workers or computer enthusiasts. These groups, which are great information seeker were the first to adopt electronic publishing technologies. Nevertheless, the higher consumption potential concerns passive applications. So, while the active user market is not expected to show any considerable growth over the next few years, most industrial players in electronic publishing are concentrating their efforts on the progress of passive applications. The market for passive services largely concerns leisure seekers, that is, a large part of the general public. Time-constrained users are also an important target for passive applications.

It appears that the rapid development of passive applications (resembling the TV context) will eventually be the only way to create a mass market. Inevitably, it has to be accompanied by a supply transfer from PC to TV. According Arthur Anderson, today's electronic publishing consumption potential among leisure seekers is nearly 7 times higher than that of current knowledge workers and computer enthusiasts. Leisure seekers, who represent the major part of the general public interested in media technologies, are driven by entertainment, curiosity and playfulness. Today, they constitute the principal gateway to the development of a mass market. To encourage these users to increase their consumption of electronic publishing, providers of multimedia services have to supply cheap and very user-friendly applications. They also have to be very shrewd in terms of marketing. The targeted public who spend 4 hours a day on average in front of the TV. So, to ensure greater use of electronic publishing by the general public, companies will have to transfer their supply from the PC to the TV set. At present, the TV presents considerable advantages over the computer: easier to use, people are all in the habit of using this terminal (familiarity with TV should prevent psychological reluctance), and, above all, there is already a wider installed base. Moreover, the history of information technologies should make companies remember that the success of mass market development depends on the size of the initial installed base.

3. *Diversification, but strong economies of scope*

To ensure a multitude of cheap services, firms will have to realize important economies of scope : The unstable character of the demand and its "zapping" behavior impose a policy of wide diversification on firms. To be competitive, each firm has to be present wherever it is possible to capture a demand. Moreover, firms have to supply their services at low costs for the general public. To combine these two imperatives, electronic publishers will have to try to obtain the largest possible economies of scope, by exploiting to the utmost the common point between different products and proliferating varieties. The target is to manage to offer products made to measure in appearance, but made in a production process that is very rationalized in reality.

It is also important to note that diversification has to be accompanied by growing interactivity of applications in order to reinforce the "zapping" possibilities.

4. *The management of information overload*

Today, the problem for publishers is not the lack of information, but its excess. The development of new technologies and the proliferation of publishers led to a plethora of publishing. To have precise information on a subject, a seeker can find a multitude of documents and can feel lost, not knowing which is the best information. Sometimes, people want information on a subject but cannot find any studies on it, not knowing whether or not such studies actually exist.

One of the main expectations of Internet publishing is to help people to find the essential part of what they want rapidly, to help them to select the best information in a short time. This management of information will be essential for Internet publishers, because all information existing today is not easily accessible for consumers.

VI. STRATEGIES FOR ACTIVATING INTERNET CONTENT INDUSTRY

1. *From mass marketing to precision marketing*

Precision marketing can be summarized by the capacity to supply a large range of personalized services, to ensure customer loyalty.

The issue in Internet publishing market is to sell a multitude of products at different prices. Each company must have a profound knowledge of the market to develop its production and determine its price policy. It therefore has to study a lot of data concerning consumer habits, such as time and frequency of access to servers, products sought, kind of network used. A detailed analysis of this data can help firms to perfect their methods of obtaining customer loyalty.

The problem for producers is that the demand on leisure is generally very unstable. People seem ready for a large access to leisure applications, but only if these are constantly renewed. Today, leisure consumption by the general public is characterized by an important awareness effect which multimedia enterprises have to take into consideration.

To overcome this constraint, Internet publishers have to supply a wide range of greatly differing leisure applications. Then, the most delicate operation for a company is to offer the consumer the possibility to move from one service to another, keeping him in the sphere of supply of this same company.

To succeed in this task, firms have to build a strong brand name that can be recognized in the overabundance of information and applications. Creating this brand awareness will be one of their principal challenges.

A content provider's effort to specify interactive digital content for highly specific target markets is termed customization. It is demand side. On the other hand, a user's interactive modification of a service for individual purposes is defined as personalization. In the Internet economy of the content industry, new concepts of readership communities based on interests, needs and lifestyles are emerging. More than ever, audiences are defining themselves as members of a group of individuals with similar interests who can interact online. The trend towards individualized lifestyles, together with the desire for personal independence and mobility, have already changed the parameters of traditional print media design.

Publishers previously reacted by publishing special interest magazines and newspaper sections. As this trend towards personalization continues, content providers are confronted with a further shift from formerly coherent markets to increasingly split market segments. These market segments can only be served with highly targeted content. Otherwise, this growing sense of online community is frustrated by the inability to easily find related content, services, and other users. Community services fulfil the needs of such groups by integrating content, communication and commerce services.

The new media, Internet provides publishers with the opportunity to join their traditional content with content-related advertising, information from other content providers and a whole range of entirely new services, such as opportunities for customer interaction through chat-lines, discussion forums, free bill-boards, consultation, institutional and governmental services, and online financial transactions.

A major driver of the customization of content will be advertisers and marketers. Online is not yet a mass medium and cannot compete with traditional media in reach. The attractiveness of online services for advertisers is the quality of the audience and not the quantity. The development of a 1 to 1 marketing has been the talk of marketers for years. With its inherent feedback circle, the online medium could be the perfect environment for this approach.

While the service provider aims at customizing his offerings, he may also consider offering the user interactive tools to modify his services for his specific purposes. *PointCast* is an example of such a service that allows the user to determine what exactly he wants within a framework of content offered. Another example of a news service allowing personalization is *NewsPage Direct,* an e-mail enhanced service launched in February 1996 by the US company Individual Inc.. It is a software that works like a news scanner, skimming articles, reports, editorials and all other sorts of news content on a daily basis. Articles are selected according to a personalized user profile the customer has generated by interactively selecting 10 topics of interest out of 2500 subject fields. Every morning, *NewsPage Direct* extracts the most relevant articles from the daily pool of 20,000 incoming stories and delivers the package to the user's e-mail box. The customized news service runs on a proprietary network and is financed through subscriptions and advertising.

Although "personalization" has been a key word in the discussion of interactive content, there is some evidence to doubt the analytical idea behind that concept. At least, "personalization" is not a value in all cases and by itself. It will certainly not be viable to improve low quality services or make them appear more attractive simply by giving the user an opportunity to "choose among the bad fruit". It may even seem contradictory to expect from content providers to act as an information organizer in the vast amount of information available (i.e. provide targeted and pre-selected high quality content) and, at the same time, let the user actively generate his own service. The problem with this idea is that this is exactly the "service" users expect from quality content providers; they are not interested in reshaping the content and services they get.

One way of viewing "personalization" in the sense of selecting content is to focus on giving the user the opportunity to quickly navigate within the service and to make intelligent queries. Classified ads are a good example. Electronic classifieds are no value added service if they do not include special query tools. It should be possible to make a database query for real estate classified ads, for example, according to categories such as <price>, <number of rooms>, <location> etc. This is the way how "personalization" of service could be understood. The task in this example would be to provide the publisher with a tool that minimizes the effort of entering classified in a database and allows the user to make an online query according to his "personal" search criteria.

2. *Marketing mix*

Content is the most important asset in the value chain of the interactive publishing industries. This holds true if some specifications are made in terms of what the concept of "content" is. In particular, it is very important to understand the transition of the media industry from a product towards a service oriented industry, since this transformation determines the concept of "content" in the digital interactive services industry.

The term "content industry", which is becoming widely used, has rarely been defined in detail. While in the traditional media industries "content" was usually media content, i.e. information (such as newspaper reports, broadcasts, etc.) and entertainment programmes (such as features, movies, talk shows, etc.), in the digital media industries the term "content" has a broader reference. Content, seen in terms of the new content industry, is more than the total of texts and images. Rather, *content is programmed and an integrated (information / entertainment, etc.) service package for a target group. It comprises communication services and transaction services.*

The content industry comprises all businesses that are part of the value chain, beginning from content creation and ending with the devices the customers need in order to access and use the final product or service. This implies that the traditional media industries are involved in the content industry as well as independent digital studios, Internet access provider, telecom operators, cable TV network operators and hardware and software companies. From a technical viewpoint, the content industry comprises each of three areas - content production, network distribution and information retrieval. Each segmented markets within the content industry has different drivers and impediments, requires different measures and initiatives to encourage market development and is at a different stage or level of market maturity.

Faced with a hesitant demand and a poor knowledge of potential users' needs, companies have to make important choices in terms of marketing positions in a very vague future. Consumption growth is characterized by several paradoxical trends which have to be taken into consideration by multimedia producers: individualization but globalization of production and consumption standards, etc.. Producers therefore have to direct their supply along different paths: very attractive and user-friendly services but also very targeted and personalized; multisensorial but easy to use services; access to an abundance of quick-to-find information. For companies, the greatest difficulty will be to combine the management of an ever-more efficient technological supply with the management of emotional values. In this situation, choices in terms of marketing-mix are particularly delicate .

3. *Added value chain*

The industrial organization of Internet publishing is moving towards vertical integration. An increasing variety of players are attracted by this recent market, but only few will be winners in the strong competition. Now, it is still too early to know exactly what the future configuration of this production will be. As traditional publishers have to incorporate an electronic supply to stay competitive, they have to face up to a new array of competitors from the communications, IT and financial services sectors. Thus, while the use of Internet publishing is being developed on a large scale, the industrial organization of the supply is taking shape. Companies with different activities and especially of different sizes, which are now in mutual competition, often have strong input-output relations with each other. Differences in size and in economic power could profit a few major players (as telecommunications operators, for example) and provoke a multitude of buy-outs. Finally, the industrial organization of Internet publishing supply will evolve on the basis of a vertical integration. Firms presenting the best marketing and technological skills, a large scale supply of services and a strong experience in strategic competition will be in the best position to win huge market shares.

While large firms have a decisive role in the development of Internet publishing market, small companies will be in the front rank in terms of creativity: Internet publishing is a capital-intensive activity. Investments in new products are ever higher because of technological progress and the fast development of standards. Moreover, the strong competition leads to increasingly high minimum investments. Internet publishing is an activity with great financial risks. To meet competition, companies have to be of a sufficient "critical size", to be able to spread their costs by achieving important economies of scale. Nevertheless, as in traditional publishing, large firms have to work with smaller subcontractors to supply a very large range of products and to ensure a greater success potential. Furthermore, a multitude of subcontractors gives large firms a higher degree of adaptability and flexibility. These subcontractors are small enterprises with a great deal of creative activity but without sufficient financial resources to develop and distribute their own products to the end user. The support of larger firms is indispensable for them. So, as an atomization of creations appears absolutely necessary to encourage the development of new products, the financial commitments of large firms is essential. In these conditions, close-cooperation will be developed between majors and the most creative of small enterprises. This co-operation will enable transaction costs in Internet publishing production to be considerably reduced, each players concentrating on his own skills and using his partners' know-how to exploit his production.

The more Internet publishing market develops, the more the added-value will move from infrastructure and services operators to content players. This added-value swing from the downstream of production chain to upstream will be the factor structuring future relations between big and small firms.

VII. CONCLUSION

The convergence of telecommunications and media industries and the resulting paradigm shift in the media industries has been enabled by the rapid development in the area of digital technologies. The new emerging markets have now reached a stage, in which these technologies as the enablers are no longer the main drivers. Case studies of success and failure show that markets for digital information and communication services tend to be more and more demand driven. User demand may be encouraged, but cannot be pushed. This is a lesson that is still to be learned by many players in this industry. Information engineers move towards the center of value generation of the new media industries. Their skills are core competencies in the converging digital media and telecommunications industry. They provide solutions for all sectors of the value chain. The know-how in information engineering is needed to create attractive content, expand service function, develop script for self executable content, improve interactive features and integrate them with e-commerce solutions. Information engineering is also required for content dissemination and delivery over networks, and it is essential for information retrieval, i.e. for the design of user interfaces and search and navigation tools.

If "content" is the most valuable and important part of the interactive digital services industry, this should be properly reflected in the value chain. Comparing the value chain of the converging industries with the value chain of the interactive services industry reveals that, indeed, the share of content creation and content packaging has increased. In the traditional telecommunications industry, 80% of value are generated by the network and services operator and 20% by manufacturing equipment. It has been estimated that in traditional print markets (here: newspaper & magazine publishing), content creation and aggregation adds about 40% to the total value. In the new digital services industry, the value added by content creation and processing will be more than 50%. Service integration, platform management and "byte transport" will each account for 10-15%, and end user technology about 10%.

Figure 7.1: Changes of the value chain in the converging industries

Traditional Telco. Industry

Network & Service Operator Equipment **80% 20%**	

Traditional Print Publishing Markets

Creation **10%**	**Content Packaging** **30%**	**Printing** **40%**	**Distribution** **20%**

Online Service 2000

Content Creation **20%**	**Content Organizer** **30%**	**Service Operator** **20%**	**Network Operator** **20%**	**Equip.** **10%**

Source: European Commission (1996)
Jahrbuch Telekommunikation und Gesellschaft (1997)

Markets of tomorrow requires a much broader skill and competency set than today. To occupy the strategic high ground, players will have to play new roles which will require combinations and extensions of current skill sets. They will be driven by market demand and by pressure from players entering the market from other industries.

Internet congestion is a bottleneck for the development of commercially viable business applications. It will be a critical success factor for all Internet based services to solve this problem.

Cross publishing demands comprehensive and systematic guidelines for efficient interface management. One focus of research must be to establish standards for the multiple use of content and to invest in software improvement and quality process enhancement.

New servers and customer service functions, as well as high speed Internet applications, will enable a next generation online services whose offerings will be fully integrated with the Internet platform.

Strategic co-operations and outsourcing are gaining importance in the content industries. As a consequence, "co-opetition" is the new market rule for big and small players: companies will have to compete in some areas, while co-operating at the same time in others. While big player concentration attracts much attention, numerous small businesses with a clear focus on specific aspects of the creation process are emerging and proving successful.

The value chain of the interactive digital services industry creates a paradoxical situation. On the one hand, the economies of digital technologies make it easier for all players to build new competencies. Content creators may develop into content deliverers, carriers think about entering the content creation sector. On the other hand, it remains almost impossible for an individual player to control the whole value chain. Everybody needs partners. As a consequence, strategic alliances are critical for success and the business landscape is changing rapidly and continuously. New companies are emerging, focusing on narrow aspects of the value chain and offering their special services to other companies. In this rapidly developing new market environment with alliances and co-operations changing everyday, companies must remain focused on their strategic objectives. The business model becomes more important than ever, i.e. the clear decision about which competencies to build in-house, and which competencies to outsource. The game of playing around with alliances and co-operations is an opportunity for entrepreneurial activities, i.e. setting up small businesses and offering services to larger businesses, especially in the area of content creation and processing.

New media creation requires a combination of "publishing" skills (traditional skills of print media) and "programming" skills (skills of broadcasting companies). Motion is not just in pictures, but also in texts.

With regard to digital content engineering, new content requires the combination of the "publishing" skills of producing in pages and chapters (space media skills) and with "programming" skills of producing in clips, sequences and episodes (time media skills). Multimedia adds animated graphics, images and video the text-based content, whilst giving the user control over the sequence of information consumption. User guidance and navigation charting become critical content features. Multimedia thus transcends both print and TV, braking constraints on reading and looking. Hypertexts end linear reception processes. Improvement of compression technologies and the transmission rates for real video and audio transmission over narrow bandwidth networks are business critical.

In the long run, once bottlenecks such as low bandwidth no longer exist, services having the highest market potential will be combining "looking" and "reading" elements. As already mentioned, 4 sectors constitute major market segments for the digital interactive services industry from a demand side perspective. It is important to consider the user motives and the preferred way to interact with media according to the target audience.

VIII. REFERENCES

1. Harnard, S.(1991), *Post-Gutenberg Galaxy: The Fourth Revolution in the Means of Production of Knowledge*, Public-Access Computer Systems Review (electronic journal), 2(1), p.35-93

2. ACTS 97. Project Summaries. Annual technical report.

3. ACTS - The Way Forward. Advanced Communication, Economic Growth and Social Development in Europe. European Commission, DG XIII/B

4. Blunden, Brian / Blunden, Margot (Ed.) (1996): *Advertising in a multimedia age.* Bruxelles: IEPRC/Pira International.

5. Bruck, Peter A. / Selhofer, Hannes (1997): *Osterreichs Content Industry*. Bestandsaufnahme und Marktstrategien. Wien: Buchkultur

6. Bruck, Peter A. / Selhofer, Hannes (1997a): *The Ignored User. Critical Factors Determining User Demand for New Information Services. Proceedings to the ENCIP European Communication Policy Research Conference 1997 (Venice, 23- 25 March 1997)*. Published in: "Communications & Strategies", Issue 26, 2 nd quarter 1997. p. 277-302

7. Burgelmann, Jean-Claude / Verhoest, Pascale (1996): *Trans-European Information Networks: Rhetoric and Practice.* In: Telematics and Informatics, Vo. 13, No. 2/3, Spring/Summer 1996. p. 67-80

8. Colombo, Massimo / Dang Nguyen, Godefroy / Perucci, Antonio (1997): *Multimedia, Paradigmatic Shift and Distinctive Competencies of Firms: an Empirical Analysis.* In: "Communications & Strategies", Issue 26, 2 nd quarter 1997. p. 207- 254

9. Databank Consulting (1996): *Review of Developments in Advanced Communication Markets*. FAIR Report Series N. 1. (Oct. 1996)

10. Diebold Deutschland Gmbh / Telemedia GmbH (1996): Business Digital

11. Dumort, Alain / Dryden, John (1997): T*he Economics of the Information Society.* Bruesel: Office for Official Publications of the European Communities.

12. EC, DG XIII (1995): *EL PUB 2001. Identification of influential technologies, impact assessment and recommendations for action.* Report by Meta_Generics Ltd., November 1995.

13. EC, DG XIII/E (1996): *Strategic Developments for the European Publishing*

Industry towards the Year 2000. Report by Andersen Consulting and IENM / Techno-Z FH F&E. September 1996

14. Page 55 EC, DG XIII/E (1996a): *The Markets for Electronic Information Services in the European Economic Area*. Supply, Demand and Information. IMO, October 1996.

15. EC (1997): *Building the European Information Society for Us All*. Final Policy Report of the High Level Group of Experts. April 1997.

16. EITO (European Information Technology Observatory) (1997): Annual Report.

17. *The Emerging Digital Economy II. A Market-Entry Strategy Analysis for Media and Technology Ventures*. KPMG (1997).

18. Feifer, Richard / Tazbaz, Denise (1997): *Interface Design Principles for Interactive Multimedia*. In: Telematics and Informatics, Vo. 14, No. 1, February 1997. p. 51- 66

19. Fontaine, Gilles (1997): *Subscriber Control. What Impact on the European Electronic Communications Industry*. In: "Communications & Strategies", Issue 26, 2 nd quarter 1997. p. 255-274

20. Fuchs, Gerhard: *Interactive Television - a Shattered Dream?* In: "Communications & Strategies", Issue 26, 2nd quarter 1997. p. 303-333

21. *The Future of the European Media Industry*. Financial Times Management Report (1996).

22. Grauer, Manfred / Merten, Udo (1997): *Multimedia. Entwurf, Entwicklung und Einsatz in betrieblichen Informationssystemen*. Berlin/Heidelberg/New York: Springer Verlag.

23. Jahrbuch Telekommunikation und Gesellschaft 1997: *Die Ware Information - Auf dem Weg zu einer Informations?onomie*. Ed. by Kubicek, Herbert et al. Heidelberg: R. v. Decker Verlag

24. Latzer, Michael (1997): *Mediamatik - die Konvergenz von Telekommunikation,* Computer und Rundfunk. Opladen: Westdeutscher Verlag.

25. OECD (1996): *Science, Technology and Industry Outlook*.

26. Pierre, Samuel / Safa, Haidar (1996): *Models for Storing and Presenting*

Multimedia Documents. In: Telematics and Informatics, Vo. 13, No. 4, Fall 1996. p. 233-250

27. Rheingold, Howard (1993): *The Virtual Community. Homesteading on the Electronic Frontier.* Addison-Wesely Publishing Company.

28. Riefler, Katja (1996): *Zeitungen online - Chance oder Risiko? Onlineaktivitaeten der Zeitungsverleger.* In: Media Perspektiven 10/96, 537-549

29. Rojo, Alejandra / Ragsdale, Ronald G. (1997): *Participation in Electronic Forums: Implications for the Design and Implementation of Collaborative Distributed Multimedia.* In: Telematics and Informatics, Vo. 14, No. 1, February 1997. p. 83- 96

30. Vogel, Andreas (1996): Fachverlage: *Behutsame Schritte zum Electronic Publishing.* Multimediaaktivitaeen von Fachbuch- und Fachzeitschriftenverlagen. In: Media Perspektiven 10/96, 526-536

31. Zimmer, Jochen (1996): *Pay TV: Durchbruch im digitalen Fernsehen? Bezahlfernsehen in Deutschland und im internationalen Vergleich.* In: Media Perspektiven 7/96, 386-401

Return to Top   View Full-screen

Integrated Internet Digital Networks:

The Post-Convergence, Pure-IP Network Model

George E. Darby

Teleport Asia, U.S.A

ABSTRACT

The flexibility and power of the ATM protocols, such as MPOA, LANE, and PNNI, stand as masterpieces of interoperability ... and overhead. A pure IP network avoids the 10% penalty in cell management bits required by ATM, but, for the time being, lacks the sophisticated network management features of ATM. Where the cost of every bit per second is important, such as in thin-route environments (whether that means digital network service to a small, remote island or to a suburban home office), a "pure IP" network can make the critical difference in affordability to the user and profitability to the carrier. Telecom carriers have entered the post-Convergence world where digital video and telephony happily coexist in pure IP networks: Web browsers play MPEG-2 video fed through Ethernet-speed cable modems and DSL access adapters, and concurrently support Internet telephony or videoconferencing. Since Internet usage is the engine driving most of the growth in digital networks, this author calls the post-Convergence, pure IP network model, the "Integrated Internet Digital Network." This paper discusses the factors that define the paramount network architectural issue of the post-Convergence era: whether to deploy IP over ATM, IP over SONET/SDH, IP over fiber, or even IP over individual DWDM channels to build "Integrated Internet Digital Networks".

View Full Text

Integrated Internet Digital Networks:

The Post-Convergence, Pure-IP Network Model

Digital Video and Telephony "Converged" in 1998. With the release in 1998 of Microsoft's Windows Media Player 1.0 and NetMeeting 2.1, and of similar software from other publishers, and the wide availability of cable modems and Internet telephony, digital Convergence is now a fact, not a prediction, in the U.S. Although Convergence is now limited to areas of Ethernet-speed (at least 1 Mbps inbound) Internet access, the proliferation of multicasting under Internet Protocol ("IP") version 6 (explained below), Ethernet-speed Internet access for end-users (whether by cable modems, DSL, set-top boxes, or VSAT), and Web streaming media will soon begin to take market share from broadcast and CATV markets in the U.S., and will similarly invade markets outside the U.S. Rapid growth of Converged, IP-based media will not only restructure consumer purchasing behavior, corporate procurements, and traditional CATV, broadcast, and print media markets, it will also substantially shift advertising allocations, redefine the classroom, and make lifelong learning feasible and affordable. The Internet is the engine driving most of the growth in telecommunications and change in modern civilization. The Internet's importance will only increase in the coming years, as the following discussion illustrates.

The US$50.00 Test and the Broadcaster's Nightmare. Put yourself in the shoes of a consumer willing to spend US$50.00 per month on electronic information and entertainment services. You have two, maybe three choices: (1) CATV service, with some premium channels, from the local cable system operator; (2) Ethernet-speed access to the Internet and Web; and, (3) where national regulations permit, a direct broadcast satellite, or Direct To Home ("DTH"), service like DirecTV, Echostar, BskyB, or Sky*PerfecTV. If you, as a consumer, could obtain "television channels" through the Web that had quality equal to or better than CATV channels (but with even more variety), your purchase decision would strongly favor Ethernet-speed Internet access, since Internet access brings with it much more than one-way viewing of entertainment programming. The Internet, accessed through a Web browser, brings interactivity and custom-tailored, individual experiences. Most Web surfers today never experienced the ASCII (character-based) world of the Internet: they know only the graphics based World Wide Web. To these users, the key features of the Internet, email and file transfers, combine with Web surfing to define the interactivity of the Web. A television broadcaster's worst nightmare: when the traditional Web browser experience transcends being "TV-like" in appearance, to be better than TV in video and audio quality, in interactivity, and in program variety, only the less fortunate (those without Ethernet-speed Web access) will be watching traditional television, even if it is digital broadcast television. Perhaps even more threatening to broadcasters is the probable migration of high-income audience segments from TV viewing to viewing "streaming video" over the Web. Digital Convergence is draped today in technical jargon, but soon will have enormous, global economic impact as consumers change the way they select and transact purchases, pursue lifelong learning, and spend leisure hours.

Digital Convergence is about "streaming media" (compressed digital video and audio) becoming the principal component of telecommunications networks and displacing traditional mass communications (newspapers, magazines, radio, and television). From a technical perspective, there is no question that streaming media works well and could displace traditional mass communications in many service/markets. Two case studies illustrate that such displacement is inevitable. DTH TV is one-way streaming media (an MPEG-2 datastream, explained below, from satellite to viewer that contains both audio, video, and related text and control information); the rapid adoption of DTH TV validates streaming media as fungible with CATV and broadcast television. The second case study is the explosion of Web Commerce, both business to business and business to consumer. Intel, for instance, achieved Web Commerce sales of over $1 billion per month, only months after commencing Web Commerce operations. The issue is to what degree and how rapidly such displacement of traditional mass communications and purchasing will occur. The DTH TV viewing experience is like analog CATV, but with digital quality. Returning to our survey question in the preceding paragraph, some DTH providers have recognized the need for interactivity to compete effectively against terrestrial streaming media and offer a "hybrid" solution that combines DTH TV and DTH Internet access (e.g., DirecTV with DirecPC). Unfortunately, the combined monthly payment for the hybrid DTH solution is far more than US$50.00 per month and often requires a larger antenna that receives signals from satellites in different orbital slots; moreover, Web access is at 400 Kbps inbound to the user, and at 33 Kbps or lower modem speeds outbound from the user (the outbound circuit is not by satellite, but by a dial-up phone line). DTH Internet service lacks Ethernet-speed, and also must accommodate satellite delays. Of the three options, terrestrial Ethernet-speed Internet access is growing most rapidly and will, in this author's opinion, become the option of choice. Although Ethernet-speed Internet access is offered today predominately via cable modems, telephone operating companies have begun to deploy digital subscriber line ("DSL") technologies that also offer Ethernet speed. The overall concept is the same: residences and business premises will increasingly have two-way, high-speed digital access to the Internet, and today's paper- and broadcast-based services will increasingly be reconfigured as, or substituted by, streaming media delivered over the Internet.

Adding additional justification to a decision to build IP-efficient networks are collaborative computing and Internet telephony products. Persons who have not used the current versions of collaborative computing and Internet telephony products, such as Microsoft's NetMeeting 2.1 (www.microsoft.com/netmeeting) or Netscape's Navigator with Cooltalk (www.download.com), will find audio quality that surpasses that of most mobilephones, and will be pleasantly surprised (if not more amazed) by how well shared applications and team authoring work. The higher the toll charges avoided by using multimedia over the Internet, the more devoted the user becomes to these new Internet technologies.

The Technical Background. The technical underpinning of digital Convergence is digital compression, the encoding of text, graphics, audio, and video in digital form with redundancy and unimportant detail omitted. Digital compression of text and graphics catalyzed the growth of the early Internet and enabled the use of the icons and graphics that give the Web its look and feel. Compression of audio and video on a commercially acceptable basis is a phenomenon of the 1990's, and the paramount technology is MPEG-2. MPEG-2 is one of three protocols for streaming multimedia developed by the Motion Picture Experts Group ("MPEG"). MPEG-2 provides the highest resolution to date of MPEG's three protocols, and was adopted by the International Telecommunications Union as the standard for DTH video broadcasting from satellites (the ITU-T DVB standard). MPEG-2 has also been adopted as the standard for DVD-Video (Digital Versatile Disk – Video, the successor technology to CD-ROM, videodisk, and Video-CD). The use of MPEG-2 involves three steps: encoding (compression) audio and video signals using an MPEG-2 encoder; distributing the encoder output as a datastream over a network or as a file stored in a recording medium; decoding (decompressing) the datastream or file at the point of use. MPEG-2 can use datarates ranging from 1.5 Mbps to over 15 Mbps: the higher the datarate, the better the resolution. For a more detailed explanation of MPEG data structures and datastreams, visit www.c-cube.com/technology/mpeg (C-Cube is the leading manufacturer of MPEG chips.) and www.mpeg.org.

Only producers of program content must deal with MPEG-2 encoders. Web surfers need only an MPEG-2 decoder, or "player". Software-based MPEG-2 players have been available for free (e.g., www.mpeg.org/~tristan/MPEG/MPEG-video-player.html). An MPEG-2 player is now included in Windows Media Player, Microsoft's free plug-in for Internet Explorer 4.x and 5.x (www.microsoft.com/windows/mediaplayer/default.asp). Not all streaming media is MPEG-2. Media Player automatically detects and plays the major streaming media protocols, i.e., Real Video/Real Audio 4.0, MPEG-1, MPEG-2, MPEG-4, WAV, AVI, MIDI, MOV, VOD, AU, MP3, and QuickTime (Media Player 1.0 does not play Real Video/Real Audio 5.0 or Quicktime 3.0 media). For definitions of the preceding acronyms, and other terms in this paper, visit http://webopedia.internet.com/. Presently, only MPEG-2 can provide CD-quality audio and, using a hardware decoder, full screen, full motion video at a resolution at least as good as analog broadcast television. Many media players other than Microsoft's are available, but most are either MPEG-2 specific, or play streaming media other than MPEG-2. The NET TOOB Stream v3.5 player (http://www.duplexx.com), for instance, detects and plays MPEG-1 and several other streaming media protocols, but does not (as of press time) play MPEG-2 streaming media. For more media players, see http://cws.icorp.net/32video-reviews.html.

MPEG-2 encoders and decoders can be either hardware or software based; hardware embodiments of MPEG-2 technology are much faster than software embodiments. Software-based MPEG-2 decoders typically provide smaller image sizes and slower frame rates than hardware-based MPEG-2 decoders. The next wave of MPEG-2 technology has already arrived: hardware-based MPEG-2 decoders for streaming media, such as RealMagic's Netstream 2 card (www.realmagic.com/ns2.html), interface with Ethernet, Asynchronous Transfer Mode ("ATM"), and Asymmetric Digital Subscriber Line ("ADSL") network services. Hardware MPEG-2 decoder cards provide full-screen, 30 fps, 720x480 pixel, 24 bit, 16.7 million color playback quality that far surpasses the "VHS quality" of many, if not most, CATV systems. These cards support the Microsoft DirectShow (www.microsoft.com/directx/ default.asp) programming interface, and are configured as Web browser plug-ins or ActiveX controls. Network-enabled, hardware MPEG-2 decoder cards are presently targeted at the corporate LAN, "video on demand" training market, but there is no difference between streaming MPEG-2 video over a LAN and streaming MPEG-2 video over the Web. The growing popularity of DVD players in new PCs will help to drive down the cost of MPEG-2 decoder cards and software.

Better than CATV and DTH. The most common MPEG-2 data rates range from 3 Mbps to 9 Mbps; 3 Mbps is typically used for non-sports programming, 6 Mbps is used for sports programming, and 9 Mbps or higher is used to maintain "studio quality." In DTH and existing digital CATV systems, many MPEG-2 video programs are typically multiplexed on a higher speed (e.g., 45 Mbps) datastream. Motion handling and scene changes in compressed digital video require higher resolution and higher data rates. Statistical multiplexing permits high motion sequences of individual programs to borrow data rate from programs that don't, at that moment, need their nominal data rate. If the several programs being multiplexed together all have scene changes and/or high motion at the same time, all programs receive inadequate data rates, and picture quality momentarily, but abruptly, deteriorates. With the multicast feature of Internet Protocol version 6.0 ("IPv6"), streaming video over the Web can avoid this "bit robbing." The multicast feature of IPv6 "forward deploys" streaming video files to a Webserver near the end-user, as explained below. DTH and CATV services are designed to deliver a complete set of up to several hundred video programs to all viewers, all the time. One viewer, however, can only watch one program at a time. Web streaming video only delivers one program at a time, from a technically unlimited selection, and does not need to depend on bit-robbing among "multiplexing partners." Thus, MPEG-2 programming from a multicast Webserver can look and sound better than "bit-robbed" MPEG-2 programming from a DTH or CATV operator.

MPEG-2 television programming served over the Web can be a continuous feed (a video feed transmitted continuously), a scheduled feed (a video feed commenced according to schedule of programs), or a "video on demand" feed (a video feed commenced upon a single user's request). The real constraint to MPEG-2 streaming video over the Web is congestion between the Web streaming video server and the end-user who has Ethernet-speed Internet access. In all feed models, streaming video programming can be "multicast," that is, distributed to (i.e., pre-recorded or buffered on) a regional server close to a group of users. Multicasting solves the congestion problem by avoiding delay-inducing Internet backbone congestion between the Web streaming video source and the end-user. For more information on multicasting, visit www.byte.com/art/9706/sec6/art6.htm. Presently, streaming video over the Web at 28.8 Kbps or 56 Kbps resembles the small, grainy images of the first CD-ROM videos. Nevertheless, the number of Web streaming video sites that feature "live multicast" and on-demand "unicast" and "multicast" video is growing (e.g., www.zulutv.com, www.audionet.com/video/netshow, www.realnetworks.com, www.comedynet.com/). There are already subscription services, such as CNBC/Dow Jones Business Video (www.cnbcdowjones.com/msnbc/free/default.htm), that use Web streaming video.

In a parallel evolution to MPEG-2 and Internet access technology, digital video production equipment has become inexpensive, relatively speaking. For instance, digital video cameras with 25 Mbps Firewire (IEEE-1394) outputs are available for under $2,000 (street price), and can be matched with Firewire input video capture cards for PCs. High-end PCs that capture digital video datastreams, perform non-linear editing, video effects, and audio processing, and then encode the edited video and audio into an MPEG-2 file essentially replace the post-production studio. MPEG-2 encoders are available in both hardware and software versions; hardware MPEG-2 encoders encode in real-time, while software encoders take longer. C-Cube (www.c-cube.com) makes a single-chip MPEG-2 encoder that enables a digital video camera to have an MPEG-2 output. These advances in technology presage an explosion of digital television production and Web-based streaming video distribution. It is a very short step from serving streaming video over a corporate or campus LAN to distribution of streaming video over the Web: the production and distribution tools are identical. Moreover, Microsoft NetShow 3.0 (www.microsoft.com/ntserver/basics/netshowservices/default.asp) supports pay-per-view and pay-per-minute billing for streaming video over the Web. This author believes that live MPEG-2 feeds straight to corporate LANs, community networks, and the Web will become common, and that the revenue from live feeds (low cost, since there is no post production) could fund the development of an astounding variety of video on demand services. Streaming video services from Webservers should become as commonplace on the Web as icons, graphics, and digital photographs are today. For more information on digital video, visit www.hypertech.co.uk/video/digvid.htm, www.dvcentral.org/, www.optivision.com/, and www.optibase.com/.

Digital Video, Collaborative Computing, and Telephony "Converged". Digital convergence has passed a critical threshold in the U.S.: free MPEG-2 players are transparently embedded in free browsers, hardware-based MPEG-2 players are available and affordable, and Ethernet-speed, unlimited time, end-user Internet access (such as Time-Warner's Road Runner or the @Home offered by Tele-Communications, Inc., and other multiple systems operators) are available in many U.S. markets for about US$50.00 per month. Ethernet-speed Internet access is spreading rapidly and will be available in locales outside the U.S. Moreover, the usage of Internet telephony, collaborative computing, and streaming media is accelerating.

Given the rapid adoption of DVD-video players (each of which includes a hardware MPEG-2 decoder) as standard equipment in new PCs, the spread of Ethernet-speed Internet access, and the affordability of digital video production equipment, the primary delay in the growth of the MPEG-2 Web streaming video market is the adoption of multicasting technology in the Internet backbone. Multicasting technology is a standard part of Internet Protocol version 6 ("IPv6"). Since IPv6 is the critical path in the dissemination of Web streaming video services, the displacement of traditional electronic and print media services should correlate very closely with the dissemination of IPv6 and Ethernet-speed Internet access.

Ramifications. Internet telephony, streaming video, and the variety of entertainment and educational programming, interactivity, shopping, messaging, telework, and community involvement available through the Web, combined with affordable high-speed access, lead to the unavoidable conclusion that digital Convergence has occurred in the U.S., and that Convergence will quickly spread beyond the U.S. as a direct function of the availability of Ethernet-speed Web access and deployment of IPv6. We can expect a rapid migration or metamorphosis of CATV operators into the Internet access and Web hosting business in an attempt to stem the appropriation of the "interactive TV" market by Internet access providers, Internet service providers, and telecommunications carriers. For satellite system operators, the rapid emergence of the Web streaming video market has two major implications. First, the digital satellite news gathering market will expand to include a new group of independent producers of digital video programming. MPEG-2 "fly-away" uplink earth stations (as opposed to uplink trucks) will become very common, which means each transponder will require more sales and marketing overhead to keep the transponder booked. Second, satellite capacity that may be freed up by the movement to MPEG-2 for video origination could be absorbed by the growth in file distribution to Webservers hosting digital video, especially internationally.

The ultimate beneficiary of these trends is the consumer, the makers of MPEG-2 equipment and software, and telecom carriers that adapt their marketing and services to attract Web streaming video business. Enormous, global economic impacts lie ahead as businesses adopt Web-based procurement and employee training, and consumers change the way they select and transact purchases, pursue lifelong learning, and spend leisure hours. The preceding establishes IP-based services as the major growth area in telecommunications, and reinforces that the economic fact that the more efficiently IP-based services are provided to subscribers, the more profitable the providing carrier will be.

The "pure IP" vs. ATM dilemma. To what degree should efficiency in handling IP-based services influence the backbone and edge architecture of a digital network? Efficiency has many ways of being measured, but the common metrics are the comparison of revenue with life cycle cost of a given complement of hardware and software ("profitability based upon rollout"), the preceding life cycle cost adjusted by upgrades of hardware and software and by the availability of skillsets required for network installation, operations, and maintenance over the product life of the equipment. The availability and cost of designers, analysts, and programmers skilled in the software underlying ATM and IP to perform software upgrades is a major consideration. Availability of such personnel determine service differentiation and delivery times of new products and services, notwithstanding the Service Creation Environment of the Advanced Intelligent Network.

ATM was designed to be the panacea for the pains of convergence. The major design objective of ATM was to accommodate voice, video, data, and related signaling and network management applications in a single backbone protocol, a "host to host" environment. The use of the term "host" (with its origins in the computer industry) by the ATM Forum (the designers of the ATM protocols being deployed today, see www.atmforum.com/) signaled a sea change from "switch" oriented network terminology. An ATM host does far more than switch. An ATM host adapts and packetizes various datastreams to fit the 53 bit cell used by ATM, routes datastreams from source to destination using a variety of techniques that depend upon the originating protocol, restores connections after failures, controls edge devices that in turn interface with end-user devices, negotiates and monitors Quality of Service and other service parameters, and more. The basic presumption of ATM is that there will be an ever-changing multitude of end-user devices and protocols. Rather than build and maintain networks in a corresponding multitude of protocols, ATM adapts end-user protocols, such as SMDS, DSL, Frame Relay, Narrowband-ISDN, Broadband-ISDN, IP, Token-Ring, etc., at the User to Network Interface, transports the datastream using ATM's 53 bit cell, and reconstitutes the end-user protocol at the User to Network Interface at the destination. In the ATM scheme, all adaptations of content types and protocols are ATM's responsibility, and were originally intended to be performed on ATM hosts. Adaptation has now been moved out to "edge devices," which are similar to remote nodes attached to a larger switch and interface with subscriber devices. Given the growth of data traffic (primarily, Internet traffic), AT&T, Sprint, and other carriers are moving, or have moved, all their voice traffic to ATM "data" networks. See www.teledotcom.com/0798/headend/ tdc0798headend_data.html. Sprint estimates a 70 percent cost reduction in delivering a voice call over an ATM data network based on the performance/cost ratio of data switches and routers versus conventional Class 4/5 central office switches.

The ATM scheme uses 5 out of the 53 bits in an ATM cell for operations and management, so approximately 10% of the datastream is overhead, not payload. ATM also requires specialized software for each type of adaptation. Since ATM's initial focus was on host to host networking, the presumption was that each media type, e.g., voice, video, and data, would arrive at the host using a different protocol, e.g., N-ISDN, MPEG-2, and IP. This approach was "digital convergence" on the carrier's premises. After adaptation to ATM cells, voice, video, and data share a common ATM path from host to host. This approach, however, did not fully anticipate the meteoric improvement of end-user devices (i.e., PCs) and the hypergrowth of the Internet.

The Internet uses IP, the Internet Protocol, the sixth version ("IPv6") of which is now being deployed. IP was initially intended to be used only for data communications. The demand by end-users in the late 1990's for faster download times of graphics-intensive Web pages and of large document files, and for uninterrupted playback of audio and video sources from Webservers, catalyzed the deployment of Ethernet-speed Internet access, as discussed above. This phenomenon produced digital Convergence on the desktop. Voice (and other audio), video, and data now arrive as part of the IP datastream at the end-user's PC. As noted above, most of the growth in telecommunications traffic at every level (local exchange, national, and international) in the last two years has been driven by the Internet. If IP can deliver what the end-user wants, desktop to desktop, could not a carrier avoid the expense of ATM and simply build a "pure IP" network, and gain market share through lower pricing? At least one carrier, Qwest (www.qwest.com), has invested hundreds of millions of dollars in building an international IP over SONET network and offers commercial IP over SONET service at OC-48 (2.5 Gbps).

Carriers and manufacturers with huge investments in ATM are responding to "digital convergence on the desktop" by bringing ATM to the desktop. There are many features that are well established in ATM that IP (as of late 1998) still lacks, such as policy management and Quality of Service. The ATM Forum continues to design and promulgate new functionality for ATM, such as the Voice and Telephony Over ATM to the Desktop ("VTOA"), LAN Emulation ("LANE"), and Multiple Protocol over ATM ("MPOA") Specifications. VTOA addresses switched voice services provided through a broadband ATM terminal, such as a PC with an ATM network interface card. Any telephone connected to these networks, i.e., to an ATM-equipped PC using G.711 PCM (pulse code modulation), can be used for voice, fax, or other telephony calling. (www.atmforum.com/atmforum/library/, and search on "VTOA"). The ATM Forum is now extending VTOA to provide PBX features such as call transfer and call conferencing, and perhaps even interoperability with voice over IP. LANE supports physical and virtual local area networks over ATM. (*Id.*, and search on "LANE"). MPOA improves routing and switching performance for the wide area network segments of interconnected LANs, including TCP/IP based LANs.

Closing the Gaps in IP. Advocates of "pure IP" networks are working hard to equal the network management features of ATM, and to eliminate even more packetization overhead by developing IP over fiber (no SONET or SDH layer), and IP over a wavelength (or channel) in Dense Wavelength Division Multiplexing ("DWDM"). Equipment manufacturers, especially Nortel and Cisco, are deeply involved in the "pure IP" movement. From the end-user's perspective, both IP and ATM can provide digital Convergence at the desktop, but IP-based hardware, software, and network service are less expensive and more available than ATM equivalents. For thin-route environments, whether the thin-route is from Honolulu to Palau, or from Toranomon to a home office in Shimoda, cost and availability are determinative factors. At present, IP owns the thin-route market. Aggregation of thin-route customers can support a "pure IP" backbone network. Such aggregation, combined with IP's being the dominant protocol for both new LANs and WANs, and for Internet telephony, collaborative computing, and streaming media, form a strong argument that "pure IP" backbone networks are here to stay. IP "standards bodies," such as the Internet Engineering Task Force (www.ietf.org) and the IP Multicast Initiative (www.stardust.com/ipmulticast/), are working to design and promulgate Quality of Service and other network management specifications for IP in the very near term, and to achieve parity with ATM.

Conclusion. This author believes that the competition among carriers and telecommunications equipment manufacturers in the post-Convergence era has a parallel in the competition between airlines. In the last decade, large established airlines lost market share to no-frills carriers. Today, IP-based multimedia networks are no-frills; they deliver any content the subscriber wants... as long as it such content remains IP packets. Several of the largest airlines established no-frills subsidiaries to compete with the upstart airlines and to regain control of feeding passengers to the full-service "network." "Upstart" IP-based networks that carry voice, video, and data, and that don't use ATM, are already successful and growing rapidly. Some telecom carriers may create "pure IP subsidiaries" to feed traffic to their existing ATM backbone networks. Other carriers with large investments in ATM will bet on the ATM Forum's ability to keep ATM functionality ahead of IP functionality, and on the adoption of ATM to the desktop service. In such a "hub and spokes" world, established carriers may deploy both pure IP and ATM spokes, whereas the new carriers will build the entire network using IP technology. Equipment manufacturers may introduce network hosts that can be loaded with either ATM and/or IP host software, subscriber cards, and interhost cards. The success of IP-based multimedia networks, and the use of IP "spokes" by the established carriers, reflects the growing reality of the Integrated Internet Digital Network, the network that can best answer a road warrior's question: "What good is a network that doesn't support Web access at megabits per second while I'm in an international conference call using collaborative computing and a prepaid calling card?" This question permits a conclusion by prognostication: Ethernet ports on IP payphones and the advent of premium phone booths, coming soon to lobbies and concourses worldwide.

Some network strategists believe that ATM, SONET/SDH, and IP are all inadequate, and that new protocols are required. These strategists are not yet prognosticating, however, on what the replacement protocols will be.

Return to Top   View Full-screen

Network Telephony: The NSP Perspectives

A white paper discussing NSP-based Network Telephony

Robert W. Harbison

StarVox Inc., U.S.A

ABSTRACT

The extremely rapid growth of the Internet since the early 1990's has spawned many new technologies such as the World Wide Web and eCommerce but none has so effected or shaken the business community, and in particular the communications industry, as much as network telephony. Network telephony has been variably referred to in the press and technical journals as IP Telephony, voice-over-IP (VoIP), voice-over-net (VoN), voice-over-frame relay (VoFR), voice-over-ATM (VoATM), and most recently voice-over-X (VoX) as a catchall acronym that represents all of these. These voice-over-X technologies represent the process of converting conventional voice telephony into packetized digital data streams that can be effectively delivered over the many different mediums that comprise data networks.

The purpose of this white paper is to explore the business perspectives and opportunities for Network Service Providers (NSPs) and how these new VoX technologies can be applied to both personal and business communication services.

View Full Text

Network Telephony: The NSP Perspectives

A white paper discussing NSP-based Network Telephony

Voice and Data Background

Digital Telephony

Prior to the 1960s all telephone communications were conducted through the transmission of analog voice signals that were subjected to many different forms of electrical and magnetic interference and required a single pair of wires to carry each voice channel. With the emergence of digital transmission techniques, telephone companies were able to transmit and receive 24 voice communication channels over a single pair of wires instead of requiring the 24 pair that were needed with analog voice transmission.

This form of communications is known as time division multiplexing (TDM) and comprises standard telephony, facsimile communications, and video conferencing. The TDM architecture is the basis for virtually all telephone networks in the modern world.

These transmission techniques are commonly referred to as DS1 circuits or T1 carriers. Each pair of transmission wires carries a set of digital signals that are divided into 24 time slots with each time slot carrying one voice communication channel. Each T1 carrier has a bandwidth of 1.544 megabits, which is exactly twenty-four (24) 64 kilobit channels. Each of the 24 channels is referred to as a DS0 circuit and is 64 kilobits in bandwidth.

Digital Voice Encoding

Analog voice signals are converted to digital signals using voice encoding techniques know as pulse code modulation (PCM). With PCM encoding, each voice channel requires the full 64 kilobit capacity of the DS0 circuit. A later voice coder improvement known as adapative differential pulse code modulation (ADPCM) made it possible to maintain voice quality while only requiring 32 kilobits of bandwidth capacity. There have been a number of voice coding techniques that have evolved over time and each subsequent voice coder has been created to either improve the quality of the digital voice or to compress the digital signal down to a smaller size than the original requirement of 64 kilobits.

Digital Channel Usage

Although the telephone companies were transmitting digitized voice communications, each DS0 circuit was completely dedicated in a point-to-point connection for the duration of each telephone call. This type of channel dedication is very inefficient when we consider that a great deal of other digital data could have been transmitted during the silent periods of the conversation. But alas, there has been no method of interspersing digital data into these telephone communications channels.

Private Use of Digital Circuits

The telephone companies also leased DS1 circuits to private companies for the transmission of digital computer data as well as for private voice networks. These leased lines have most commonly been referred to as T1 circuits or T1 lines and were charged for on a monthly connection rate plus an additional mileage charge for the distance of the connection. In some cases, the T1 could be used for both voice and data through a technique known as channel banking. Channel banking allowed the 24 channels to be divided into groups that would provide a number of DS0 voice channels in one group with the remaining DS0 channels aggregated into a data bandwidth that was equal to 64kb times the number of DS0 channels that remained in the second group. In this configuration, a private company could carry both voice and data between their geographically dispersed offices at a lower rate than they were previously incurring.

Leased-line T1 circuits were implemented extensively in the corporate world throughout the 1970s and 1980s to interconnect primary corporate locations. In general they were used to connect like computer systems together, and they did not cross-connect all of the corporate offices with a mesh network design due the high expense of these mileage-based circuits.

Packet-based Communications

As a result of these high costs to interconnect smaller offices and dissimilar computer systems, a technology known as X.25 packet switching was defined by the Consultative Committee for International Telegraphy & Telephony (CCITT) to provide data packet switching networks that were capable of bandwidths of up to 64kb. These public data networks and private data networks were both referred to as PDNs and encompassed such networks as TeleNet, Tymenet, & Sprintnet in the public domain and such networks as WangNet, DecNet, and many others within private domains. The X.25 protocol for packet switched PDNs began to interconnect an array of dissimilar computer systems and became an early part of what is now the Internet. Networks built on the X.25 protocol were OK for low bandwidth data transfers such as email, occasional file transfers, etc. but could not handle large volumes of data and could not handle voice traffic due to the low bandwidth and high latency inherent in the protocol.

In the early 1990s a new communications protocol emerged that changed data communications dramatically. This protocol is known as frame relay and takes its roots from the X.25 protocol. It is also a packet switched protocol but removes all protocol checking from the network and leaves it up to the intelligent endpoints to correctly packetize and reassemble the data streams. Frame relay provided for bandwidths ranging from 16 kilobits up to T1 capacities of 1.544 megabits with a network latency that was an order of magnitude improvement. That is to say, the round trip over an X.25 network would often be as high as 2 full seconds whereas frame relay was capable of less than 200 milliseconds.

Within a few years, virtually every communications carrier in the world was offering frame relay connections at fractions of the cost of leased line connectivity. By 1995, most of the data communicated throughout the world was be handled with frame relay. Frame relay is now capable of T3 performance at 45 megabits.

Many believed that another new communications protocol would quickly displace frame relay, a protocol known as asynchronous transfer mode or ATM. This protocol is capable of performance from 25 megabits through 155 megabits and beyond to 6 gigabit transfer rates. It did not displace frame relay because it was too costly to implement high speed data links between the customer premise equipment (CPE), located at the customer's offices, and the point-of-presence (POP) of the carrier where the high speed ATM network was terminated. In general, this local loop connection between the CPE and POP have been limited to copper wire, telephone line connections that are only capable of speeds up to 1.5 megabits. Larger corporations, city centers, and campus implementations may have fiber optics connections but the branch offices rarely have these higher speed CPE-POP connections.

These packet-based network architectures comprise the second major network architecture in existence today. In essence, TDM and packet architectures carry virtually all of the world's communications traffic.

Introduction

The Internet Service Provider business began to flourish shortly after Marc Andreessen wrote one of the first Windows based Web browsers; Mosaic. Within a few short years the number of Internet users had doubled, tripled, quadrupled, and still shows no sign of slowing in it's growth. More amazingly, it has become the communications media of choice for businesses and corporations to advertise themselves and make their products known to the world.

The early ISPs, like PSINet, Netcom, and others were centered around universities and government locations because these were the primary early users of the Internet. As more and more Windows users began to migrate to the Internet, ISPs sprang up in offices, shops, and garages around the world; many of whom have now been acquired by larger ISPs and communications companies. By the mid 1990s almost every major telephone company in the world was offering some type of Internet connection services, from Internet access to Web design services and Web hosting services.

ISPs began to offer an ever expanding set of services including data conferencing with such products as Microsoft's NetMeeting by providing Internet Locator Services (ILS) that would register users as they came on-line so that users could locate each other.

By 1995 a small Israeli company, Vocaltec, offered an end-user software package, Internet Phone, that would digitize and packetize voice and send the communication stream over the Internet to another user with the same software providing the first free telephone calls. This was the beginning of the voice communications revolution. The quality of such calls was of course subject to Internet delays and was in no way comparable to conventional telephone quality, but it was free, and that started the VoX goldrush.

Following the release of Internet Phone, many individuals and companies, including StarVox, Lucent, InterTel, NetSpeak, Vocaltec, and many others, saw the need and opportunity to produce a voice gateway that would connect with the PBX and allow telephone to telephone calls over the Internet or corporate intranet. Within a year there were many companies offering some form of network telephony gateway that would use the Internet, intranet, or extranet to provide lower cost telephone calls.

Most small to medium Internet Service Provider connections to the Internet are implemented using frame relay whereas the major ISPs are almost all connected to the Internet using direct ATM connections. The connection between the customer and the ISP vary widely including 28.8~56kb modems, ISDN (integrated services digital networks that can carry both voice and data), frame relay, leased line, xDSL (variations of digital subscriber line that can perform up to about 6 megabits over conventional telephone lines) and ATM.

With improved connectivity and performance, ISPs can continue to expand their services offerings into the realms of music, radio, Web TV, and other applications that require increased bandwidth and lower latency. This focus of expanded ISP-based services continues today and network telephony is one of the major service offerings being initiated by many ISPs.

What is Network Telephony

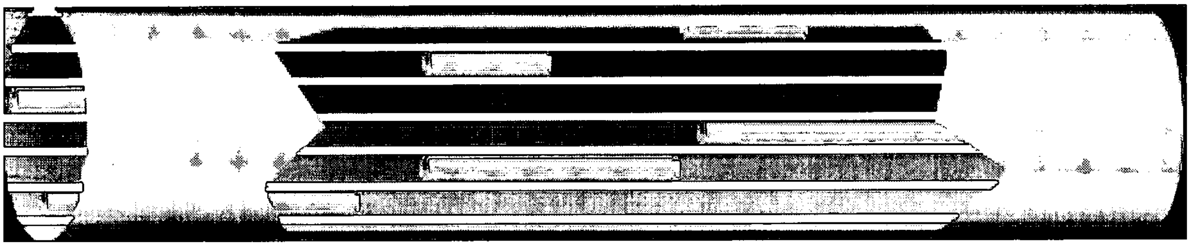
Network telephony is beginning to provide the first major change in voice telephone communications since the emergence of digital voice communications in the 1960s. To fully understand network telephony, lets first describe the tenants of our conventional telephone system, known as the Public Switched Telephone Network (PSTN) that is based upon the TDM networks previously described.

Traditional Voice Telephony

Traditional TDM-based telephony uses the conventional Telco owned voice networks that have proven reliability, resiliency, and excellent quality voice, but they are also inefficient in bandwidth use and incur minute use charges that make calling expensive.

Traditional Telco voice networking has evolved, and been designed, over the years to be the most highly reliable and resilient networks services available anywhere. When the power is out and the heat is off, the telephone still works; most of all, this is what we have come to expect of our telephone services. They have also been designed to use expensive bandwidth, and to charge for it by the minute or by the mile, making them the most expensive networks to use.

Traditional TDM-based telephone networking uses a complete channel for each voice conversation even when there is no active voice information being transmitted. As can be seen in below, the channels are inefficiently used and in the case of voice virtual private networking (VPN), the channels remain idle when no calls are being placed.



Signaling and Switching

Throughout the evolution of the traditional Telco networks, the method of signaling has changed a number of times from operator switchboard connections, to rotary pulse dialing, to our current touch-tone systems. All of these, however, are how we see signaling from the edge of the network. Internally, the telephone switching networks have gone from ***in-band*** signaling where the connection information is passed over the same circuit that will finally carry the voice, to ***out-of-band*** signaling where a separate circuit is used to perform connection setup. The current signaling system is referred to as SS7, or Signaling System 7

Routing and Numbering Plans

The many years of development in the PSTN has evolved elaborate routing schemes and a numbering plan that allows us to direct-dial connect to almost anywhere on earth. Most of us realized that even this system is becoming taxed with all of the area code splits that have occurred throughout the past few years of Internet and cellular/wireless communications growth. These routing tables and numbering plans are maintained within the PSTN in an extremely redundant fashion so that no single failure can disable the PSTN.

Corporations too, create simplified numbering plans that allow them to use a plan that suits their needs to easily dial other corporate offices. However, the PBXs must be able to communicate with each other in order to properly implement them and they generally cannot communicate such inter-PBX signaling without expensive dedicated leased lines or ISDN lines to carry the signaling information.

Billing and Rate Settlement

One of the most important parts of the PSTN and worldwide STN is the ability for signaling and billing information to pass between networks and systems to perform rate settlement. This is the computer process of determining which local telephone company, long distance telephone company, and international telephone company receive what part of the total call charge, and to ensure the proper customer is correctly and completely billed for the calling minutes used.

Rate settlement continues to be a major stumbling block for carrier adoption of any industry-wide network telephony implementation. There are currently a number of companies providing proposals with proprietary systems, but as yet there is no universal adoption of a rate settlement scheme for network telephony calling. This is an issue that also needs to be adopted internationally due to the regulated nature of foreign governments' telephone systems and networks.

Voice-over-X Network Telephony

Network telephony uses modern packet-based networks that are far more efficient in bandwidth utilization and provide the means to concurrently communicate data, voice, video, and other forms of data over a single, converged network connection

Network telephony is the umbrella term for the growing variety of voice-over-X technologies that are moving conventional voice telephony onto packet data networks and providing a ***convergence*** of traditional TDM traffic with data networks. Data networks are far more efficient in bandwidth utilization than TDM networks and it is only logical that voice traffic will simply become another form of data.

There are many forms of network telephony from the PC-to-PC applications, such as Internet Phone, WebTalk, CoolTalk, etc., to high-end carrier-grade solutions that can handle thousands of concurrent calls per minute. Let's first explore the many variations of network telephony.

Advantages of Network Telephony

Enabling voice communications on packet-based networks provides a wide range of advantages over conventional TDM-based PSTN communications. Unquestionably, there are toll savings that can clearly cost justify the implementation of network telephony, particularly if international communications are a part of the network telephony implementation. There are additional methods of corporate cost saving that can also be realized with network telephony when the applications are more fully developed to meet corporate needs as opposed to those of individual callers.

Cost Savings

When corporations subscribe to ***on-net*** voice telephone communication services from a major Telco carrier, they can obtain per-minute costs for calling between corporate offices at rates as lows as $0.04 to 0.06 per minute. Even with these low-rate charges, an on-net call between offices would still be a corporate cost of $ 2.40 ~ $ 3.60 per hour as can be seen in Table 1 below. Network telephony can easily packetize one hour of voice into approximately 2 megabytes of data. Current frame relay costs of approximately $ 0.04 ~ $ 0.06 per megabyte mean that network telephony can deliver the same telephone call for $ 0.08 ~ $ 0.12 resulting in dramatic cost savings.

Voice Service Type	Costs / Minute Versus Cost / Mbyte	Costs per Hour 60 Minutes vs. 2 Megabytes	500 Users, 250 days / year 30 Minutes Calling / Day 500 x 250 x .5 = 62,500 hrs.	Annual Corporate Calling Costs
PSTN	$ 0.04 ~ 0.06	$ 2.40 ~ 3.60	62,500 calling hours	$ 150,000 ~ 225,000
VoN	$ 0.02 ~ 0.04	$ 0.04 ~ 0.08	62,500 calling hours	$ 2,500 ~ 5,000
Network Telephony Corporate Toll-Bypass Savings				$ 147,500 ~ 220,000

Table 1 Annual calling cost savings experienced from toll-bypass operations

Although the above table does not represent the cost of the network telephony hardware and software, it clearly indicates that there are substantial savings to be realized with the average return on investment (ROI) generally being realized within the first year. With the high cost of international calling, ROI can often be realized in six months or less.

Further cost savings can be experienced from worker productivity gains when the network telephony application implements more than just simple toll-bypass. Applications that take advantage of computer telephony integration (CTI) with the PBX can deliver application integration and advantages that have only heretofore been experienced in very expensive call center environments. Through CT integration, server-based software applications can extend the feature sets of PBXs and even provide and equal set of services across multiple and disparate PBXs.

As an example, if incoming calls could be detected, routed to the appropriate person automatically, and notify the employee of who is calling, it would be easy to save at least one minute per call per person per day. As can be seen in Table 2 below, the soft dollar savings experienced from potential increased worker productivity can be even more dramatic than the hard dollar savings of the toll-bypass operations above.

# of Corp. Users	Calls per User per Day	Minutes Saved per Call	Hours Saved per User per Day	Hours Saved per User per Year	Burdened Av.Hourly Salaries	Savings per User per Year	Annual Productivity Gain
100	30	1	$ 0.50	125	$ 25.00	$ 3,125	$ 312,500
500	30	1	$ 0.50	125	$ 25.00	$ 3,125	$ 1,562,500
1000	30	1	$ 0.50	125	$ 25.00	$ 3,125	$ 3,125,500

Table 2 Annual productivity gain experienced from increased worker efficiency

CT Integration with existing PBXs also preserves and extends the corporate investments that have been made in telephone systems and equipment. This, of course, provides another, and rather substantial, cost savings as opposed to replacing PBXs to obtain new features.

Network Convergence & Bandwidth Utilization

The costs of maintaining two separate data and voice networks can be reduced by converging conventional TDM-based voice onto existing packet-based networks. Even if the current corporate network is using channel banking to carry both data and voice over the same wide area network (WAN) connection, network telephony would replace the channel bank equipment and compress the voice signals from 64 kilobits to approximately 8~10 kilobits per voice channel. Therefore, if a T1 line had been used to carry 12 channels of voice, the voice channels would be using one half of the T1 circuit (1.544 Mb – (12 x 64 kb = 768 kb) = 768 kb) leaving only 768 kb for data applications.

With the implementation of network telephony, using the industry standard G723.1 vocoder, each voice channel would be compressed down to 5.3 ~ 6.3 kb and with the added IP headers would be roughly 8 ~ 10 kb per voice channel. Assuming 10 kb per voice, bandwidth utilization for 12 voices of network telephony would only be 120 kb, therefore returning 648 kb of bandwidth for data applications. It is clearly shown in Table 3 that the implementation of network telephony can provide a net return of bandwidth to data applications while providing quality voice and tremendous cost savings.

Table 3 assumes a T1 circuit of 1.536 megabits capacity between two sites and illustrates the difference of how much bandwidth is available for data applications when using network telephony instead of conventional channel banked systems.

Type of Voice/Data Integration	Voice Channel Reqs.	Available Data Bandwidth

Channel Banked Voice/Data	12 x 64 kb = 768 kb	768 kb
Network Telephony	12 x 10 kb = 120 kb	1414 kb

Table 3 Network Telephony Bandwidth Utilization

Figure 2 below illustrates the far more efficient use of bandwidth for combined data, voice, and other forms of network traffic as compared to the channel usage of TDM-based networks illustrated in Figure 1.

If virtual private networks (VPNs) such as frame relay are being used to carry data, the incremental costs of adding voice bandwidth capacity is minimal as compared to creating a voice VPN based on the dedicated 64 kb channel usage per voice.

Enhanced Services & Virtual PBX features

Network telephony provides the software capability to provide many new ***PBX-like*** features that can greatly enhance worker productivity including intelligent networking features such as dial plan support. Many of the current voice-over-net gateways provide network dialtone and voice-over-network as a cheaper phone-call service but do not provide any enhanced services; in essence, they are ***dumb*** voice gateways.

Through CT integration with existing PBXs and directory services integration (DSI) with existing native network directory services, and extremely enhanced set of PBX-like features and network service can be delivered to the user desktop as well as to telecommuters and mobile workers. In general, these enhanced features and services translate into user productivity that can provide improved business and user performance.

Some of the many enhanced features that are provided by StarVox's StarGate™ Server are caller name display, call disposition screens, corporate white pages, intelligent rules-based call forwarding, on-net and off-net dial plan support, guest office support, telecommuter and mobile worker support. Additionally there are automatic reliability features that will dynamically route calls, fall-back to the PSTN when network bandwidth is unavailable, and automatic synchronization of voice servers.

Unified Network Management

Network telephony also saves corporate investments by unifying the management of both data and voice network systems. Through the implementation of network telephony, both network user data profiles and telephony system moves, adds, and changes (MAC) can be managed from a unified and consistent single interface bringing them under a single point of administration and reducing overall management costs.

Since network telephony is a data network service, it can easily be managed with browser-based management utilities that allow the network telephony servers to be managed from anywhere within the network, or for that matter from outside the network via Internet access. StarVox provides browser-based management as well as integration with native network management consoles including SNMP alerts.

Application-based PC-to-PC Network Telephony

This form of network telephony can be categorized as user-to-user communications. Individual personal computers can load applications which will receive voice communications from a PC microphone, digitize the analog stream, convert the digital data into packets and send them over a network to another PC that reverses the process and plays the audio through the speakers of the computer. The original sound cards used to perform the audio services were half-duplex and the communications were conducted in much the same fashion as ham radio or walkie talkie communications. Subsequent sound cards now provide full duplex audio services and the parties can both speak and listen (send and receive) at the same time, just as in the case of a conventional telephone call.

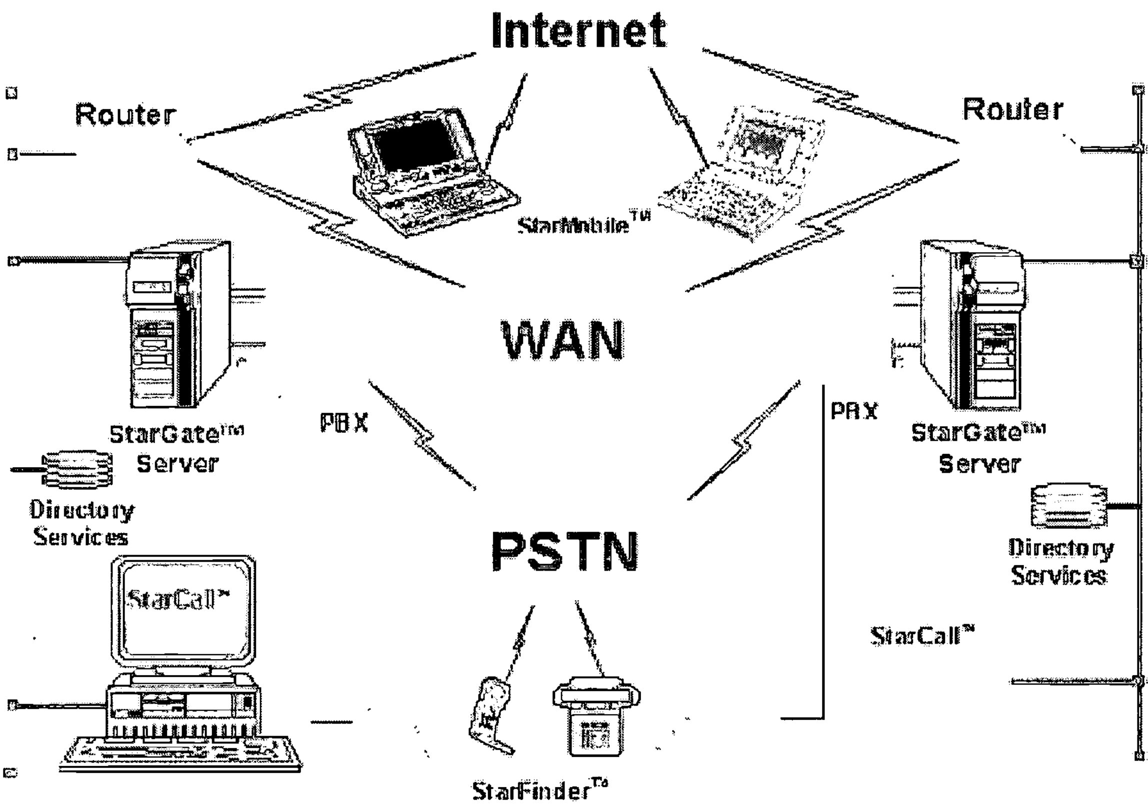
insert [PC-to-PC Telephony Drawing]

The voice quality of PC-to-PC telephony has been subject to a great deal of criticism due to the low quality of PC microphones and speakers, the inordinate processing time of sound files, and the inherent indeterminate latency issues of the Internet. Although the Internet has been continually expanding bandwidth, it is virtually impossible to estimate the latency between two points and when it begins to exceed 250 milliseconds, the call quality begins to sound like an increasingly bad satellite telephone call where, once again, walkie talkie procedures need to be used.

A continuing problem in this form of communications is that you can only call another party when they are on-line and there is no central registration service that will indicate when this is so. In other words, you must call the other party over conventional telephone circuits to tell them to go on-line, or prearrange a time through email, and then place the Internet telephony call. This problem is further exacerbated in that most ISPs are issuing dynamic IP addresses to subscribers and therefore you cannot preconfigure the called parties with static IP addresses.

PC to Conventional PSTN Network Telephony

This form of network telephony can be categorized as user-to-gateway communications. In this instance, the PC-user application initiates a network telephony call that connects to a voice gateway where the call is converted into a conventional TDM-based telephone call and either directly connects to the telephone or connects to a PBX where the telephone is connected. In most gateway applications, the call can be initiated from either the PC or the telephone, but requires a table in the gateway to convert telephone numbers into IP addresses for outgoing calls. As mentioned above, if the PC-user is using dynamic IP addresses, this can be a extremely difficult task and generally requires the PC to be connected to or logged-in to the gateway before an outgoing call can be placed.



Web Call Network Telephony

Another form of PC to telephone communications is the Web call gateway that allow a user to click on a ***Call*** button when browsing an Internet site. This form of network telephony can be categorized as user-to-business communications and requires a specialized voice gateway that integrates into the company's call center and call center applications.

This form of network telephony requires the PC to have a voice application compatible with the Web Call server. The Web Call gateway then converts the call to a conventional TDM-based telephone call, sends the call to an automatic call distribution (ACD) mechanism that rings the next available call center operator. The gateway continues to handle to conversion of voice between the caller and the agent.

Web call telephony requires a web call voice gateway to be implemented at each company's call center and is generally only configured for incoming calls from users browsing the company's Website. Many of the Web call gateways will synchronized the call agent's screen with the Web caller's screen so that the assistance provided by the call center agent is context specific to the

Web caller. This allows call agents to easily guide the caller to the appropriate Website location or answer specific questions the caller may have.

The inherent problem with past Web call systems is that the user voice application must be consistent with the Web call gateway application. With IP telephony standardization and the broad use of the H.323 protocol, these problems are diminishing. A more serious problem for Web call systems is the voice quality experienced in Internet calling. If the Web caller and the Web call gateway are on the same Internet backbone carrier, the call quality will very likely be that of a conventional TDM-based telephone call. On the other hand, if the Web caller must traverse through multiple routers and backbones to reach the Website, the quality of the call is very likely to be unacceptable due to the indeterminate nature of the Internet. One must remember that the Internet has indeterminate routing, indeterminate latency, and indeterminate packet loss, all of which effect the quality of the voice call. Moreover, all of these factors can vary from moment to moment on the Internet and call quality just cannot be guaranteed.

Corporate Network Telephony

Corporate use of network telephony may well become the single most important growth factor for network telephony. This form of network telephony can best be categorized as business-to-business communications. Most corporations already have some form for wide area network (WAN) connectivity established to facilitate email and file transfer communications between the corporate offices. These WAN circuits, often referred to as the corporate Intranet, provide a means for corporate network communications that is rapidly becoming a necessity for business survival.

Since corporations typically subscribe to WAN communications services from major carriers, they can control bandwidth capacity and utilization in such a fashion that network latency is determinate and controllable. The ability to control determinate bandwidth allows corporations to implement network telephony in an acceptable quality of service that does not exist in Internet telephony models. This sets the stage for network telephony to be first adopted in the corporate world not only because of the ability of the corporation to have control over WAN bandwidth, but also because the hard dollar cost savings and soft dollar productivity savings that reduce corporate operations costs and improve the bottom line.

Telco and CLEC Carrier Network Telephony

Although Telco and CLEC grade requirements for network telephony are continuing to evolve, the imporatnt issues are extremely high reliability and scalability to be able to carry thousands, even tens of thousands of calls through any single point of presence. Although improvements in digital signal processors are bringing the hardware much closer to real implementation to support the needed scalability, the real problems lie in potential regulatory issues, access charges, and rate settlement issues.

Will Telco and CLEC carriers charge by the minute, flat rate as ISPs currently charge, or will new billing paradigms evolve? It has been said that what is good for the Telcos is not good for competitive or alternate carriers. Telco carriers do not want to see the per minute charges diminish or become flat rate, nor do they wish to have competitive carriers connect to the PSTN without equal access charges and tariffs being applied. Each of these trying issues will continue impede network telephony adoption by major carriers unless it is simply background services that will reduce their own operating costs.

Internet Telephony Service Providers

Internet Service Providers are in a unique position to provide network telephony offerings to both individual users as well as enhanced services to business and corporate users. This is due not only to their existing network connections and bandwidth management capabilities, but primarily because they are already in the service provider business with ever increasing number of both individual and business subscribers.

Those ISPs that adopt network telephony are being referred to in the press and trade journals as Internet Telephony Service Providers or ITSPs. Internet Telephony Service Providers (ITSPs) can provide a variety of network telephony services that are user-oriented services, business-oriented services, or a combination thereof.

A growing number of ISPs have become, or are in the process of becoming, ITSPs as well. Companies such as Qwest, PSINet, NetCom and others are currently offering some form of network telephony. Since these large ISP/ITSPs own or contract their POPs and network backbones, the quality of voice over their networks is controllable and the billing issues and rate settlement are straight forward issues.

ITSP Personal Subscriber Telephony Services

ITSP Personal Subscriber Telephony Services (PSTS) can provide users with PC-to-PC Internet telephony connectivity by providing gateway services that become the directory, on-line registry service and routing service for it's subscriber base. Further, ITSPs can provide enhanced network telephony services that connect the subscribers to the Public Switched Telephone Network (PSTN) through ITSP-based gateways.

PC-to-PC Internet Telephony Communications Services

When providing a purely PC-to-PC based set of Internet telephony communications services, there is still a need for the ITSP to have a directory service of subscribers, a on-line registration system of users currently available for voice communications, and a routing service to route calls and connect the parties transparently.

There is a need for a Gatekeeper to register available end-points, subscribers, as they come on line to the ITSP network. The gatekeeper software must be capable of handling thousands upon thousands of concurrent users.

Enhanced PC to Conventional PSTN Services

ITSPs can also provide and enhanced set of personal subscriber telephony services that allow the subscribers to place ***off-net*** telephone calls to conventional TDM-based PSTN telephones. In this configuration the ITSPs POP locations become the ***hop-off*** point in such a fashion that the personal subscriber uses the Internet for the long distance segment of the telephone call and at the ITSP POP it is converted into a TDM-based call and connected to the local PSTN.

ITSP Business Subscriber Telephony Services

In providing business communications services, the ITSP must consider the volume of calls placed by corporate customers and that it is likely that CPE based gateways will be required to adequately handle the corporate needs. There are a number of important aspects to consider with CPE-based voice gateway solutions.

Business Communications Services

The need for CPE-based network telephony gateways becomes evident when reviewing the corporate calling needs and patterns. Typically, a corporation or business would lease on-net voice services from a major Telco carrier to provide less expensive calling rates between corporate offices. This would require an additional T1 line from the corporate office to the carrier POP to carry the voice channels. Since the corporation also has local loop lease lines connected to its ISP of choice, voice can be carried over the ISP connection at a substantially lower rates than those offered by the Telco as we saw above in Table 1. It is important to recognize that the network telephony gateway must therefore be CPE-based and located at the customer site.

By providing CPE-based gateways, the ITSP can provide many of the enhanced services offerings by integrating with the existing PBX and network directory. The ITSP can provide and manage not only a data VPN for its business subscribers, but also a voice VPN as well.

Since the StarVox StarGate™ Servers can be managed from anywhere in the network, as any other data service, the improved management capabilities allow the ITSP to continue to manage both the data and voice networks for the customers creating a stronger bond and commitment between the ITSP and their customers. With many different ISPs to chose from, customers have readily switched whenever new offerings or lower rates became available from another ISP. When a customer has both their voice and data being carried by an ITSP, it is unlikely that they will be willing to switch to a different ISP or ITSP with considerable forethought.

Not only does this aid the ITSP in maintaining customer ownership, but it also provides them with another stream of potential recurring maintenance revenue.

Inter-Enterprise Communications Services

With the expansive network backbones and network interconnections that today's ISPs have, it provides an ideal means of inter-connecting network telephony between multiple customers, clients, and other businesses.

This would require that the network telephony gateways support the implementation of some form of directory services to provide the necessary access, profiles, and authentication services to ensure that the VPNs were properly implemented and enforced for security purposes. This would provide business-to-business network telephony solutions between various businesses, suppliers, and customers creating an increasingly strong bond between the customers and the ITSP.

Summation: The Network Telephony Opportunity

Network telephony has emerged as one of the most important and fast growth industries of our time. It provides the capability of lowering the cost of call minutes, network infrastructures, and network management, as well as the immense capability to provide an entire new range of communications services that can be integrated with collaborative computing applications.

The combination of reduced costs and new services will result in an overall increase in call minute usage that will further spur the growth of network telephony as the preferred communications media of the future. Those who embrace it will see revenues increase and those who do not will almost surely see declines. These trends will be first noticed in the international and corporate communications arenas through network service providers and VPNs with personal communications services soon to follow from Telco carriers and ITSPs.

The StarVox StarGate™ Network Telephony Solution

In the following diagram, one can see that the StarGate Network provides both telephone and data application collaborative computing. The voice over network cost savings are dramatically enhanced with corporate-wide caller name notification, call alert and callback features, and directory support. Additionally, StarGate servers provide server-based services such as dial-plan support for on-net and off-net calling, automatic routing, follow-me intelligent call forwarding services, mobile IP-phone services for nomadic workers, guest office support, automatic fallback to the PSTN when WAN bandwidth is unavailable or when WAN QoS degrades. In short, StarVox provides the first fully integrated network telephony gateway to support all of the corporate needs and requirements, The Complete Network Telephony Solution.

Return to Top   View Full-screen

How a Carrier Can Offer Global IP Service Without Owning Equipment or Having Global Bi-lateral Agreements

STEVEN OTT

Vice President of Global Sales, ITXC Corporation, USA

Abstract:

Not available

View Full-text

What is an Internet Telephony Exchange Carrier?

An Internet telephony exchange carrier connects and adds value to a "network" of individual companies, carriers, and smaller networks that exchange real time voice and fax in IP format. The exchange carrier provides authorization, routing, settlement, redundancy, quality control and network management to the members of the network, giving each member the value of the total network. An Internet telephony exchange carrier today sells minutes of a quality good enough for many, but not all, applications.

A Tier 1 IP telephony exchange carrier adds the most value to a network by providing a global IP footprint, redundancy and therefore a consistent quality of service. Tier 1 carriers also provide provisioning assistance, timely payments to terminators, Best Value Routing (BVR) and consistent quality to originators.

An IP exchange carrier today must build a network that is robust and global. It then charges the customers, who are resellers or carriers, a wholesale price for the calls and pays the terminating gateway operators for every minute terminated on their gateway while all the time controlling the quality. Rates from a Tier 1 carrier are often a few cents higher than from Tier 2 or 3 carriers, but always below PSTN. The quality is what is paid for.

An example might help. A carrier selling low-end products, like pre-paid calling cards, to immigrants or college students in their country wants to purchase routes at a reduced cost. The carrier typically connects, at least at ITXC, to a switch and purchases whichever routes it desires, as with any other international carrier. Typically however, the Internet telephony route is at the top of the routing table because Best Value Routing allows the most favorable prices.

The Internet telephony exchange carrier routes most calls over the public Internet, a Virtual Private Network (VPN), or a leased line. Buyers can decide on the call quality they need and what price they are willing to pay. Calls that go over the public Internet are the most inexpensive and the quality is often similar to cellular or 1980's-ish satellite calls. Calls that go over a transport mechanism where the exchange carrier has total control of the traffic are more expensive. They can be of toll quality.

Lets discuss this issue of quality a bit further. Quality comes from two things: gateways and transport routing or congestion. Always purchase gateways, or routers with gateway functionality or switches with IP conversion ability from a vendor that follows industry standards, is committed to interoperability, and has a large R&D department with a well conceived plan for the future. You do not want to spend $100,000 purchasing equipment that limits you to a very small network or that will be abandoned in the near future. Also, you should not build your own. There are many gateway vendors already in the market who have spent the last six months to two years learning how to maximize this new technology. Take advantage of their expertise. Experienced gateway manufacturers use industry accepted codexes, echo cancellation techniques, and buffering plans that greatly improve call quality.

The most frequent reason for a poor call quality today is congestion in the "pipe" that the IP packets travel on. Lets simplify this a little. In the world of email, a modem sends IP packets to another modem. Each packet leaving the sending modem is numbered and free to travel its own route to the terminating modem. If the network is congested, the packets do not arrive in sequential order. If Packet 6 does not arrive at all, the receiving modem "asks" the sending modem for a re-send of packet 6. By the time they all finally arrive and line up correctly, you'll say "Gee, email is slow today." While inconvenient, such delay is still "acceptable" - with email, store and forward fax, and voice mail; however, it is not okay with real-time applications like telephony.

Often, pipe congestion delay is affected by packet routing problems. When packets leave the originating gateway, they take various routes over the Internet on their way to the terminating gateway. In the previous scenario, when packet 6 does not arrive, the terminating gateway has to do something that is difficult for a computer to do -- make a subjective decision - if Mary will be more annoyed waiting for packet 6 to arrive or having the call completed with the packet missing. If the gateway "chooses" to complete the call with the packet missing, it "hopes" that her ear fills in the missing packet during the conversation. No matter the outcome, the decision-making process creates more delay.

A Tier 1 IP telephony exchange carrier has experience with what is called Best Value Routing (BVR). Using BVR, the carrier uses a combination of PSTN and various IP routes to complete calls at a consistent quality. There are several reasons why using a combination of PSTN and IP may be the optimal solution for routing a call. For example, if a call originates in Boston and is destined for Moscow and there is a change of power in the Kremlin, the Internet could be so congested that the packets are not arriving sequentially and many packets are getting lost. The quality of the call is not good. The technician in the Tier 1 carrier's NOC should see this and reroute the calls to a different terminator in Moscow or to PSTN until the congestion subsides.

And if the change of power causes the economic crisis to get worse, the local ISP may not be able to pay its bills and UUNet may cut it off. The NOC should immediately see an error message. The NOC should reroute the call to another terminator in Moscow, with hopefully a different ISP, route calls from Slovania to Moscow or if need be fall back again to PSTN until the problem is resolved. A Tier 1 IP telephony exchange carrier has the ability to purchase PSTN routing and the tools to know when to use it to keep the call quality consistent.

The Internet telephony exchange carrier sells discounted calling to call originators of a consistent quality for many of their low end products today. As the technology improves over the next year, the industry expects to reach near toll quality.

The Internet telephony exchange carrier provides the terminator with minutes. The terminator does not need to have hundreds of relationships all over the world and does not have to worry about billing and collecting from them all. The terminator has one relationship with the Internet telephony exchange carrier who takes care of the network, the quality, the authentication and settlement issues.

In summary, an IP telephony exchange carrier connects various gateways owned by different companies into a network. Each of the smaller members of the network become more valuable because the exchange carrier can supplement their shortcomings and use their strong points to the advantage of the entire network. There are various levels of exchange carrier. A Tier 1 exchange carrier adds the most value to the network by providing a large international footprint and by providing Best Value Routing. Tier 2 and 3 carriers provide less expertise, less dependability, but they are often cheaper.

Return to Top View Full-screen View Presentation

PSTN and Internet Convergence for Telephony:

Market Opportunity for Carriers in the Asia Pacific Region

Heidi Bersin

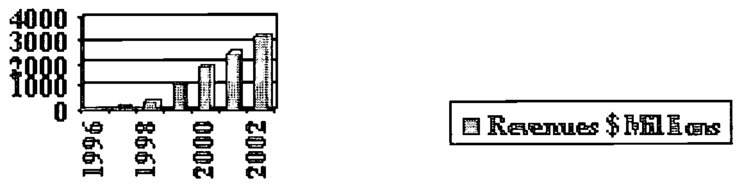
Clarent Corporation, U.S.A

ABSTRACT

The Internet Telephony industry is one of the fastest growing segments in high technology today. While theindustry is less than 5 years old, by the year 2000, it is estimated to generate billions of dollars in worldwiderevenue to the service providers and technology companies that are selling Internet Telephony-based services or products.

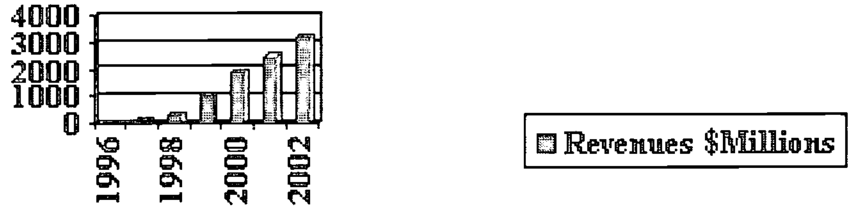
Frost and Sullivan's April 1998 industry report (data shown below) indicates that IP telephony equipment revenues are estimated to be $3 billion in 2002. Worldwide IP telephony minutes are estimated to be 9 billion in 2002.

IP Telephony Equipment Market
Annual Revenues ($ millions)



Source: Frost and Sullivan, April 1998

IP Telephony Equipment Market
Annual Revenues ($millions)



Source: Frost and Sullivan, April 1998

This paper will:

- provide a brief history of the IP telephony industry
- discuss the market characteristics that are driving its strong growth rate in the carrier segment
- discuss how carriers are implementing the technology today
- provide a strategic model of how carriers might view the opportunities associated with this new technology.

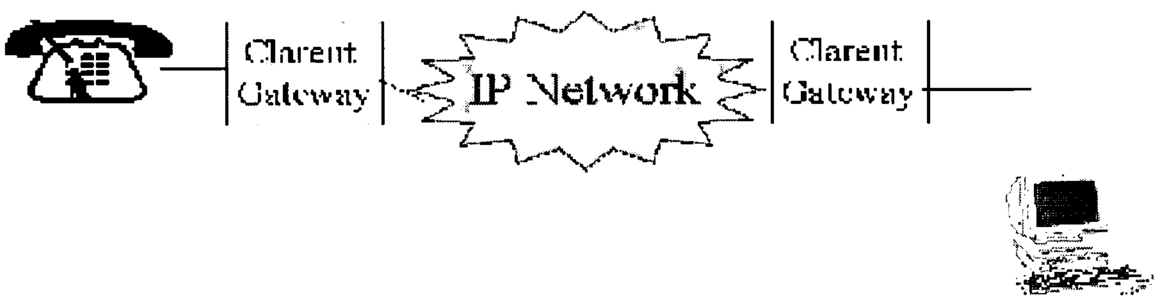
View Full Text

PSTN and Internet Convergence for Telephony: Market Opportunity for Carriers in the Asia Pacific Region

I. INTRODUCTION

Internet Telephony is the technology that allows people to make phone calls or send faxes, where a portion of their phone call or fax is sent over the Internet or other IP network. There are several ways the technology can be used. The primary application today is for someone to use their regular telephone to make a long distance call. Their call goes over the PSTN to a gateway, which converts their voice to Internet Protocol (IP) data packets. These IP data packets are then routed over the Internet or other IP network to another gateway, which converts the voice back to circuit-switched voice, and then delivers the call to the called party.

The following illustration shows that PC's can also act like a combined telephone/IP telephony gateway and can originate or terminate an IP telephony call.



II. A BRIEF INDUSTRY HISTORY

The IP Telephony industry started in the early 1990's, when Silicon Valley-based companies began developing technology to allow voice chat services to operate over the Internet. These services were first demonstrated in 1994.

In 1995 and 1996, a handful of companies began developing technology to allow PC to

PC long distance calls. Early technology was crude – the voice quality was poor and it was cumbersome for people to use their PC as a telephone. However, this early development set the stage for the development and evolution of products that allow people to use their regular telephones, and have very high quality, low priced long distance calls.

Suppliers soon saw that the best initial market for IP telephony was the long distance provider market. IP telephony technology companies began developing carrier-focused technology. This is the fastest growing segment of the IP telephony industry today.

At the present, the primary purchasers of internet telephony technology are traditional long-distance carriers; a new breed of phone companies called Internet Telephony Service Providers (ITSPs), some of which were Internet Service Providers who decided to extend their ISP business by adding long distance to it. These carriers are offering lower priced consumer-based long distance calling services. Many enterprises are starting to look actively at this technology and are planning to implement it in their intranets or are planning to purchase it as part of their Virtual Private Network (VPN) service.

III. WHAT IS DRIVING THE RAPID DEVELOPMENT AND ADOPTION OF INTERNET TELEPHONY TECHNOLOGY?

There are a combination of technology, market and regulatory factors that are driving the development of this industry.

From a technology perspective, only recently has Internet Telephony become possible. The Internet has become stable as a backbone. Routers have become mature enough to handle the packet volume needed to process a high quality voice conversation. Microprocessors and operating systems have become fast enough to process at the speed needed to support a high quality phone conversation. Specialized, single function processors called Digital Signal Processors (DSPs) have evolved to best handle some of the voice processing functions. Speech compression technology has evolved to work well in this environment. And the primary technology driver – the sophisticated technical developers – have evolved their knowledge base and experience so that they can develop these sophisticated call processing applications.

The market readiness has been substantial for a long period of time. This is because the initial application for this technology is lower priced long distance calling, and consumers and enterprises are always looking for opportunities to be able to talk longer for a lower price.

Because long distance calling prices are still very high in many countries, there is strong demand for a technology that can change this. Also, because this technology offers long distance providers a lower cost way of implementing phone calling technology in their networks, they are now rapidly evaluating and implementing this technology.

The regulatory environment is also driving industry development. While the United States has allowed long distance phone competition for almost 15 years, most of the rest of the world has still allowed long distance phone monopolies, until the recent past.

Within the last couple of years, the World Trade Organization (WTO) has provided a strong incentive for countries that still provide phone service through regulated monopolies to deregulate quickly. Deregulation in Asia Pacific started in Australia, New Zealand, and the Philippines, then went to Japan and Korea. Hong Kong is about to allow phone competition, as are Taiwan and Singapore. Most of the Asean countries are also planning for deregulation.

In other parts of the world, most of Western Europe deregulated their phone service in January 1998; Brazil just privatized and broke up its phone monopoly; Mexico has been deregulated for a couple of years; and many other countries are quickly following suit.

How does deregulation drive the development of an industry? New competitors entering a deregulating market can much more quickly turn up an Internet Telephony-based network than they can turn up a circuit switch-based network. Once new competitors come in with such an offering, incumbent providers see the benefit and they, too, implement the technology. Also, incumbent long distance carriers themselves want to enter new markets, so they go to recently deregulated neighboring countries and turn up service quickly based on the new Internet Telephony technology.

The other way that the regulatory environment has provided incentive for the growth of Internet Telephony is by precluding internet-based calls from traditional settlement and access charges. Over time, as the industry and technology matures, these charges will probably be assessed from IP telephony-based service providers. In the meantime, service provider can reduce their costs significantly by using this technology.

IV. WHAT ARE THE PRIMARY APPLICATIONS THAT CARRIERS ARE IMPLEMENTING IN THE MARKETPLACE AND HOW ARE THESE APPLICATIONS LIKELY TO EVOLVE?

The first application is lower priced, phone to phone, consumer long distance calling.

Initially, carriers are offering this using calling cards which are sold through retail channels; through advertising with fulfillment in an inbound call center; and through online signups. If the calling cards are easily available with strong brand recognition, this application is very attractive because of prepayment by the consumers.

When consumers use calling cards, they must go through a several stage dialing process (1:Dial access number; 2:Dial PIN/password; 3:Dial destination number). This is why the next application that carriers are implementing reduces the dialing steps. Consumers can register their household phone number. With "caller id", the consumer has a 2 step dialing process rather than 4 steps (1:Dial access number; 2)Dial destination number).

Carriers are also moving quickly to single stage dialing, which will significantly grow usage of this technology. Carriers have several applications for single stage dialing. In some countries in Asia Pacific, the major carriers are offering users a choice between making a traditional international call (dial 011+number) or a "budget" phone call, based on IP telephony (dial xxx+number).

Another way that carriers are offering single stage dialing is by transparently bundling the technology in their networks and routing a portion of their usage traffic over this service. By using Signaling System 7 interfaces, these carriers have the network and traffic data that they need to transparently route the call.

After consumers, carriers are targeting enterprise customers. Some carriers are bundling IP Telephony technology into their Virtual Private Network offerings. This will enhance the value of the VPN offering, and will also allow the carriers to sell more bandwidth to the enterprise customer. Carriers are also beginning to distribute IP telephony technology for direct sale to enterprise customers.

V. WHAT IS THE STATUS OF DEPLOYMENT OF IP TELEPHONY TECHNOLOGY AMONG THE MAINSTREAM CARRIERS BASED IN THE ASIA PACIFIC REGION?

Most of the carriers in Asia Pacific are in the process of conducting IP telephony lab tests, doing market trials, or running full scale IP telephony networks. The Asia Pacific region was one of the ideal initial target markets for carrier-based IP telephony implementations because of major country deregulation, which incented new competitors entering the previous monopoly markets; a strong and rapidly expanding IP backbone in major countries throughout the region, and high long distance calling prices.

The first major deployment in Asia Pacific was the rapid building of a consumer calling card network by AT&T Jens in Japan, which offered lower price long distance calling to initially 57 countries and now, 10 months later, to 130 countries worldwide. Many of the other countries followed suit.

In Korea, Korea Telecom and Dacom are turning up networks; in Australia, Telstra is conducting market trials; in Japan, KDD has announced several different IP telephony services; and there have been announcements and trials among many other dominant carriers across the region. Also, these carriers are setting up partnerships with each other to exchange traffic. Many of the usage traffic exchange deals have been bilateral agreements. AT&T Jens has set up and publicized an IP telephony clearinghouse, and is recruiting regional partners around the globe.

The carriers in a number of areas of Asia Pacific are deploying IP telephony quickly so that they will have their networks in place to offer new, enhanced services as the IP telephony market evolves.

VI. HOW SHOULD MAINSTREAM CARRIERS VIEW IP TELEPHONY?

1. *IP Telephony provides both short and long-term opportunities*

Because some of the financial advantage of IP telephony is driven by the fact that access and settlement charges are not yet assessed on these calls, many carriers believe that the financial benefits of this technology are short-lived.

This is not true. The lack of universal service taxation is certainly not the only financial benefit to this technology. The other financial benefits include: 1)The technology is as efficient today, and will soon be more efficient than traditional multiplexing and compression technology. Therefore, service providers will have a more efficient use of constrained bandwidth. 2)IP telephony provides the opportunity to combine voice, fax, data, and video streams over the same pipe. This shared bandwidth provides tremendous efficiency and cost savings. 3)The software architecture of some of the IP telephony technology in the marketplace is so flexible, that new features can be added much more easily, less expensively, and more efficiently than they will ever be able to be added in the circuit switched world. 4)In markets where long distance calling prices are very high, and demand is highly elastic, the lower prices that are being offered using IP telephony can actually increase overall revenues and profits because callers talk significantly longer.

2. *Carriers can use IP telephony as the most efficient way to enter new geographic markets*

As countries deregulate their telecommunications monopolies, there are many opportunities for experienced carrier to go into these countries and develop new markets. IP telephony networks can be set up in days. IP telephony technology presents one of the fastest, most efficient ways for setting up calling services in these new markets.

3. *The big communications growth market in the future is based on data and bandwidth*

Data traffic is currently growing at 100% per year. Because of this, one of the strongest future growth opportunities for carriers is to sell the bandwidth that will be needed to support these mixed media applications.

4. *The time to begin building these networks is now*

With deregulation, large, new, well-capitalized carriers are entering the market. They are building global high capacity IP-based networks and will deploy them quickly in markets that were previously dominated by carrier monopolies. These new carriers will bundle voice, fax, data, and video applications in their backbones. Traditional carriers can choose to ignore these new providers, or to be one of these new carriers and lead the market by building sophisticated IP backbones the merge telecommunications and data applications.

Return to Top View Full-screen

The Use of Electronic Commerce by Small Business

Supriya Singh

Centre for International Research on Communication and Information Technologies (CIRCIT) at RMIT, Australia

ABSTRACT

This paper focuses on Australian small businesses as users of electronic commerce. Placing the small business at the center of the study shows that electronic commerce introduces a new way of business communication. Open–ended interviews with 27 small businesses in Australia helped us understand how small businesses mix traditional and online channels of communication for different activities to communicate with customers, other businesses and government. These understandings were tested via three industry workshops and a random, quantitative survey of 675 small businesses across Australia. We found the choice of communication channel is influenced by the fit between the characteristics of the channel, the requirements of the business activity, the audience and the social and cultural meanings associated with ways of communication. Communicating via the Internet also needs to be more explicit than interpersonal communication in order to engender trust. This is why a small business may rapidly use Internet communication in one activity but may not use it for other activities.

View Full Text

The Use of Electronic Commerce by Small Business

I. INTRODUCTION

Electronic commerce is not just a matter of doing business differently. It is a new way of business communication. Hence we focus on small businesses and their activities such as giving and getting information; producing, buying and selling goods and services; marketing, payments and managing money.

We thus concentrate on the way people in small business use new information and communication technologies to communicate and do business with customers, other businesses and government. This approach complements the more usual story of electronic commerce that is told in terms of small business' ownership of enabling equipment such as PCs and modems, together with the use of software. We graphically depict our approach in Figure 1.

In this paper we draw on open-ended interviews we conducted with 27 small non-agricultural businesses in Victoria and South Australia in 1997. The understandings from the qualitative study were tested through three industry workshops in 1997 and a random, representative survey of 675 small businesses across Australia in May and April 1998.

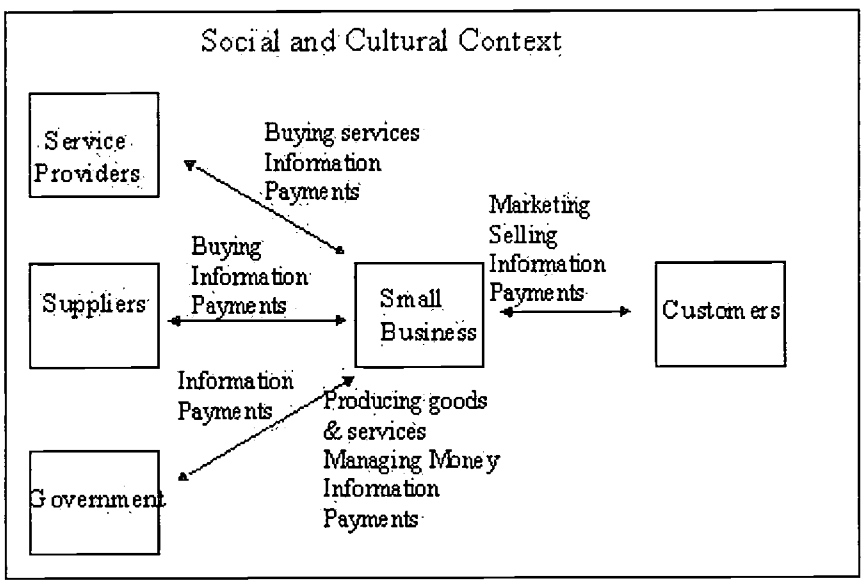


Figure 1.

II. SMALL BUSINESS AND ELECTRONIC COMMERCE IN AUSTRALIA

Nearly two thirds of businesses in Australia (64%) are connected to the Internet. This places Australian businesses is second only to Japan (See Table 1). Internet access of small businesses in Australia is however lower at 34 per cent

(Yellow Pages Australia, 1998).

Table 1. Internet access of all businesses in selected countries, 1998

Country	Internet Access (a)
Japan	73 %
Australia	64%
United States	57%
United Kingdom	49%
Germany	44%
France	24%

Percentage of businesses weighted by workforce size

Sources: Burke et al, 1998; Spectrum Strategy Consultants, 1998; Yellow Pages Australia, 1998.

In this paper we examine electronic commerce at three levels. At its broadest level, electronic commerce is defined so as to encompass business activities and processes that use computer and telecommunications networks. This use reflects the way a business copes with new technologies. The second level includes only Internet and EDI enabled commerce and is appropriate for studying business-business activities. The narrowest definition sees electronic commerce as Internet commerce and is particularly relevant for studying business-consumer and business-government activities.

III. MIXING WAYS OF COMMUNICATING

Businesses use a mix of communication channels across groups and activities in diverse ways. Having the option to use online communication does not translate to using online services for every business activity and group. Our qualitative data show that a business may use email and modem-to-modem communication to communicate with suppliers, but meet face-to-face and talk on the telephone with customers. A business may have a Web page for marketing and selling its goods; it may even receive payments by credit card over the Internet, but still might pay its own staff by cash and its suppliers by check. Another business may use online communication services very expertly but still have an outdated business telecommunications system.

Black Consulting's use of communication channels illustrates this mix. This is a business whose core activity is advising businesses on information strategy. It uses the full range of available communications options, from face-to-face interaction to the Internet. But the mix is different according to activities.

Printed tenders and word of mouth references are important for getting clients;

Face-to-face communication and the telephone remain critical in working with clients;

The Internet and face-to-face communication are important for research;

Their newsletter is faxed;

The invoice is always mailed;

Payments are made by check;

Payments are received by check and direct credit.

Table 2. Importance of communication channels across activities for small business in Australia, 1998

Activities Percentage of respondents who saw the channel as "important" and "very important" (a)							
Marketing, promotion	Phone 85%	Face-face 84%	Mail 49%	Fax 30%	Homepage 16%	Other Internet channels 7.7%	TV advertising 7.1%
Receive orders	Phone 84%	Face-face 69%	Fax 67%	Mail 45%	Email 15%	Online ordering via homepage 4.5%	
Order goods/services	Fax 82%	Phone 80%	Face-face 44%	Mail 29%	Email 13%	Modem to modem 4.9%	Online ordering via homepage 3%
Communicate within business	Face-face 89%	Phone 71%	Fax 32%	Mail 19%	Email 16%		
Get information on goods and services	Phone 72%	Mail 66%	Face-face 63%	Fax 62%	WWW searching 19%	Email 19%	

(a) Small businesses were asked to rate the importance of the different communication channels on a five point scale ranging from "not important" to "very important". The percentages are for responses 'important' and 'very important'.

Source: Slegers, C., Singh, S., and Hall, J. (1998). *Small Business and Electronic Commerce: An Australian Survey.* Research Report No. 22. Melbourne: Centre for International Research on Communication and Information Technologies at RMIT.

The quantitative study substantiates the qualitative findings, showing that the importance of communication channels differs according to activity and the group with whom the business is communicating. (See Table 2) The telephone, face-to-face, mail and the fax remain the most important channels when communicating with customers, with suppliers and service providers, and within the business. Table 2 also reveals that the email and the WWW have become important communication channels for 4.5 per cent to 19 per cent of small businesses depending on the activity.

Businesses also use a mix of payments instruments and channels. These differ depending on whether the businesses are paying for goods and services, paying their employees or whether they are being paid. Table 3 reveals that checks by mail remain the most important way of paying and being paid. However direct debit has now become a significant way for small business to pay for goods and services. Direct debit is more important than cash, credit cards or EFTPOS. This is an important finding for in the overall picture of payments transactions, direct debit has languished.

Direct debit has changed only slightly in volume from 2 per cent of non-cash payments in 1980 to 5 per cent in 1997 (Australian Payments System Council, 1998). Retail direct entry, that is direct debit and direct credit has changed from 2 per cent of the value of gross payments exchanged between Direct Clearers in 1991 to 3 per cent in 1998.

Credit card payments over the Internet are now beginning to be part of the mix of the ways small businesses make and receive payments. The latest figures from the Australian Bureau of Statistics show that 44,000 persons paid bills or transferred funds via the Internet in the three months to February 1998. This accounted for 0.3 per cent of the persons 18 years and over (Australian Bureau of Statistics, 1998).

Figure 3: Online Selling and Physical Selling: Retailing boots online

Selling boots	**Physical store**	**Online store**	**Engendering Trust**
Attracting the customer	Designing the store Advertising	Designing the web site. Listing with search engines Advertising online and other media	
Information about boots	Interpersonal information Visual and aural information Price tags Brochures	Giving information on the web site and/or email about: History of the boots Descriptions of boots sold Information about assessing size Information about experience of other customers Price information Photograph of provider Email as to particular questions and concerns of individual customers	Comfort Control Comfort Control Comfort Caring
Ordering boots	Interpersonal	Email order Provider telephones to authenticate order and ensure payment	Control Comfort

Payment Receipt	Interpersonal	Give credit card number by email, fax or telephone. Notify customer that payment has been received	Control
Delivery	Interpersonal	Notify that goods have been sent Customers can track their goods on the Web Customers at times use email to respond to goods received Place those comments back on the Web to develop a community of customers	Control Control Comfort Comfort/Caring
Servicing customers	Interpersonal	Individual queries by email	Caring/Control
	Flyers/Brochures	Web-page for upgrades or further developments with the product Information about new products	Control Control
Selling to existing customers	Interpersonal	Giving information on the web site or email… Entertaining correspondence	Comfort Caring

Behind this macro picture lie differences according to the nature of the business, the size and history of the small business. Much also depends on how comfortable a person feels with the new information and communication services. However a strong conclusion from the qualitative study was that a person may use the latest technologies for one activity but may continue with outdated technology for another activity.

Brendan, 68, with a farm supplies business portrays himself as a traditionalist in some things, and an innovator in others. He has been one of the first to use PCs, the fax and mobile phones. Yet, he is satisfied with what he knows is an outdated PABX.

Brendan was also the only one of the 27 businesses we interviewed who banked online. But he uses checks to pay for goods and services and thinks direct debit is not foolproof. He has yet to get email or have a home page. He says for him face-to-face interaction with his customers is critical. He realises that having a home page is going to be very important, but he is deferring it. However he is waiting impatiently for satellite technology which will allow him to tell how much fertiliser and pesticide the farmers will be needing for their crops.

IV. MATCHING COMMUNICATION CHANNELS, ACTIVITIES AND MEANINGS

In order to understand the mix of communication channels in small business, we asked: Why does a small business choose one channel to communicate over one activity and another channel for another activity? The answer from our qualitative study was that the choice of communication channel is influenced by the fit between:

The characteristics of the channel;

The requirements of the business activity;

The communication choices of the audience; and

The social and cultural meanings associated with the activities and channels of communication.

Examining face-to-face interaction, telephone calls, fax, email, the Web page and mail, we can place the different communications channels and business activities along the dimensions charted in Figure 2.

At the beginning of a relationship, when a person needs to be sure that understandings have been reached and a measure of comfort has been achieved, face-to-face interaction is the chosen medium. The lack of a record also makes this the medium of choice when there are sensitive or private matters to be discussed.

Face-to-face communication allows for immediate interaction. It is personal communication with the ability to gauge the non-verbal elements of communication. One of its most important advantages is that communication is placed in a personal, cultural and situational context. Within this context, it becomes easier to assess the importance of what is said and what is not said. Communication by silence is done most effectively face to face. These non-verbal, unspoken elements of communication cannot be replicated with email communication. Once the relationship has been established then email is effective in maintaining it.

Email, however, can seldom be matched when there is a need to work together on the same digital data. Email is unobtrusive, appears transient because it can so easily be changed, yet like a letter or a fax, it also persists as archived text. These characteristics of communication channels contribute in different ways to engendering trust by giving the user control, comfort and a feeling of being cared for and attended to in an interaction. Communicating by email is cheaper than by telephone and the Web page is cheaper than individual transmission of information. However, it is the fit between the social and cultural meanings of the communication channels and the characteristics of these channels and business activities which contribute in different ways to engendering trust.

The importance of meaning is most clearly demonstrated in the choice of small business to mail rather than email or fax an invoice. The immediacy of the email which is its main advantage in certain activities is a disadvantage when it comes to the invoice. The email may indicate that the small business wants immediate payment. When this is indeed the case, one of the persons interviewed said it would be more effective to send the invoice by mail, because "Most people are still used to the traditional ways of getting an invoice that says "Overdue" and a little man standing there with his hands in the air."

Martin, the chief executive of Black Consulting says an important reason for not using the email for invoicing is that often there needs to be a sense of distance between payment issues and the consultant-client relationship. He says:

> *"We often divorce the payment, the chasing up of the payment from the relationship with ...the purchaser in the client organisation. So if there's a delay in payment, it may not be the person who's been doing the interfacing on the project. It may be someone else who rings them up and basically acts as a person in the accounts payable department saying we haven't received our cheque for our invoice number whatever, rather than the person who has done the job."*

The distancing of the client relationship from the payment issues is like the doctor-patient relationship says Martin.

> *"What would the patient think of the doctor if the doctor was ringing her up and saying 'Look, I noticed you haven't paid for that examination I gave you two months ago'."*

The importance of cultural contexts stands out in Naomi's case. She is a wholesale trader dealing in food and manufactured goods. Naomi visits Taiwan regularly to promote her wholesale trade. These personal visits remain essential because in Taiwan, that is the way business is done. The face-to-face interaction is crucial to establish trust. Once a relationship is established she makes 20 to 30 minute telephone calls to discuss the business in hand. Though an email would be cheaper, the first telephone call is essential. It is only the second telephone call that can be substituted by email, if the desired meanings are to be communicated.

Figure 2. Characteristics of Communication Channels and Activities for Small Business

Characteristics of Communication channel and activity	Most appropriate ---Least appropriate					
Record	Mail	Fax	Email	Face-to-face	Telephone	Web page
Establishing relationship	Face-to-face	Telephone	Email	Fax	Mail	Web page
Reducing ambiguity	Face-to-face	Telephone	Email	Mail	Fax	Web page
Personal communication	Face-to-face	Telephone	Email	Fax	Mail	Web page
Speed (Written communication)	Email/fax/ Web page	Mail				
Cost (Overseas communication)	Web page	Email	Fax	Mail	Telephone	Face-to-face
Accessibility – one to many (Over time and distance)	Web page	Email	Fax	Phone	Face-to-face	Letter
Manipulability (Data)	Email	Web page	Computer diskette by mail			

Source: Singh, S. and Slegers, C. (1998). Small Business and Electronic Commerce. Policy Research Paper No. 44. Melbourne: Centre for International Research on Communication and Information Technologies at RMIT.

The critical importance of face-to-face communication in business limits the global expansion of small businesses in areas where doing business is wholly dependent on customer relationships. In the industry workshops, when an Australian consulting business was given the opportunity to expand to South East Asia, there was a visible drawing back. The success of the business depended on an intimate knowledge of local needs and continuing face-to-face communication. If the business did not have the needed cultural and social knowledge, it would be difficult to satisfy customers.

The importance of the fit between channel, activity and meaning is also demonstrated in the choice of payments instruments and transaction modes. Both the qualitative and quantitative study show that the check remains the dominant payments instrument for small business. This is despite the price incentives to shift to electronic channels. The comfort with the check is that it generates a paper record in the check butt, which is central to the way small businesses account for and prove expenditure.

The choice of online communication is influenced by the fit with characteristics of the activity, the ability of the audience to access it and the meanings associated with the communication channel and the activity. But when a small business chooses to mainly communicate online, it changes both the nature of the communication and the activity.

V. THE EXPLICITNESS OF ONLINE COMMUNICATION

When most communication is online, it needs to be more explicit than interpersonal communication in order to engender trust. This is because:

> Online communication lacks the implicit information communicated in face-to-face and telephone communication;
>
> Online communication lacks a sense of what is not being said;
>
> The information dimension of activities is enlarged;
>
> The explicitness of information helps redefine the nature of the activity.

Alan's physical and online retail boots business allowed us to compare the communication processes involved (See Figure 3). Each question a customer would ask, or not ask, needs to be consciously answered. This explicitness is particularly important with online communication, as unlike face-to-face and telephone interactions, there is no implicit information being conveyed through body language, voice quality, tone and actions.

Meaningful interpersonal communication rests on an understanding of what is being said and what is not being said. Face-to-face interaction and telephone conversations are able to give a greater sense of what has been left out. With online communication, the context needs to be spelt out, rather than taken for granted.

The changes seen in online communication are similar to those that occur with the computerisation of work processes. As Soshana Zuboff (1988) has argued, the first effect of computerisation is the automation of tasks that were previously performed physically. The more far-reaching impact is that of *informating*, that is giving information about the discrete work processes, which in turn changes the way work is done.

The conscious spelling out of what is being said enlarges the information dimension of activities to the extent that it is information about the action that becomes the overarching framework for the action. It also draws attention to the component actions that comprise an area of activity. Instead of thinking in terms of selling or buying, for instance, the focus shifts to the actions that make up selling or buying.

The selling and buying process hinges on giving appropriate information to the customer in a way that he or she can understand and trust that information. In a physical store, a customer walks in, browses, absorbs the information about the goods on sale from the layout, the variety and the price tags. A salesperson may ask if the customer needs assistance and the customer might take up or decline the offer. If the customer buys something at the store, there may be some information sought and given. It is then a matter most often of paying the money, the money being received, a receipt issued and the customer taking delivery of the goods bought. This face-to-face purchase has been rich in information, but not all of it was consciously sought or overtly given. Much of the information is received, without the questions being asked, from the physical surroundings, the behaviour of the staff, and the prices on display.

When this shopping experience is translated online, at each point Alan must knowingly give the information that the customer has not asked for, but information that would help the customer trust the online provider. On the Internet, informing the client becomes a series of different activities, such as giving the history of the product, describing the range, showing how the customer can assess which is the right product for his or her needs, giving references to other customers' experience, price information, and information about the provider. Added to this is the particular information that the customer requests.

This information needs to be complete in itself, because the Internet allows the customer to navigate the site through hypertext, and thus the linear pattern of printed and spoken communication is broken (Newhagen and Rafaeli, 1997).

In Figure 3, we track the differences in the way Alan communicates with his customers in the physical boot store and the online boot business. In order to retain control of his own business and engender trust in the online context, he has to go through discrete *informating* actions to retain authority while also giving the customer sufficient control, comfort and caring with the communication and the transaction. It is this change in the nature of information and activity that makes online communication such a fundamental change in the way business is done in an online world.

Alan's experience is similar to Nigel's, who operates a Shareware business. Nigel is conscious that his email communication with his customers must be very explicit. He says:

> *"..the language [customers] use might not be immediately obvious to you, you might have to sit down and think about what they're saying or what they're trying to say in what to them might be a foreign language and being prepared to deal with people in their second language .... You've really got to put yourself in the user's shoes and say this is what I think they mean....I went into a lengthy explanation of something and the user said, no I know all that but this is what I wanted. So you've got to cut through to that straight away."*

Figure 3: Online Selling and Physical Selling: Retailing boots online

Selling boots	Physical store	Online store	Engendering Trust
Attracting the customer	Designing the store Advertising	Designing the web site. Listing with search engines Advertising online and other media	
Information about boots	Interpersonal information Visual and aural information Price tags Brochures	Giving information on the web site and/or email about: History of the boots Descriptions of boots sold Information about assessing size Information about experience of other customers Price information Photograph of provider Email as to particular questions and concerns of individual customers	Comfort Control Comfort Control Comfort Caring
Ordering boots	Interpersonal	Email order Provider telephones to authenticate order and ensure payment	Control Comfort

Payment Receipt	Interpersonal	Give credit card number by email, fax or telephone. Notify customer that payment has been received	Control
Delivery	Interpersonal	Notify that goods have been sent Customers can track their goods on the Web Customers at times use email to respond to goods received Place those comments back on the Web to develop a community of customers	Control Control Comfort Comfort/Caring
Servicing customers	Interpersonal	Individual queries by email	Caring/Control
	Flyers/Brochures	Web-page for upgrades or further developments with the product Information about new products	Control Control
Selling to existing customers	Interpersonal	Giving information on the web site or email… Entertaining correspondence	Comfort Caring

VI. IMPLICATIONS FOR POLICY AND STRATEGY

The stories of small businesses as users of electronic commerce illustrate the complexity of communication choices in small business. The main implication of our study for policy and strategy is that the economic, technological and supply side story of electronic commerce needs to be complemented by the study of the way people use electronic commerce within their social and cultural contexts.

Our user and activity story, like the supply and technology focused stories, is partial. A failure to recognise that both the users' and providers' perspectives are partial means the partial story will be mistaken for the whole - hence the need to connect the providers and users' perspectives.

Bridging the two perspectives involves complementing the focus on business efficiency, security and competitiveness with a corresponding emphasis on communication, trust and meaning. The languages and frameworks of economics and engineering are thus connected with those of sociology and communication.

Within this framework, our study suggests that policy makers and providers are more likely to increase online access and its effective use if:

They promote electronic commerce as part of a mix of communication options. Thus electronic commerce is seen as one way to enhance business activities and communication;

The Internet is recognised as a new way of communicating meaning and engendering trust. It is this distinctiveness that has the potential to change the way business is done and redefine business activities;

The take-up and use of electronic commerce is linked to increasing trust in online communication; and improving the design of online services; and

The effective use of electronic commerce is regularly monitored.

The study brings to the centre the issues of trust and design that connect the perspectives of policy makers, industry and users. Electronic commerce, therefore, becomes an issue not just of business efficiency and global competitiveness, but also of government and industry working towards enhancing trust and meaning via new communication channels.

VII. REFERENCES

1. Australian Bureau of Statistics. (1998). *Household Use of Information Technology: Australia.* Catalogue No. 8128.0. Canberra: Australian Bureau of Statistics.

2. Australian Payments System Council. (1998). *Annual Report 1997/98.* Sydney: Australian Payments System Council.

3. Burke, J., Kelso, R., Miller, S., and Singh, S. (1998). *Australia's Progress Towards Effective Use Of Online Services: Monitoring policy outcomes and market developments.* Melbourne: Centre for International Research on Communication and Information Technologies at RMIT www.circit.rmit.edu.au/monausol/

4. Newhagen, John E. and Rafaeli, Sheizaf . *Why communication researchers should study the Internet: A dialogue.* http://jcmc.huji.ac.il/vol1/issue4/rafaeli.html, as at 3 September 1997.

5. Singh, S. and Slegers, C. (1997). *Trust and Electronic Money.* Melbourne: Centre for International Research on Communication and Information Technologies.

6. Singh, S. and Slegers, C. (1998). *Small Business and Electronic Commerce.* Policy Research Paper No. 44. Melbourne: Centre for International Research on Communication and Information Technologies at RMIT.

7. Singh S. and Slegers, C. (1998). *The Story of Small Business and Electronic Commerce.* Policy Research Paper No. 43. Melbourne: Centre for International Research on Communication and Information Technologies at RMIT.

8. Slegers, C., Singh, S., and Hall, J. (1998). *Small Business and Electronic Commerce: An Australian Survey.* Research Report No. 22. Melbourne: Centre for International Research on Communication and Information Technologies at RMIT.

9. Spectrum Strategy Consultants. (1998). *Moving into the Information Society: An International Benchmarking Study,* Spectrum Strategy Consultants. Report for the Department of Trade and Industry, UK.

10. Yellow Pages Australia. (April, 1998). *Survey of e-commerce in Australian small and medium businesses.* Small Business Index. Melbourne: Telstra Corporation Limited.

11. Zuboff, S. (1988). *In the Age of the Smart Machine: The future of work and power.* New York: Basic Books.

Return to Top View Full-screen

Electronic Commerce between Retailers and Suppliers:

What Influences the Adoption and Use of Information Technologies?

Alice P. Chan

Cornell University, U.S.A

ABSTRACT

Aside from EDI stories, the latest networking fad-the Worldwide Web- has increasingly fueled the hype surrounding electronic commerce and stimulated speculations of prospects for electronic coordination and control of commercial transactions. Existing knowledge in this area mainly consists of anecdotal observations and research that is predominantly conceptual and case-based. While these are valuable insights, it would appear that there is a dire need for empirical, generalizable insights. Driven by the motivation to fill this void, the empirical research reported in this paper was undertaken. The broad research question is: What are the factors influencing organizational adoption and use of electronic information networks in retailer-supplier transactions?

View Full Text

Electronic Commerce Between Retailers And Suppliers:

What Influences The Adoption And Use Of Information Technologies?

I. INTRODUCTION

Inter-organizational networks, most notably electronic data interchange (EDI) systems, have been recognized for helping to ease the burden of interacting with suppliers, customers and other constituencies, and play a key role as a linking element of business relationships (Davidow and Malone, 1992; Rockart & Benjamin, 1991). Well known cases of success include Baxter International's (previously known as American Hospital Supply Corporation) ASAP system and McKesson's Economost system. These electronic supplier-customer networks have helped to boost overall sales for these two supplier firms and improve their positions in the respective markets of hospital supplies and drugs (Clemons, 1993). In addition, inter-firm data networks have been found to enable full-scale coordination in form of customer-supplier partnerships, bringing both parties benefits beyond cost-savings associated with reducing inventory levels (Konsynski & McFarlan, 1990; Malone, Yates & Benjamin, 1989). Overall operations associated with production, delivery and processing of ordering and billing for both the buying and selling firms are trimmed substantially.

Aside from EDI stories, the latest networking fad—the Worldwide Web—have increasingly fueled the hype surrounding electronic commerce and stimulated speculations of prospects for electronic coordination and control of commercial transactions. Existing knowledge in this area is mainly consisted of anecdotal observations and research that is predominantly conceptual and case-based. While these are valuable insights, it would appear that there is a dire need for empirical, generalizable insights. Driven by the motivation to fill this void, the empirical research reported in this paper was undertaken. The broad research question is:

What are the factors influencing organizational adoption and use *of electronic information networks in retailer-supplier transactions?*

This paper is organized as follows. Presented first is the theoretical background from which hypotheses tested were derived. After that is the presentation of the methods used in this research, which is followed by the discussion of results. Then, the paper closes with some concluding observations, including implications for future research and practice.

139

II. FACTORS INFLUENCING TECHNOLOGY ADOPTION AND USE

Addressing the research question at hand calls for drawing on the strength of interdisciplinary wisdom. More specifically, 140
transaction cost economics help to illuminate the influence of costs and market imperfection on technological decisions vis-a-vis

supporting buyer-seller transactions. Economic factors aside, relationship-based factors will also likely play a crucial role in whether and how networks are used to help coordinate and control exchanges. The underlying rationale is that many economic transactions do not occur among completely autonomous, atomized units in the market place; instead, business are often conducted on a recurring basis among the same trading partners. This section presents the theoretical background for this paper, which are grounded in these two bodies of literature that offer supplemental insights.

1. *Transaction Cost Factors*

For the past ten years, transaction cost theory has been a popular approach adopted to study electronic network use as it relates to the alternative structures of coordinating economic activities, namely, "markets" and "hierarchies" (e.g., Benjamin & Wigand, 1995; Gurbaxani & Whang, 1991; Hess & Kemerer, 1994; Kraut, Steinfield, Chan, Butler & Hoag, 1998; Steinfield, Caby, Jaeger & Kraut, 1997). Adopting the theory advanced by Williamson (1975), Malone, Yates and Benjamin (1987) initiated this strand of research with their seminal précis on "electronic markets" and "electronic hierarchies." This thesis considers ways in which electronic communication networks can facilitate the coordination and control of transactions and business activities. One main effect is in reducing coordination costs, including those incurred in search, conveying product information and quality monitoring (Bakos, 1991; Gurbaxani & Whang, 1991). Moreover, Bakos & Treacy (1986) proposed that electronic networks can reduce the costs of contracting (with external trading constituents) and monitoring, thus aiding in overcoming managerial bounded rationality and vulnerability to opportunism.

Coordination costs rise when uncertainty is high (Williamson, 1975, 1979). Due to savings in the costs of communication and information processing, electronic networks can help with coordination and control by reducing uncertainty. When the uncertainty faced by an organization is high, sound decision making necessitates a greater amount of information to be gathered, interpreted and synthesized (Galbraith, 1973; Tushman & Nadler, 1978). In order to control this situation, there must be either a reduction in the amount of information to be processed or an increase in the capacity to process information. In the case of a firm acquiring a product from a supplier, a source of uncertainty may stem from the contingencies surrounding the transaction. In this regard, uncertainty can be conceptually defined as *the predictability of the conditions in which a transaction takes place*. Electronic information networks effectively increase the technological capacity available to an organization for meeting the heightened information processing demands, and, as a result, place the firm in a better position to cope with uncertainty. In support of this observation, Sabherwal & Vijayasarathy (1994) found empirical evidence that organizations rely on telecommunication links with suppliers in the face of high environmental uncertainty. It follows logically that electronic network adoption and use would be motivated by the need to reduce high uncertainty. Thus, the following relationship is hypothesized:

H1: Electronic network adoption and use increases with uncertainty.

Malone et. al. (1987) also argued that electronic information networks can diminish the constraints on market coordination stemming from asset specificity. Asset specificity deals with *the extent to which a needed asset is specific to any given organization* (Williamson, 1975). With electronic interconnections, producers become more aware of similar product needs faced by multiple buyers, which may have been previously deemed as highly asset-specific (Malone et. al., 1987). Having this information concerning a larger market than previously known, more firms will be willing to get tooled up for production, effectively increasing the number of suppliers in the market. A potential benefit is in electronically gathering and linking up information about suppliers who may be geographically spread out, thereby reducing the difficulty and costs of search. These effects serve to attenuate the threat of small-numbers bargaining and fear of opportunism, affording procurers of needed assets more choices in the marketplace. In turn, firms are rendered less vulnerable to being taken advantage of by few powerful suppliers or customers in the market. As such, it would appear that a rational motivation to adopt and use networks is to overcome the disadvantages associated with high asset specificity.

Similar logic applies to the effect of network use in reducing the impact of the complexity of product description (Malone et. al., 1987). Product description deals with the information a buyer needs to have in order to evaluate the features of an offering that ultimately affects the purchasing decision (Porter & Millar, 1985). Complexity of product description, then, refers to the difficulty in describing these critical product attributes. In the context of coordinating supplier-customer transactions, it is important that the information about products be usable to the buyer (Malone & Crowston, 1994). Electronic networks, especially sophisticated systems offering multimedia features, can help to convey complex information. Moreover, by allowing buyers to have information about the offerings of alternative trading partners of whom these buyers may not have been aware previously, the relative imbalance of power, dependence and bargaining positions can be potentially eliminated (Johnston & Vitale, 1988).

Kraut et. al. (1998) found that, aside from predicting the level of internalization of production activities, various types of asset specificity and the complexity of product description have meaningful associations with whether networks have been used and regarded as important. Similar results were also found in a replication of the study in France (Steinfield et. al., 1997), suggesting that the utility of the transaction cost analytical framework applies to another country that has markedly different characteristics in terms of market conditions and network infrastructure and use.

Derived from the above review are the following hypotheses regarding how asset specificity and complexity of product description relate to electronic network adoption and use:

H2: Electronic network adoption and use increases with asset (product, time and knowledge) specificity.

Product specificity is defined as *the extent to which a product is useful only to a specific organization needing it*. Time specificity deals with *the time pressure involved in completing the transfer of an asset to the intended user*. Knowledge specificity is defined as *the extent to which knowledge required to coordinate business activities is perceived to be useful only to a specific pair of trading organizations or units*.

H3: Electronic network adoption and use increases with the complexity of product description.

143

2. *Social Relational Factors*

Critics of neoclassical and institutional economics call attention to the fact that these paradigms carry biases and limiting conditions, which must be recognized when applied to the study of organizational phenomena. Most importantly, limitations exist in the key assumptions of these economic perspectives in viewing social relations in transactions as a source of "friction" (Biggart & Hamilton, 1992). Social relations are arguably seen as conflict to the presumed preferences of economic actors: the pursuit of self-interests through arms-length transactions in open markets consisting of atomized buyers and sellers. These perhaps flawed assumptions about the pursuit of self-interests, frequently at the expense of another party (as often modeled in game theory), belie the concerns for vulnerability and opportunism (Parkhe, 1993).

Many researchers have called attention to the importance of social relationships to coordination and control efforts, particularly in the inter-organizational context. One reason is that many buyer-supplier relationships do not fit the traditional market-hierarchy dichotomy (Sheppard & Tuchinsky, 1996). While markets and hierarchies rely on prices and routines, respectively, for coordination and control, "hybrid" inter-organizational arrangements depend on relationships, mutual interests and reputation to manage exchanges that tend to be more social than mundane or bureaucratic (Powell, 1990). As observed by Eisenberg, Farace, Monge, Bettinghaus, Kurchner-Hawkins, Miller and Rothman (1985), information is usually exchanged at the personal level. In practice, organizations are indeed represented by individual members, for example, sales force or upper management. Besides, coordination success and other perceptual assessments are often largely determined by personal linkages (Eisenberg et. al., 1985).

In discussing the strengths and limitations of electronic media use in interpersonal negotiations and interactions, Nohria & Eccles (1992) argued that it is a fallacy to conceive electronic networks as substitutes for the face-to-face communication modality. They argued that electronic networks are good for mobilizing action, but face-to-face interactions are required to take actions themselves. One of the main reasons is that electronic networks are simply not robust enough for these actions. Finding empirical evidence consistent with this argument, Kraut et. al. (1998) concluded that electronic networks have been viewed predominantly as complements to—rather than substitutes for—personal relationships, contacts and interactions.

Based on the above review, interpersonal relationships are conceptualized as *interactions, contact and knowledge at the personal level* (between members of trading relationships). In addition, adopting the testable view that interpersonal relationships and electronic information networks complement each other in supporting the execution of inter-firm transactions, the following hypothesis is derived:

H4: Electronic network adoption and use increases with the importance of interpersonal relationships.

Examination of existing research shows that there is general recognition on the part of firms in a trading relationship that, rather than remaining separate and autonomous, their interests and welfare are interdependent and their fate intertwined with one another (Hart & Estrin, 1991; Johanson & Mattsson, 1987; Johnston & Lawrence, 1988; Powell, 1990). For instance, perspectives such as the resource dependency view (Pfeffer & Salancik, 1978) points to the fact that few organizations are fully self-sufficient, but will likely need external constituents to fulfill their resource needs. Recognizing the presence of such resource control and dependence, Johanson & Mattson (1987) argued that "an interfirm relationship is a mutual orientation of two firms toward each other" (pg. 37). Grounded in the social exchange perspective, such mutuality is a demonstration of respect for each other's needs, and overtime, interactions help to develop a mutual orientation between members of the relationship. Furthermore, mutuality as manifested in mutual commitment to a relationship is increasingly evident in what has been called information partnerships, which are characterized by organizations sharing crucial information resources and costs in their relationships (Konsynski & McFarlan, 1990). Computerized databases and other information technologies are among the critical, but expensive, resources that motivate these types of partnerships.

Given the above discussion, it appears logical to expect electronic network adoption and use to be an indication of, and favored by, the existence of mutual commitment in a pair of trading firms. With mutual commitment (toward the business relationship) conceptually defined as pledge to each other's business needs and the success of the relationship, the following hypothesis is derived:

H5: Electronic network adoption and use increases with mutual commitment.

Cooperation in a committed business relationship necessarily places firms in a vulnerable position (Powell, 1996). Vulnerability develops, in part, because of reliance on one other (such as resource-based dependency) as the relationship grows. In order to off-set the unsettling feelings of vulnerability and interdependence associated with cooperation, the governance structures regulating a trading relationship must allow for constant monitoring and consultation. It has been proposed that constant monitoring and consultation can be substituted by the presence of trust. For instance, Bradach and Eccles (1991) suggested the view of trust as a general control mechanism when the nature of inter-firm associations extends beyond ephemeral transactions, and when specialized control mechanisms like price and authority are insufficient. Ouchi (1991) proposed the notion of "clans" as a form of governance structure that depends on trust as a means of coordination and control. According to this view, trust is embedded in the networks of social relationships.

Moreover, it is highly unlikely that direct control of an external trading partner can be enforced. Therefore, when two organizations are bound to an interdependent trading relationship, there are few alternatives to managing the business liaison than trusting each other. This perspective is precisely what Kipnis (1996) argued, that out of increased reliance arises the need for partners to trust each other. Developing trust would be a necessary strategy to control the relationship, if dependence cannot be reduced. This is because trust conveys the acknowledgement—and, more importantly, expectations—of each other's ability to manage resources valued by the parties involved.

Based on the discussion thus far about vulnerability, interdependence and the need for trust, it would appear that a network connection between two trading partners would be more likely when there is already some measure of trust between them. The underlying reasoning begins with the observation that inter-organizational electronic linkages have the effect of shifting the nature of interdependence among organizations (Hart and Estrin, 1991). It is argued that "new" costs and vulnerability are created as the firms come to depend on the electronic interconnections in their transactions with one another. Therefore, it would be reasonable to expect that before two organizations are willing to open up themselves to such new risks, there needs to be a certain level of confidence and assurance that they would not take advantage of each other's vulnerability and dependence on the relationship.

In addition, information forms the basis of control, and that information technology serves as a control mechanism (Beniger, 1986, 1990; Nass and Mason, 1990). According to this perspective, electronic interconnections provide an infrastructure for two trading companies to monitor and manage task interdependence. Linking this observation to the role of trust as a means of managing trading a relationship, it is possible (and empirically falsifiable) that electronic information networks and trust complement each other in supporting business transactions.

Conceptualizing trust as *the belief that one's trading partner will refrain from malfeasance*, the extent to which this belief affects the likelihood of electronic network use and adoption is hypothesized as follows:

H6: Electronic network adoption and use increases with trust.

III. METHODS

1. *Data Collection*

A telephone survey of 143 product buyers in the U.S. grocery retail industry was conducted (response rate = 73%). They were asked a series of questions concerning the importance of computer-based information networks to the acquisition of key products from major suppliers. These questions were created from the operationalization of the major concepts in the hypotheses to be tested. Sampling of organizations was aimed at maximizing systematic variance and minimizing error for later analyses. As such, selection of firms included stratification by size (annual sales) to account for the resource dependency prediction of likely positive association between firm size and network use. Surveys were closely monitored during data collection to ensure variability in the measures of product specificity and time specificity (described below) so as to achieve close to an equalized distribution of cases.

2. *Measurement*

With the exception of the two independent variables of product specificity and time specificity, all variables were measured with at least two survey items with a five-point, Likert-type scoring scale. Respondents rated a number of items related to each variable from "1," which means "strongly disagree" or "not important at all," to "5," representing "strongly agree" or "very important."

3. *Dependent Variables*

In this research, empirical assessment of the adoption and usage of electronic information networks to support transactions was performed separately with two variables, namely *information technology cluster* and *importance of electronic network use*, respectively. Tornatzky and Klein (1982) recommended that researchers distinguish between adoption and practice/use, and incorporate separate measures for both constructs. They argued that it is a fallacy to assume that organization-wide implementation or usage of a technology necessarily comes with adoption. Individuals most affected by using the technology are often not the ones directly responsible for technological adoption decisions. Motivations for adoption and use will likely be different also.

- **Information Technology Cluster** *(see Table 1)* as measured by whether a number of technologies and applications that can enable electronic information exchange with a supplier are adopted for use in an organization: the Worldwide Web, electronic data interchange (EDI) systems, electronic point-of-sale (POS) systems, computer-based on-line services, electronic mail for internal communication and electronic mail for communication with external suppliers).

- **Importance of Electronic Network Use** *(see Table 2)* as assessed by the perceived importance of electronic links to the following activities associated with the acquisition of a key product from a major supplier: developing the specifications of an order to acquire a key product; seeking price information; negotiating the terms of an agreement to purchase a key product; ordering a key product; monitoring the quality of the orders received; fixing problems after-sales errors or problems; and practicing just-in-time inventory management.

4. *Independent Variables*

Two sets of independent variables were derived: transaction cost factors (*uncertainty, asset [product, time and knowledge] specificity and complexity of product description*) and social relational factors (*interpersonal relationships, mutual commitment and trust*). Survey items were written based on operationalization of the conceptual definitions of each concept (printed in italics in previous section). Factor analysis was conducted to eliminate items that did not display sufficient validity. Valid and internally consistent items were summed to form index measures. For instance, mutual commitment is a 4-item scale with an Alpha score of .84.

Product specificity and time specificity were not assessed with perceptive measures. Instead, product specificity was measured by varying the brand names/labels of products, from national (non-specific) to regional to local/store (highly specific). As for time specificity, it was treated by selecting four product categories, two highly perishable (i.e., fresh fruits and vegetables and diary products) and two relatively low in perishability (i.e., breakfast cereals and confectionery goods, e.g., potato and chips, candy, etc.).

The importance of interpersonal relationships was measured by the ratings of the same seven activities used to assess the importance of electronic network use. This operationalization strategy is aimed at providing common bases for comparing electronically mediated and interpersonal interactions between grocery buyers and their suppliers.

5. *Control variables*

151

- **Organizational size:** Resource dependency theory (Pfeffer & Salancik, 1978) calls attention to the fact that the size of a firm often has implications for the slack resources available for investments in technology. Hence, the current study controlled for this potential extraneous source of variance. Size was measured with a 3-item index comprised of annual sales, total number of employees and stores.

- **Integration with major supplier:** Previous research found that electronic network use are more important to working with internal suppliers or trading firms with whom there is an existing relationship (Kraut et. al., 1998; Steinfield et. al., 1995). Besides, whether a major supplier is internal or external is theoretically linked to the transaction cost predictors of asset specificity and uncertainty. Therefore, to avoid the specification error of failing to account for an important confound, the level of integration with the major supplier was included as a control variable. It was measured by the level of ownership (no, partial or full ownership) the retailer has in the most important supplier dealt with in the last 12 months to acquire a key product.

IV. RESULTS AND DISCUSSION

Out of a total of 143 firms surveyed, 43 did not use any networks at the time of the study. The next subsection provides a few observations about the non-adopters. Hypotheses were tested using only the 100 adopter cases. Results of these tests using multiple regression analysis are summarized in Figure 1 *(see Figure 1)* and Table 1*(see Table 1)*. Discussion of these results are organized around the dependent variables, i.e., information technology cluster and the importance of electronic network use.

1. *Hype vs. Reality*

The current study finds that the level of electronic network use to support retailer-supplier transactions may not be as high as generally perceived. After all, one-third of the surveyed retailers were not using electronic information networks to support their product acquisitions from major suppliers. Compared to the 100 adopters, buyers in the non-adopter firms rated the descriptions of their key products being surveyed to be less complex, interpersonal relationships with their major suppliers to be more important, and that they had more trust in these suppliers. These results suggest that when electronic networks are not available, firms rely on more "traditional" means of coordinating and controlling transactions. As will be seen later, these findings are consistent with subsequent analyses of the 100 adopter firms.

2. *Adoption vs. Use*

As proposed, the factors found to have significant influence on adoption and use are indeed different (more discussion will follow below). It is plausible that while electronic linkages adopted may not be rendered important to supporting one specific set of buyer-supplier transactions, other buyers managing different product categories in the same company may find electronic exchange of information with their suppliers to be important. In addition, technological adoption may be motivated by other priorities than facilitating the coordination and control of product acquisition activities (such as various reasons associated with attaining competitive advantage or meeting strategic necessities).

All hypotheses concerning the adoption variable are rejected. Regression results show that a larger share of the information technology cluster would have been adopted when interpersonal relationships with major suppliers were viewed as less important and when there was less trust in these suppliers (ß = -.17 and -.18, $p < .05$, respectively). While the directions of the standardized beta weights are opposite of that hypothesized, the associations are nonetheless significant. (Further discussion on the implications of these findings vis-a-vis interpersonal relationships and trust are presented later.) It should also be noted that both control variables, i.e., organizational size and integration with major supplier, have significant impact on the share of the IT cluster adopted, but do not appear to affect the importance attributed to network use.

With respect to the organizational size variable, the results suggest that once technologies have been adopted, size—and its implications on slack resources—no longer appears to be an important determinant of usage (see betas in Table 1). This empirical observation is consistent with the findings of previous research (Kraut et. al., 1998) and intuitive logic. Consider that the highest technological costs are generally incurred during initial implementation. Relatively speaking, the operating costs thereafter are usually significantly smaller.

As for the other control variable, a larger portion of the information technology cluster is more likely to be adopted by grocery retailers who were integrated with their major suppliers (ß = 15, $p < .05$; see Table 11). This finding is also consistent with existing research concluding that electronic linkages are more likely to be considered important in situations where the major supplier is an internal unit or a trading partner with whom a firm has a pre-established, long-term business relationship (Kraut, et. al., 1998; Steinfield et. al., 1995). Moreover, this observed positive relationship between technological adoption and the level of retailer-supplier integration is also suggestive of the possible perception that electronic interconnections are beneficial to supporting smoother interfacing with major suppliers, manifesting what Malone et. al. (1987) termed the electronic integration effect.

3. "Dynamic" vs. "Static" Transactions

Unanticipated *a priori* are the findings that the importance of electronic network use differ depending on the types of activities. In particular, factor analysis yields two "pools" of transactions among the seven surveyed. Loading on the same factor are activities that would likely require more interactions with a supplier. Labeled as the "dynamic" transactions, these include: fixing after-sales errors or problems; monitoring the quality of the orders received; practicing just-in-time inventory management; and negotiating the terms of an agreement to purchase a key product. Likewise, response patterns were consistent among the relatively more "static" transactional activities: developing specifications of an order; ordering a key product; and seeking price information. What is suggested in these findings is that there is (are) some abstract dimension(s) concerning electronic communication and information exchange in which these two sets of activities vary qualitatively. One possible source of difference is the likely amount, frequency and complexity of interactions between the retailer and supplier necessitated in carrying out these transactional tasks. It is quite logical to expect more frequent and complex interactions with suppliers to be associated with contract negotiations, quality monitoring and problem fixing (the "dynamic" activities) than ordering or seeking price information (the "static" activities).

On average, electronic networks were perceived to be more important to the "static" than the "dynamic" activities (by comparing mean scores). There are a number of plausible explanations. First, relative to the "dynamic" transactional tasks, the "static" ones would likely incur less demand for robust, interactive communication. Moreover, execution of "dynamic" activities, such as negotiations and problem solving, would still rely heavily on face-to-face interactions and less so on electronic networks. Indeed regression results support this conjecture (discussed below). Further, drawing on insights advanced by Nohria and Eccles (1992), the "static" activities are also relatively less ambiguous, more standard and routine, as well as less reliant on robust relationships. Yet another potential explanation can be traced to the need for coordination routines and patterns to eliminate the need to treat each situation as new and to provide stability to an organization's operations (Galbraith, 1973; March & Simon, 1958, 1993). For instance, once a retailer-supplier EDI connection is implemented, a system and routine for performing such standard activities as price check and ordering can be developed and followed. On the other hand, activities involving negotiations or problem solving are likely less routine, but may instead require different treatment across situations. As such, it would be more difficult to routinize or automate the execution of the "dynamic" activities electronically than the "static" ones. Last, but not least, is the potential of equalizing status or power in bargaining and negotiations through technology use (Bakos & Treacy, 1986; Weisband, Schneider & Connolly, 1995). Powerful buyers or sellers may not want to relinquish their more advantageous position. As such, although network use might be allowed to automate some of the ordering activities, electronic exchange of information that has implications on negotiations, bargaining and other more sensitive types of interactions would be discouraged.

As can be observed in Table 1, factors having significant influence on the perceived importance of network use in the "static" transactions are product and knowledge specificity ($ß = .18$ in both cases, $p < .10$), mutual commitment ($ß = .28$, $p < .05$) and trust ($ß = -.25$, $p < .05$). These results lead to the conclusion that the data are consistent with H5 (mutual commitment), but are inconsistent with H2 and H6 in terms of directionality. As for the "dynamic" transactions, significant regressors include the complexity of product description ($ß = .21$, $p < .05$) and interpersonal relationships ($ß = .33$, $p < .05$), thereby lending support for H3 and H4. All the other hypotheses concerning the importance of electronic network use are rejected.

4. *Influence of Transaction Cost Factors*

In the current study, complexity of product description shows strong influence on computer-based networks being viewed as important to the transactional activities that are more "dynamic" in nature. In other words, the more difficult it is to describe the critical attributes of a key product needed, the more a grocery buyer is likely to rely on electronic networks for pre- and post-sales negotiations and interactions with their suppliers. This finding also receives support from the fact that the average rating for the complexity of product description was significantly higher among the network users than the non-users (mentioned above under "Hype vs. Reality.")

This observation can be traced partly to the fact that variations of products are often associated with various forms of standardized codes used in the grocery industry (e.g., UPCs, ULNs, SKUs, etc.). It would also appear that the more complex a product is, the more efficient these codes tend to be in describing the grade or quality that is desired in the product. For instance, one respondent reported that there are different numbers associated with different grades of bananas. While it would be difficult to describe in words precisely the shade of yellow that an order of bananas should have, the standardized codes serve as an efficient short-hand description for this otherwise highly complex communication task. Since these product codes can be easily transmitted over networks, whenever there is a problem with an order, or when an urgent replenishment is needed (just-in-time), interactions with the supplier can be expedited. Rather than having to relay verbally problems with an order that is difficult to describe, the product code and other order information stored electronically in an EDI system can be recalled to facilitate problem fixing. Similar logic also applies to negotiations, when the exchange of complex product specifications can be enhanced by the use electronic data networks. Networks in this context would likely play a supplemental or complementary role to other modalities of coordination and control, e.g., interpersonal contact. Indeed, as will be discussed below, networks have been found to supplement/complement interpersonal relationships in executing the "dynamic" activities.

Consistent with the finding by Kraut et. al. (1998), this empirical observation rejects the hypothesis advanced by Malone et. al. (1987) that electronic linkages are associated with lower complexity of product description. A possible explanation is that, if a set of product attributes could be easily described, existing communication mechanisms might suffice (e.g., faxing and telephoning). As such, it would be less worthwhile or justifiable to invest in a state-of-the-art electronic network. Moreover, recall from the conceptual discussion earlier, compared to a decade ago, the technologies available today are more sophisticated; they are more capable of supporting multi-media representation of product features that may be otherwise challenging to describe verbally or in writing alone. Empirical observations in this study concerning the construct of complexity of product description appear to confirm this proposition. In turn, this "revelation" calls for a change in the seemingly out-dated conceptualization originally proposed by Malone et. al. (1987).

Like other transaction cost factors, uncertainty does not display significant influence on technological adoption and use. A reason is that it is difficult to measure directly, and is often manifested or embedded in other hypothetical constructs. For instance, it has been argued that the complexity and compatibility variables in diffusion of innovations research "are merely indices of the degree and type of ‘uncertainty-arousing’ potential" (Tornatzky & Klein, 1982, pg. 41). Nohria and Eccles (1992) offered another conceptual explanation: electronically mediated exchanges are likely to be more effective when situations involve higher certainty. In addition, some organizational theorists (e.g., Galbraith, 1973; March & Simon, 1958, 1993) would argue that lower uncertainty can facilitate the development and implementation of routines and programs to manage standard tasks. When there is high certainty, the need to treat each electronic order or price seeking activity as a new, unique situation is eliminated.

Similarly, the asset specificity measures have not been found to have much influence. Notable influence is attributed to product and knowledge specificity in accounting for grocery buyers viewing electronic network use to be important in supporting the "static" activities. A product bearing a retailer’s private label (high product specificity) is unlikely to be produced by more than one or a few suppliers. Given the need to engage in recurring transactions with this supplier (or small number of suppliers), automating the ordering process has the appeal of reducing coordination costs. Moreover, as long as the retailer needs to replenish a store-label product supplied by a particular trading partner, there is a guarantee for long-term business over which to spread technological investment and operational costs. Similar logic applies to the finding concerning knowledge specificity characterizing retailer-supplier transactions. Having highly specific knowledge about each other can facilitate the joint effort to automate pricing and order processing electronically. Furthermore, the average respondent in this study attributed fairly high importance to the need for both retailers and suppliers to know each other beyond basic industrial practice in order to do business effectively (mean score = 3.74). This observation implies the existence of idiosyncrasies in the highly complex and intricate grocery retail industry. It also suggests a considerable amount of strategizing being practiced by the industry participants. Under these conditions, it would be difficult for negotiations or problem fixing (the "dynamic" activities) to be automated or carried out electronically.

Measurement problems may also account for the insignificant findings associated with uncertainty and the different types of asset specificity. Internal consistency reliability scores are in the order of .51-.52. Therefore, the attenuation of associations observed due to lack of reliability cannot be ruled out.

5. *Influence of Social Relational Factors*

Perceptions toward interpersonal relationships present an interesting case in which the associations are different with technological adoption and the importance attributed to electronic network use. As far as adoption of the information technology cluster is concerned, it is found to have a negative relationship with the perceived importance of interpersonal relationships ($ß = -.17$, $p < .05$). What can be inferred are signs of substitutability between the two modalities of dealing with suppliers in the acquisition of a key product. When interpersonal contact is not considered crucial to the coordination and control of interactions, electronically mediated communication can suffice. However, the results are altogether different in the assessment of the importance of electronic network use. Perceived importance of interpersonal relationships does not appear to have a significant association with that attributed to electronic network use for supporting transactional activities that are more "static" in nature ($ß = .17$, $p > .05$). With respect to the more non-routine, "dynamic" activities that are likely to require more recursive interactions between the grocery retailer and supplier, a significant positive relationship has been observed ($ß = .33$, $p < .01$). In other words, it would appear that electronic networks have been regarded as complements to interpersonal contact in these transactional contexts. This is consistent with a previous finding that there is a complementary relationship between the importance of electronic network use and interpersonal relationships (Kraut et. al., 1998). When interactions are complex and ambiguous, redundancy in communication channels is often desired. For instance, Sitkin, Sutcliff and Barrios-Choplin (1992) reported that the use of multiple media and multiple communicators is especially associated with ambiguous tasks. In this regard, electronic networks appear to provide additional capacity as an additional modality for supporting "dynamic" interactions.

Other existing literature can also help to explain the differential patterns of associations with the two measures of network use. From a media richness perspective, the "dynamic" tasks that are more complex and ambiguous than the "static" tasks necessarily require the richest communication media, i.e., face-to-face interactions (Daft & Lengel, 1984; Trevino, Daft & Lengel, 1990). Therefore, in supporting these more media-rich tasks, the more likely function of electronic networks is to complement or supplement face-to-face interactions, rather than substituting the latter in serving as the sole medium of business exchanges. Furthermore, according to what has been reported as of the present, EDI systems are useful for automating invoicing and exchanging straightforward pricing and shipping information; many ordering and payment processing activities beyond simple information exchange still require human intervention (Clark and Schiano, 1996). Again, technological capabilities merely complement and supplement interpersonal interactions for improved communications and efficiency.

With respect to mutual commitment, Powell (1996) offered some insights into the different patterns of relationships between this variable and the various technology and network use measures. He contended that organizations in a trading relationship are sometimes willing to forego fears of vulnerability and collaborate when they have complementary resources; these resources could be anything, from materials to labor, and even information technology. Furthermore, it has been argued that electronic networks can facilitate the establishment of mutuality by providing the infrastructure for "reliable, prompt, and relatively low-cost information" (Parkhe, 1993, pg. 821). In turn, this translates into reduction in coordination efforts and safeguards against opportunism. It is likely that at the early stages of transacting with one another, mutual commitment is manifested in the form of "credible, significant non-recoverable investments on both sides" (pg. 821). It would appear that investing in an electronic interconnection is a sign of mutual commitment of the more tangible nature.

On this note, anecdotal comments provided by a number of surveyed buyers in the current study may help to explain why mutual commitment is not a significant predictor of electronic network use to the "dynamic activities." These respondents commented that their willingness to cooperate with their suppliers was strictly because that was the nature of conducting business. To the extent that a trading partner's success is tied to their own, they are committed to the business relationship. While the (perhaps superficial) display of mutual commitment allows for routine, non-threatening activities to be coordinated and controlled electronically, the "dynamic" activities are too important to the protection of self-interests to be performed electronically. The most robust modality of interaction would still be required, even if networks are used to exchange information to supplement the face-to-face negotiations and bargaining. This finding adds practical insights into the extent to which retailer-supplier transactions can be automated, based on how vulnerable the parties would likely feel as a result.

Perhaps the most "surprising" finding of the current study is the negative association between trust and technological adoption and use. Also, compared to the network users, non-users reported significantly higher trust in their suppliers (noted earlier). One possible explanation for the negative relationships observed is that electronic networks help to increase the span of control (Beniger, 1986; Kipnis, 1996). Also, it is plausible that electronic networks increase the bandwidth of human interaction. It would appear that electronic supplier-retailer interconnections in this context might serve as a functional substitute for trust as a mechanism for control and coordination of the transactions that occur with the acquisition of a key product.

Another possible explanation for the negative association is in the conceptualization of trust, given the different dimensions associated with the concept. (To recap, trust in the current study is conceptualized as the belief that one's trading partner will refrain from malfeasance.) More specifically, the manifestations of two parties appearing to trust each other may be the result of deliberate actions rather than the reality of truly feeling the presence of affective bonds with one another (Clark and Schiano, 1996). With this characterization, while a respondent might not perceive a high level of trust in a supplier in the psychological sense, contractual and other mechanisms are able to substitute for this lack of affective sense of confidence and security. Expressed differently, the presence of a contract would be a sufficient indication of actionable trust for routine activities to be automated with the use of networks. Another safeguard against opportunism disguised as trust is that of reputation. Several respondents in the current study contended that their suppliers would unlikely take advantage of them because of negative reputational ramifications. These observations are consistent with Granovetter's (1985) argument concerning the need for institutional arrangements to enforce trust. It would appear, then, that a gap exists between *a priori* conceptual reasoning and empirical observations in the present study, i.e., viewing trust and electronic information networks as complementary, rather than substitutable, control and coordination mechanisms.

V. CONCLUSIONS

1. *Limitations and Caveats*

Like all empirical research, the study reported here is tempered with a number of limitations and caveats. First, because the current study used a cross-sectional design to test the presence and strength of hypothesized relationships, causality cannot be overstated. Furthermore, unique characteristics associated with grocers likely limit the extent to which findings of this research can be generalized to organizations in other industries, despite commonalities shared by retail industries. Another limiting condition of the current study stems from the relatively small samples available for the empirical tests of the hypotheses developed in this research. In addition, as alluded to in previous discussion, measurement problems may have attenuated the strength of association observed.

2. *Implications*

Previous conceptual work grounded in transaction cost analysis offers valuable insights into how electronic networks may help to reduce costs associated with buyer-seller transactions. The current study shows that a number of social relational factors influence organizational adoption and use of electronic networks in ways that are not explained by transaction cost variables. In particular, the lack of trust in a trading partner has been found to be a significant factor associated with technological adoption and electronic network use. In addition, technology is seen as a functional alternative to interpersonal relationships in coordinating and controlling "static" transactions, while playing a complementary role in "dynamic" ones. Mutual commitment has also been found to be a crucial factor influencing organizational network use. The only transaction cost factor that is significantly correlated with network use is the complexity of product description. Future research efforts devoted to the refinement of the conceptualizations and measurement proposed in this study can further test the relative utility of transaction cost and social relational analyses.

In addition, results of the current study show that there is insufficient model fit (R-square values; see Table 1). This implies the need to consider other constructs, such as those related to the retailer-supplier power structure and other organizational attributes. Moreover, it may be valuable to consider and incorporate insights derived from other theories, such as the diffusion of innovations and the information processing approach. Last, but not least, the incorporation of overtime analysis of a set of key factors would also be meaningful in distinguishing between the antecedents to and the effects of technology use on inter-organizational coordination and control.

At a practical level, this research shows that electronic network use in commercial transactions is not as prevalent as existing hype would suggest. After all, one-third of the grocery retailers surveyed did not consider electronic networks to be important to their interactions with major product suppliers. Therefore, the level at which technology can actually facilitate trade should not be overstated. Moreover, findings in this research also lead to the recommendation that retailers should not be concerned solely with technological implementation and operational costs. Decisions to adopt and use electronic networks need to factor in the varying complementary and substituting roles technologies play in relation to the pre-existing social relational conditions characterizing trade with suppliers. For instance, as a mechanism for coordinating and controlling transactions, how does an electronic link fit in with established interpersonal relationships with the trading partner? To what extent is the supplier trustworthy and/or can be monitored electronically? Do both the retailer and supplier feel sufficiently committed to the business relationship to open themselves up to new interdependencies and vulnerabilities associated with electronic trading?

It would appear that much excitement and momentum has been gathered over the emerging phenomenon of electronic commerce. This is, in part, fuelled by the exponential growth of the Worldwide Web and its popularity. Empirical observations in this research show that the actual use of electronic buyer-seller information networks falls short of the level inferred by the prevailing hype. Continued research in the actual roles and functions served by information technology in commercial transactions can help to separate the "true" value of using inter-firm electronic networks from sheer hype.

VI. REFERENCES

1. Bakos, J. Y., & Treacy, M. E. 1986. Information technology and corporate strategy: A research perspective. *MIS Quarterly*, June, 107-119.
2. Beniger, J. R. 1990. Conceptualizing information technology as organization, and vice versa. In J. Fulk & C. Steinfield, Eds., *Organizations and communication technology,* Newbury Park, CA: Sage Publications, Inc. pp. 29-45.
3. Beniger, J. R. 1986. *The control revolution: Technological and economic origins of the information economy*. Cambridge, MA: Harvard Univeristy Press.
4. Biggart N. W., & Hamilton, G. G. 1992. On the limits of a firm-based theory to explain business networks: The bias of neoclassical economics. In N. Nohria & R. Eccles, Eds., *Networks and organizations: Structure, form, and action*, Boston, MA: Harvard Business School Press. pp. 471-490.
5. Benjamin, R., & Wigand. R. 1995. Electronic markets and virtual chains on the information superhighway. *Sloan Management Review*, Winter, 62-72.
6. Clark, T. H., & Schiano, W. T. 1996. Seven levels of interorganizational connectivity: An examination of the U.S. grocery distribution channel. *Proceedings of the 49th Annual Conference on System Sciences*, Hawaii. pp. 281-289.
7. Clemons, E. K. 1993. Information technology and the boundary of the firm: Who wins, who loses, who has to change. In S. P. Bradley, J. A. Hausman & R. L. Nolan, Eds., *Globalization technology and competition: The fusion of computers and telecommunications in the 1990s*, Boston, MA: Harvard Business School Press. pp. 219-242.
8. Contractor, N. S., & Eisenberg, E. M. 1990. Communication networks and new media in organizations. In J. Fulk & C. Steinfield, Eds., *Organizations and Communication Technology*, Newbury Park, CA: Sage Publications, Inc. pp. 143-172.

9. Daft, R. L., & Lengel, R. H. 1984. Information richness: A new approach to managerial information processing and organization design. In L. L. Cummings & B. M. Straw, Eds., *Research in organizational behavior*, *6*, Greenwich, CT: JAI Press. pp. 191-134

10. Davidow, W. H., & Malone, M. S. 1992. *The virtual corporation.* New York: HarperCollins Publishers.

11. Dow, G. K. 1988. Configurational and coactivational views of organizational structure. *Academy of Management Journal*, *13*(1), pp. 53-64.

12. Eisenberg, E. M., Farace, R. V., Monge, P. R., Bettinghaus, E. P., Kurchner-Hawkins, R., Miller, K. I., & Rothman, L. 1985. Communication linkages in interorganizational systems: Review and synthesis. In B. Dervin & M. J. Voight, Eds., *Progress in communication sciences*, Norwood, NJ: Ablex. pp. 231-261.

13. Galbraith, J. 1973. *Designing complex organizations.* Reading, MA: Addison-Wesley Publishing Company.

14. Granovetter, M. 1985. Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, *91*(3), 481-510.

15. Gurbaxani, V., & Whang, S. 1991. The impact of information systems on organizations and markets. *Communications of the ACM*, *34*(1), 59-73.

16. Hart, P., & Estrin, D. 1991. Inter-organizational networks, computer integration, and shifts in interdependence: The case of the semiconductor industry. *ACM Transactions on Information Systems*, *9*(4), 370-398.

17. Hess, C. M., & Kemerer, C. F. 1994. Computerized loan origination systems: An industry case study of the electronic markets hypothesis. *MIS Quarterly*, September, 251-275.

18. Johanson, J., & Mattson, L. G. 1987. Inter-organizational relations in industrial systems: a network approach compared with transaction-cost approach. *International Studies of Management and Organization*, 17(1), 34-48.

19. Johnston, H. R., & Lawrence, P. R. 1988. Beyond vertical integration: The rise of the value-adding partnership. *Harvard Business Review*, July-August, 94-101.

20. Johnston, H. R., & Vitale, M. R. 1988. Creating competitive advantage with inter-organizational information systems. *MIS Quarterly*, June, 153-165.

21. Joskow, P. L. 1985. Vertical integration and long-term contracts: The case of coal-burning electric generating plants.

Journal of Law, Economics, and Organization, *1*(1), 33-80.

22. Konsynski, B. R., & McFarlan, E. W. 1990. Information partnerships--Shared data, shared scale. *Harvard Business Review*, September-October, 114-120.

23. Kraut, R., Steinfield, C., Chan, A. P., Butler, B., & Hoag, A. 1998. Coordination and Virtualization: The Role of Electronic Networks and Personal Relationships. *Organization Science* and the *Journal of Computer-Mediated Communication*, 3(4) (http://www.ascusc.org/jcmc/vol3/issue4/kraut.html), Special Issue on Virtual Organizations.

24. Malone, T. 1987. Modeling Coordination in Organizations and Markets. *Management Science*, *33*(10), 1317-1332.

25. Malone, T. & Crowston, K. 1994. The interdisciplinary study of coordination. *ACM Computing Surveys*, *26*(1), 87-120.

26. Malone, T., Yates, J., & Benjamin, R. 1987. Electronic markets and electronic hierarchies: effects of information technology on market structure and corporate strategies. *Communications of the ACM*, *30*(6), 484-497.

27. March, J. G., & Simon, H. A. 1993. *Organizations* 2nd ed.. Cambridge, MA: Blackwell Publishers.

28. Nass, C., & Mason, L. 1990. On the study of technology and task. In J. Fulk & C. Steinfield, Eds., *Organizations and communication technology*, Newbury Park, CA: Sage Publications, Inc. pp. 46-68.

29. Nohria, N., & Eccles, R. 1992. Face-to-face: Making network organizations work. In N. Nohria & R. Eccles, Eds., *Networks and organizations: Structure, form, and action*, Boston, MA: Harvard Business School Press. pp. 288-308.

30. Ouchi, W. G. 1991. Markets, bureaucracies and clans. In G. Thompson, J. Frances, R. Levacic & J. Mitchell, Eds., *Markets, hierarchies and networks: The coordination of social life*, London, UK: Sage Publications Ltd. pp. 246-255.

31. Parkhe, A. 1993. Strategic alliance structuring: A game theoretic and transaction cost examination of interfirm cooperation. *Academy of Management Journal*, *36*(4), 794-829.

32. Pfeffer, J. & Salancik, G. R. 1978. *The external control of organizations: A resource dependence perspective.* New York: Harper and Row.

33. Porter, M. E., & Millar, V. E. 1985. How information gives you competitive advantage. *Harvard Business Review*, July-August: 149-160.

34. Powell, W. W. 1996. Trust-based forms of goverance. In R. M. Kramer & T. R. Tyler Eds., *Trust in organizations: Frontiers of theory and research*, Thousand Oaks, CA: Sage Publications, Inc. pp. 51-67.

35. Powell, W. W. 1990. Neither market nor hierarchy: Network forms of organization. *Research in Organizational Behavior, 12*, 295-336.

36. Sabherwal, R., & Vijayasarathy, L. 1994. An empirical investigation of the antecedents of telecommunication-based interorganizational systems. *European Journal of Information Systems*, *34*, 269-284.

37. Sitkin, S. B., Sutcliffe, K. M., & Barrios-Choplin J. R. 1992. A dual-capacity model of communication media choice in organizations. *Human Communication Research*, *18*(4), 563-598.

38. Steinfield, C., & Caby, L. 1993. Strategic organizational applications of videotex among varying network configurations. *Telematics and Informatics*, *10*(2), 119-129.

39. Steinfield, C., Caby, L., Jaeger, C., & Kraut, R. 1997, June. *Electronic data networks and inter-firm relations: A French and U.S. comparative analysis*. Paper presented at Global Networking '97, Calgary, Canada.

40. Steinfield, C., Kraut, R., & Plummer, A. C. 1995. The impact of interorganizational networks on buyer-seller relationships. *Journal of computer mediated communication*, *1*(3). Available http://www.usc.edu/dept/annenberg/vol1/issue3/vol1no3.html.

42. Thompson, J. D. 1967. *Organizations in action*. New York: McGraw-Hill.

43. Tornatzky, L. G. & Klein, K. J. 1982. Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, *EM-29*(1), 28-45.

44. Trevino, L. K., Daft, R. L., & Lengel, R. H. 1990. Understanding managers' media choices: A symbolic interactionist perspective. In J. Fulk & C. Steinfield, Eds., *Organizations and communication technology*, Newbury Park, CA: Sage Publications, Inc. pp. 71-94.

45. Tushman, M. L., & Nadler, D. A. 1978. Information processing as an integrating concept in organizational design. *Academy of Management Review*, *3*, 613-624. Reprinted in D. A. Nadler, M. L. Tushman, & N. G. Hatvany Eds., *Managing organizations: Readings and cases*, Boston, MA: Little, Brown and Company. pp. 291-301.

46. Williamson, O. 1979. Transaction-cost Economics: The Governance of Contractual Relations. *Journal of Law and Economics*, 22, 233-262.

47. Williamson, O. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.

Table 1 - Information Technology Cluster

Information Technology Cluster		
	Standardized Beta (ß)	Probability Level
Transaction Cost Factors		
uncertainty	.06	.44
product specificity	-.05	.53

175

176

time specificity	-.11	.20
knowledge specificity	.06	.49
complexity of product description	.12	.15
Social Relational Factors		
importance of interpersonal relationships	-.17	.04
mutual commitment	.12	.23
trust	-.18	.05
Control Factors		
organizational size	.43	.00
integration with major supplier	.15	.05
N = 140 Multiple R = .50	**R-square = .25** (F = 4.35, p = .00) **Adjusted R-square = .19**	

Go Back

Table 1 - Information Technology Cluster

Information Technology Cluster		
	Standardized Beta (ß)	Probability Level
Transaction Cost Factors		
uncertainty	.06	.44
product specificity	-.05	.53
time specificity	-.11	.20
knowledge specificity	.06	.49
complexity of product description	.12	.15
Social Relational Factors		
importance of interpersonal relationships	-.17	.04
mutual commitment	.12	.23

179

180

trust	-.18	.05
Control Factors		
organizational size	.43	.00
integration with major supplier	.15	.05
N = 140 Multiple R = .50	**R-square = .25** (F = 4.35, p = .00) **Adjusted R-square = .19**	

Go Back

Table 2. Importance of Electronic Network Use

	Importance of Electronic Network Use In			
	"Static" Activities		**"Dynamic" Activities**	
Transaction Cost Factors	Standardized Beta (ß)	Probability Level	Standardized Beta (ß)	Probability Level
uncertainty	-.10	.32	.08	.45
product specificity	.18	.07	.11	.23

time specificity	-.04	.72	-.08	.43
knowledge specificity	.18	.07	.09	.38
complexity of product description	.17	.11	.21	.05
Social Relational Factors				
importance of interpersonal relationships	.17	.12		
to "static" activities			.33	.00
to "dynamic" activities				
mutual commitment	.28	.03	-.09	.47
trust	-.25	.03	.08	.49
Control Factors				
organizational size	.09	.38	.09	.56
integration with major supplier	.08	.43	.01	.93

N = 100	Multiple R = .44 **R-square = .19** (F = 2.10, p = .03) **Adjusted R-square = .10**	Multiple R = .50 **R-square = .25** (F = 3.03, p = .00) **Adjusted R-square = .17**

Go Back

Figure 1. Summary of Findings

Independent Variables and Hypotheses*	Dependent Variables		
	Information Technology Cluster	Importance of Electronic Network Use to	
		"Static" Activities	"Dynamic" Activities
1. Uncertainty	Rejected	Rejected	Rejected
2a. Product Specificity	Rejected	**Rejected (but marginally significant β)**	Rejected
2b. Time Specificity	Rejected	Rejected	Rejected
2c. Knowledge Specificity	Rejected	**Rejected (but marginally significant β)**	Rejected
3. Complexity of Product Description	Rejected	**Rejected (but marginally significant β)**	**Supported**
4. Importance of Interpersonal Relationships	**Rejected (but significant negative β)**	N/A	N/A
"Static" activities	N/A	Rejected	N/A

"Dynamic" activities	N/A	N/A	**Supported**
5. Mutual Commitment	Rejected	**Supported**	Rejected
6. Trust	**Rejected (but significant negative β)**	**Rejected (but significant negative β)**	Rejected

**All independent variables were hypothesized to be positively associated with the dependent variables.*

Go Back

Monopoly Infrastructure: A Trade Barrier to Electronic Commerce

Kevin R. Hartmann

International Communications

Center for Strategic and International Studies

Washington D.C.

January, 1999

Abstract:

The absence of competition in the provision of telecommunications infrastructure will have depressive effects on the introduction of Internet products and services. Liberalized entry of multiple providers of telecommunication networks and access, in turn,of Internet Service Providers to those networks is the most favorable economic environment that can support and sustain diverse applications of Internet-based commerce for the purposes of trade and micro-economic development. This paper posits the argument that failure to open national markets to competitive telecommunications infrastructure will constitute a market access barrier to trade in electronic commercial services and applications. The economic development implications for developing countries of such a trade barrier are outlined.

View Full-text

Monopoly Infrastructure: A Trade Barrier to Electronic Commerce

The absence of competition in the provision of telecommunications infrastructure will have depressive effects on the introduction of Internet products and services. Liberalized entry of multiple providers of telecommunication networks and access, in turn,of Internet Service Providers to those networks is the most favorable economic environment that can support and sustain diverse applications of Internet-based commerce for the purposes of trade and micro-economic development. This paper posits the argument that failure to open national markets to competitive telecommunications infrastructure will constitute a market access barrier to trade in electronic commercial services and applications. The economic development implications for developing countries of such a trade barrier are outlined.

Measurable Gains in 1998

This past year, 1998, may prove to be the watershed year for the age of electronic commerce. Over the past six months, web-based enterprises have started, for the first time, showing measurable profits, especially as during the immediate past holiday season. America Online, for example, surpassed their Christmas projections of $600K as early as December 17. Many other web sites experienced equally stellar sales, often doubling and tripling expectations. A popular US auction site, E-bay, was so overwhelmed with bids and inquiries during the days leading up to Christmas that their web site crashed on a number of occasions. Similarly, financial service companies now marketing to customers online have watched their stocks climb into the double digits just since this past summer. E-Schwab (a product of Charles Schwab & Co.), is now the leading trading company online with a 33% share of the market and exceeding its rival Merrill Lynch. This is particularly ironic as Merrill has maintained the view that web brokerage will not play a significant role in personal brokerage services. Moreover, they contend that web brokerage will ultimately harm investors who are unable to make proper and informed personal finance decisions without professional advice and consultation.

At CSIS during the next two years, we will be examining three trade dimensions of Internet commerce: taxation of Internet transactions, national treatment of Internet-based businesses, and market access for Internet service providers and retailers. We are especially interested in these issues in the context of developing economies. Here, I will touch on some of the questions that we believe that must be addressed relative to market access, particularly questions that arise relative to the trade barrier effects of a telecommunications monopoly structure relative to Internet commerce.

Declining Role of Traditional Telephone Monopolies in Electronic Commerce Services

While the countries that signed the Basic Telecommunications Agreement of the World Trade

Organization represent an overwhelming percentage of the current global market in telecommunications services, there remain many nations that are either bound by exclusive licenses or contracts to an incumbent operator, or that continue monopoly provision through a state-owned administration. As a result, the shift to a knowledge-based economy that is occurring at a rapid rate around the globe will not be enjoyed by the countries that continue to protect these monopoly arrangements from exposure to competition in telecommunications and value-added services. In the past, such monopolies have been seen as justified in most developing countries because their economies have not had the ability to sustain telecommunication resources offered by a multi-provider structure due to the constraints on scale and scope.

However, with the advent of new wireless and satellite systems capable of providing high bandwidth at substantially lower costs than wireline networks, the opportunity for sustainable competition in developing economies has expanded dramatically. Some of these networks can address small-scale markets in countries with restricted purchasing power and are capable of providing a broad scope of services responsive to diverse user communities. Networks featuring distributed switching and self-healing capabilities enable scalable deployment of infrastructure in response to actual market demand. The incremental build-out that is possible with such networks is compatible with the dispersed, infesting nature of the Internet. Consequently, Internet services and Internet commerce can now be brought into markets with relatively low purchasing power, enabling developing countries to participate in this dynamic new source of economic activity.

The Importance of Intelligent Network Capabilities

The economic value of telecommunications networks comes increasingly from the expanding varieties of functionalities made possible by intelligent network technologies. The underlying transport network -- generally understood to be the traditional telephone network -- is declining in relative economic value. The value-added components of the intelligent network are the drivers of Internet applications and of Internet commerce. Experience in competitive markets, such as the United States, the UK, Finland, and others suggests that telecommunications service competition increasingly centers on the provision of evermore creative and diverse capacities in this segment of telecoms networks. This competition is sharpening as technological convergence increases, making possible intermodal provision of such capabilities by cable television networks, fixed and mobile wireless systems, and new generation satellites. Users are no longer tethered to traditionally defined telecommunications networks for provision of these Internet-enabling capabilities. Consequently, the competitive deployment of those technologies and capabilities should be a primary focus for trade policy analysts as the growth of electronic commerce will require such facilities, even in developing economies.

Potential Trade Distorting Effects of Internal Subsidization of Basic Service Rates

A perennial problem for competitive telecoms services is the historic cross-subsidization of local exchange rates from long-distance or international service revenues. Because Internet users generally access the Net through dial-up local access, policy makers must address the distortion effects of below-cost local rates for this access service. Where service rates do not reflect actual costs, then e-commerce service providers may choose uneconomic routes to market. Such below cost rates may send false pricing signals to users who, in turn, develop usage patterns and service applications tied to the assumption that those pricing arrangements will be available over time. Such assumptions may cause users to resist competitive offerings of comparable services that cannot benefit from the lower access charges achieved through uneconomic subsidization. The WTO agreement over basic telecoms services calls for a end to such subsidization. However, we are investigating the possibility that such below-cost pricing might also be deemed a trade barrier to electronic commerce.

The use of flat rate pricing to provide inexpensive access to Internet services presents an intriguing and challenging case. In countries where dial-up Internet access is available under a flat-rate structure, users often access ISPs at below-cost prices. Any new network entering those markets will be compelled to provide Internet access at prices dictated by flat rate that is likely to be below-cost. Presumably, the new network operators, with very small market share, would be unable to engage in cross-service subsidization and would experience negative economic effects from this competition. However, for the providers of Internet-based services, uneconomic user access may be relatively less consequential than to providers of telecoms services as their revenue flows from the sale of services and goods reached through the Internet rather than from the sale of the access service that is the source of revenue for the network provider. In fact, the absence of flat-rate access in a given national market, whether uneconomically priced or not, may constitute a substantial market depressant to Internet activity and, in turn, may be seen as having trade barrier effects on electronic commerce.

Case in Point: The Eastern Caribbean Nations

Nations that restrict diversification of communications infrastructure that is the critical gateway to global electronic commerce stand to lose ground in view of the unforgiving pace of economic activity in information economies. Whether subject to the WTO agreement or not, those countries must respond to the rapid shift of commercial activities to Internet-based applications.

The Eastern Caribbean states provide an instructive example of a region that stands to gain substantial and economically critical advantages through deployment of advanced information services. The introduction of competition in the telecommunications sector has been made a public policy priority for economic development. During the past year, the governments in the region have begun to re-visit (and in some instances breach) the monopoly regime that is now in place. Communications ministers of the Organization of Eastern Caribbean States announced this past October their intention to terminate the current monopoly arrangements by June of this year. In addition, several of these countries are bound by the WTO Agreement on Basic Telecommunications Service that requires opening markets to competition and implementing sectoral regulation. Consequently, the regional governments are broadly committed to phasing out sectoral monopoly in telecoms and to opening their markets to competition in voice and data services.

In the context of the Caribbean islands, the tourism and travel, information service, and financial service sectors are all critical to economic development in the region. Those sectors all require advanced telecoms capacity and services that are best provided in a competitive telecoms market. Telecommunications services in this region have historically been provided under monopoly arrangements. However, these arrangements have failed, by in large, to provide network capabilities adequate to support the information-intensive applications required in other sectors. Moreover, services rates charged by telecom monopolies across the Caribbean have been among the highest in the world, depressing usage and development of innovative services. With the decline in agricultural sector now being experienced by these countries, state-of-the-art information services are viewed the region's governments as necessary to economic survival. In a high-cost monopolistic environment, those services will not develop to the degree required to support expanding economic growth.

The Caribbean islands are characterized by several advantages that would support electronic commerce. They have an English-speaking population with a 98% literacy rate, one of the highest in the world. They are in close proximity to the United States and are major trading partners with Canada, the UK, and other parts of Europe. As an example, Barbados has made available a number of business incentives for the information technology services industry including, a special tax rate of 2 1/2% on net profits, full exemption from import duties on production-related equipment such as computers, full and unrestricted repatriation of capital, profits and dividends, and reimbursement of a maximum of 75% of wages paid to trainees during the first two years of operation. In addition, Barbados and other Caribbean states have successfully established a reputation as international financial services centers. Off shore banking, exempt insurance companies, foreign sales corporations and trust companies are all part of a network of services that enjoy very favorable legislation and tax climates.

However, the full trade stimulative effects of these policies will not be realized without full competition in the telecoms and information services that financial services require. A core consideration for all of these countries will be the degree to which all or most services may be opened to competition regardless of the terms of their offers. To the degree that priority may be given to infrastructure needed to stimulate economic activity rather than to concerns over increased teledensity and low basic service rates, competitive provision in all service segments is likely to dictate policy approaches to the terms and conditions of liberalization. In turn, the ability of theses nations to benefit from rapidly expanding electronic trade will depend on their removal of the incubus of monopoly telecoms structures.

The Chinese have a saying, "may you live in interesting times." Today, we are in a time of economic changes that are transcending geographic limitations made possible by more available and affordable communication and information technologies. The celebrated "death of distance" made possible by the Internet will only produce its full economic impact when trade constraining effect of monopoly telecoms structures are removing from all markets.

Return to Top View Full-screen

Internet Coverage in Developing Countries of Asia

Geoff Long

Ph.D Candidate, Singapore

ABSTRACT

In an effort to provide a clear picture of what is happening in the Asia Pacific region in terms of Internet conditions, the International Development Research Centre (IDRC) with financial backing from the Singapore government through its Singapore ONE initiative, recently compiled a report known as the PAN Asia Networking Yearbook. The report gives detailed information on areas such as Internet infrastructure, regulatory environment, and content initiatives for 22 countries in the Asia Pacific region, stretching from Pakistan/Nepal/India at one end through to Papua New Guinea, Australia and New Zealand at the other. It incorporates information on many of the countries that seldom figure in market research or media reports. This paper provides an overview of these conditions for many of the countries mentioned in the PAN Yearbook as well as an overview of the PAN Asia Networking program, which has successfully partnered with local organisations to create Internet infrastructure and local content in some of the least developed countries of Asia.

View Full Text

Internet Coverage in Developing Countries of Asia

I. INTRODUCTION

The media in the past year has had a steady stream of articles about the spread of Internet in Asia. The topics swing wildly from Asia apparently lagging behind in Internet take-up to the region's ability to leapfrog technology stages. But what most of the coverage ignores is that what is true for one country in Asia is most certainly not true for the next country. Whether it's the take-up of Internet by the population, the regulatory approach of the government, the number of ISPs or web hosts, or approaches to providing infrastructure, the only constant is that every country does it differently and is at a different stage of development. To give a shapshot of the situation take these few examples: In Singapore, one of the most "wired" countries in the region, there are only 3 ISPs as per government policy. Across the waters in the Philippines there is a more relaxed approach to regulation that has spawned some 145 ISPs and countless walk-in access centres. In war-torn Cambodia the government is so far happy with the two ISPs that are offering a full range of Internet services and has no plans to censor content, but over the border in Vietnam the authorities have implemented a firewall that intentionally blocks access to selected sites and unintentionally has caused numerous others to become unavailable through technical problems. Further to the North, Laos has so far been unwilling to allow its citizens to access the web and has implemented an e-mail-only connection. Up in the Himalayas, Nepal has a burgeoning Internet industry and some interesting local content programs, however near-neighbour Bhutan is one of the few destinations in the world still without any Internet access. In Mongolia, the locals are using their high-levels of literacy and technical education to create an innovative network using whatever means possible – satellite, xDSL modems, radio modem and some creative fund-raising schemes. The list goes on throughout the region. Even in more focussed research reports the generalisations about Asia and the lack of any information on countries that don't fit the description of "market opportunities" is a familiar feature.

In an effort to provide a clear picture of what is happening in the Asia Pacific region in terms of Internet conditions, the International Development Research Centre (IDRC) with a financial contribution from the Singapore government through its Singapore ONE initiative, recently compiled a report known as the PAN Asia Networking Yearbook. The report gives detailed information on areas such as Internet infrastructure, regulatory environment, and content initiatives for 22 countries in the Asia Pacific region, stretching from Pakistan/Nepal/India at one end through to Papua New Guinea, Australia and New Zealand at the other. It incorporates information on many of the countries that seldom figure in market research or media reports. The yearbook is a component of IDRC's PAN Asia Networking (PAN) program, which has itself been successful in helping some of the least developed countries in Asia connect to the Internet. In countries such as Mongolia, Cambodia, Vietnam, Bangladesh, Sri Lanka, and Laos, for example, some of the earliest, in many cases only, Internet infrastructure has been through co-operative agreements between local organisations and PAN.

This paper then will attempt to provide an overview of conditions for many of the countries mentioned as well as information on the yearbook itself. It will also present information on the PAN Asia Networking program and how it has been able to partner with local organisations to create Internet infrastructure in a number of different countries.

II. A BRIEF OVERVIEW OF PAN A

At this point, it may be useful to give some background information on PAN. The PAN Asia Networking is a program implemented by Canada's International Development Research Centre (IDRC), a non-profit organisation that helps researchers and communities in developing countries. Specifically, PAN aims to promote the development of communications infrastructure in the least developing countries of Asia by seed-funding existing organisations involved in networking. The program has already been instrumental in setting up Internet services with local partners in Mongolia, Sri Lanka, Laos, Vietnam, and Bangladesh. Where infrastructure exists, a second stage of the program assists local information providers to put their content on the Internet with the goal of sharing it with other development and research organisations. PAN information servers have been set up in the Philippines, Nepal, Vietnam, and Papua New Guinea. In another aspect of the program, PAN is helping many other Asian organisations to put their content on the Internet using the PAN main server, which is located at IDRC's regional office in Singapore, and it has a significant research and development program that gives grants to Asian R&D organisations with suitable research topics.

The four stated aims of Pan Asia are as follows:

- E-mail and Internet access through telecommunications connectivity
- Content building and dissemination through websites
- Access, communication, linking, sharing and exchange through networking
- Development of Internet policies, technologies and systems through applied research

III. MONGOLIA - - THE PILOT

Mongolia was the first initiative of PAN's Asian networking program and was used, among other things, as a pilot to assess how assistance might also be offered to other developing countries in the region. By all accounts, the three-year project was a success, with Mongolia firmly established within the global Internet community. The country now has full Internet access and is working on providing unique local content to users within and outside the country.

Mongolia was chosen as the pilot for a number of reasons: Having only recently made the transition to a market economy, it was in urgent need of information from the rest of the world and ready to reforge links with neighbouring countries. Datacom, then the only domestic provider of data communications services, also had a team that could undertake the demanding technical requirements needed to become an Internet provider. And as a remote country without Internet access, it offered a chance to study the technical challenges that would be applicable to other countries in the region.

With an initial grant from IDRC, Datacom was able to purchase the necessary capital equipment, hire consultants, and plan research activities and training programs. This led, in late 1994, to the installation of a dial-up gateway system based on UUCP protocols that connected its domestic network to the Internet. The system was compatible with Internet e-mail and newsgroups, and initially these were transferred twice weekly by connecting to the Institute of Global Communications (IGC) in the US.

Successful completion of this first phase of the project attracted further support from groups such as the US National Science Foundation (NSF) and the Soros Foundation.

Satellite communications equipment from ComStream was installed in late 1995, along with a Sun Netra server and Sun workstation to host Web, FTP, and Gopher servers, culminating in the opening ceremony for the country's first permanent Internet connection in January 1996 and a Mongolian web site in March of the same year.

As a mark of the success of the project, PAN was able to hold its first All Partners Networking Conference in Mongolia in June 1997, showcasing the high standard of the country's Internet personnel and services in the process.

The initial infrastructure also allows other projects and groups to expand the existing Internet coverage. For example there is now a well functioning public access centre in Ulaan Bataar thanks to funding from the Soros foundation. In other projects for the coming year, Datacom is planning to expand the reach of Internet in Mongolia by creating a wireless metropolitan area network (MAN) in Ulaanbaatar and using VSAT technology to extend the service into other centres. The wireless MAN project connects four central sites through 2 Mbps radio modem links, which in turn serve remote routers that can service up to 200 remote sites. The network covers 80 per cent of Ulaanbaatar territory.

At present, many Mongolian provinces are connected to the capital via analogue microwave links, which are not reliable for Internet data transmissions. As a result, Datacom has teamed up with the Mongolian Oil Import Company to piggyback Internet services onto its VSAT network. It will extend to the centres of 18 provinces and some other settled areas. The network is reliable but the speed is slow, which will mean that e-mail only services will be introduced. However, in each province there will be mirror sites that will contain web pages from Ulaanbaatar that are updated in the evenings when the VSAT channels are not used.

The Mongolian UNDP office also has a number of IT initiatives which focus on Internet. One of the most significant is the establishment of a government-wide MAN/WAN to give information access to the government sector. The network uses DSL modems that can provide access at speeds up to 2Mbps for sites up to 3km apart. Most of the infrastructure is in place and users include Government House, the Statistics Office, the Supreme Court and the Board of Foreign Investment, with the Standardisation Agency, Ministry of Defence and the Ministry of External Relations to follow.

IV. SETTING UP INFORMATION SERVER -- THE PHILIPPINE EXAMPLE

The Philippines is notable for its open market approach to Internet services. The number of organisations providing Internet access in the Philippines has increased markedly in the past 18 months By May 1998 there were more than 145 ISPs, most located in Metro Manila but many with local dial-up access in regional towns throughout the country. Only about 15 ISPs had their own international leased line to provide direct access to the Internet -- most to the United States, but also to Hong Kong, Singapore, and Australia -- with the remainder using the larger providers to obtain access to overseas Internet sites.

In line with the flourishing interest in Internet has been a number of related initiatives, including: the formation of the country's first formal Internet association as well as an electronic commerce association and a local chapter of ISOC; a growing number of walk-in Internet centres that allow relatively cheap, casual access; the formation of a Philippines Internet Exchange for connecting local ISPs; and plans to connect 5000 schools across the country as well as another to encourage all government agencies to put their information on the Web.

With a well established Internet community already existing, there was no perceived need for PAN to fund further infrastructure. However, there was considerable scope for the funding of local content initiatives. PAN Information Networking and Services Philippines (PINS Philippines) is a five-year project that will allow local organisations involved in social and development issues to put their resources on-line and exchange information with others in the region. The PINS Philippines server will be one of a number of regional information nodes containing unique content that is combined within the Pan Asia framework.

The initial PINS Philippines content partners are Approtech Asia, Philippines Business for Social Progress (PBSP), Micro Impacts of Macroeconomic Adjustment Policies (MIMAP), the Corporate Network for Disaster Response (CNDR), and the APEC Senior Women Leader Network. Technical assistance is provided by the Philippines Department of Science and Technology's Philippine Council for Health Research and Development (DOST-PCHRD), which is jointly leading the project with Approtech Asia.

While each of the content partners involved has a distinctive area of expertise, they also have some essential common elements, in that each group is a Philippines-based NGO with partners in other Asian countries; promotes the objectives of sustainable and equitable development; and has access to the necessary communications infrastructure and trained personnel.

Each of the PINS members will provide a key component of what is hoped will be an "information village" on social development, using the Internet and the World Wide Web as the means to exchange the information with others, both in the Philippines and regional partners in Asia and the rest of the world.

The first year of the PINS Philippines project, 1996, involved strengthening the technology base of Approtech Asia and selecting the other content providers. Now in the second year, PINS Philippines members have already undergone training in HTML and the other technical formats that are necessary to create a presence on the World Wide Web. Each organisation already has the equivalent of an electronic brochure on the web and is now preparing the specialised information that will form the basis of the site.

In terms of content, each of the organisations has a unique angle. Approtech Asia is a regional network of institutions and individuals in eleven countries whose goal is the promotion and transfer of appropriate technology for the benefit of poor rural communities in the region. Philippine Business for Social Progress (PBSP), an organisation with more than 25 years experience in development work, promotes the concept of "corporate citizenship" by the business community in the Philippines and the Asia-Pacific. Micro Impacts of Macroeconomic Adjustment Policies (MIMAP), another IDRC-funded project, has developed models for determining the impact of macro economic policies on different sections of the population, which it hopes to share with similar organisations in the region. While the Corporate Network for Disaster Response, formed in 1990 as a response to the Baguio earthquake, will bring with it hard-earned research and experience in disaster prevention and management.

Through the project funding, Approtech Asia has hired an information network manager who will lead the way in content development and, in conjunction with DOST-PCHRD, provide support and training to relevant people in the other organisations. Each of the partners already has people in place to handle the different tasks associated with publishing online, including creative, content, and technical personnel. The project grant also provided funds for a Sun Netra server, to be managed by DOST-PCHRD, that will host the PINS-Philippine web site, while DOST-PCHRD will provide free dial-up access to the Internet for each of the content partners.

V. VIETNAM -- A LATERCOMER TO THE NET

Despite Vietnam being a relative latecomer to the Internet – the government only allowed a full connection in late 1997 – the ISP NetNam has had a long association with the Internet through various research and development activities. Many of its pioneering staff have been experimenting with Internet in Vietnam since as far back as 1991, when the Institute of Information Technology (IOIT) trialed a dial-up connection with the University of Karlsruhe in Germany. The experiment was hampered by high access costs of between US$4-5 and bad lines, which prevented much of the data from getting through. Nevertheless, it provided a taste of the Internet and encouraged them to experiment further.

In early 1993 they met with researchers at the Australian National University (ANU), who were willing to provide a grant through an Australia-Vietnam research cooperation scheme. They used this to setup another link, which utilised software called Kermit to establish a server to server e-mail connection. They later moved to a UUCP connection that allowed them to setup VARENET – the Vietnam Academic, Research, and Education Network. However, after one-year the grant ran out and Vietnam's Internet connection again went quiet.

In 1994 NetNam was created to fill the void. With later assistance through PAN, the team was able to build its networking capacity and serve as the only real option for Internet mail services for NGOs and other organisations. Up until November 1997 NetNam used a UUCP connection to ANU in Australia to provide Internet mail to its predominantly NGO, academic and research clients. It also had a local BBS service that contained a number of file libraries and locally-oriented material. So when the government finally allowed for full Internet access in late 1997, NetNam was well-prepared and is today one of the most established players of the four companies that are permitted to provide Internet commercially.

In the future, NetNam plans to continue to serve grassroots communities in Vietnam but will be able to improve its infrastructure and recoup costs by providing more commercially oriented services as well as services to its traditional user base of NGOs, academic and research organisations.

In Vietnam PAN is providing both assistance to NetNam to boost its infrastructure and at the same time funding local information services along the lines of the Philippines model. A significant problem in presenting local information on the World Wide Web is the lack of a unified coding standard for the Vietnamese character set. To counter this, one of the first tasks NetNam undertook when it received a grant from PAN was to design a utility that would recognise the various codes that were in use to display Vietnamese text. Now, when NetNam users view Vietnamese web pages they generally don't have to worry about incompatible formats, as the utility can detect the six most common formats (out of about 10) that are in use.

One of the longest standing content efforts has been undertaken by the National Centre for Scientific and Technological Information and Documentation (NACESTID). As a major partner in the PAN project, NACESTID staff have been working in close collaboration with their counterparts at NetNam and the Institute of Information Technology. An important step has been a common approach to designing their network structure so that its network, known as VISTA (Vietnam Information for Science and Technology Advance), can easily share information with NetNam and another IOIT-run network, VARENet (Vietnam Academic, Research and Education Network).

Their aim is to create one huge databank on science and technology that consists of many databases. They then hope to serve small enterprises with the information and promote the competitiveness of the enterprises. NACESTID's databases include such information as R&D reports, science and technology conference papers, information from forums and workshops, dissertations, information on indigenous technology, and equipment catalogues and procedures. They are also a coordinating centre, or focal point, for an ASEAN databank on technology as well as for the Asian Science and Technology Network, another ASEAN project. All of the databases have been created from within NACESTID, which is renowned as one of the richest content sources in Vietnam for science and technology information. Its print library alone boasts some 400,000 books and 1400 periodicals.

Information that can already be viewed through a standard web browser on VISTA includes a weekly electronic bulletin covering science, technology, environment, and economics; a bi-weekly e-bulletin of international news condensed from print periodicals; a bi-weekly bulletin on environmental and sustainable development; a bi-weekly newsletter on development strategies for decision makers; an ASTNET newsletter; and an occasional bulletin that covers rural development.

In Vietnam a majority of the population live outside urban areas. For this reason, making the information available on the Internet is only the first step. Each province has a network centre that is able to access the information. It is then photocopied and distributed to as many districts as possible and made available through traditional means, such as noticeboards. The provincial centres can also add some local information to the bulletins before they are distributed.

NACESTID's own dial-up network connects information centres in 61 provinces and has its own 64kbps connection to Vietnam's Internet backbone. Its main centre in Hanoi has a staff of 170 people and more than 70 workstations on the network. The organisation itself plans to become a non-profit Internet service provider later this year in an effort to better serve clients such as universities and research organisations. Other forthcoming projects include a NACESTID-developed search engine and multimedia titles from a newly-formed multimedia unit.

VI. CONCLUSION

The above case studies are only a small sample of some of the projects that are happening in the region. However, as the sample suggests it is impossible to generalise on what is happening in the Internet in Asia. While the examples outlined are intended to show how PAN is promoting Internet initiatives in some of the least developed countries of Asia, the PAN Asia Networking Yearbook gives a clear picture of all Internet infrastructure, regulatory environments, and various developments in detail for the 22 countries.

For information on the PAN Yearbook and other projects, go to www.panasia.org.sg

Return to Top View Full-screen

Internet Growth, Economic Development and Political Change in

Malaysia, China and Singapore

Joshua Gordon and Meheroo Jussawalla

University of Hawaii at Manoa, U.S.A

ABSTRACT

This paper explores several of the factors driving governments to embrace Internet technologies in China, Malayasia and Singapore: an exploding number of users, the enormous profit potential of electronic commerce, and a growing consensus that Internet and Information Technologies (IT) will be crucial to future competitiveness. We examine the changing nature of Internet censorship in China, Malaysia and Singapore, and conclude by analyzing how the Internet will continue to impact political development in these countries.

View Full Text

Internet Growth, Economic Development and Political Change in

Malaysia, China and Singapore

I. INTRODUCTION

Exploding demand for the Internet is rapidly leading to the convergence of technologies in the information industry. Traffic volume is growing at a dizzying pace as suppliers from all channels frantically try to capture a healthy slice of this dynamic and rapidly evolving market.

Today, the Internet is not just for e-mail or exploring the World Wide Web. It is also a conduit for phone calls, faxes, and video. As its popularity grows, users often find themselves stranded in cyberspace because TCP/IP applications lack the intelligence to specify bandwidth demand. The situation can be especially burdensome in developing countries seeking to rapidly evolve their Internet infrastructure such as China, which aims to connect 1,000 universities to the Internet in a project reminiscent of the earlier NSFNET in the United States.

As noted in the Clinton Administration's policy paper *A Framework for Global Electronic Commerce*, e-commerce holds tremendous potential for international business between large and small companies and between developed and developing countries. Indeed, the Internet is already linking global buyers with Asian suppliers. The Asian Sources web site, for example, helps level the playing field for small Asian manufacturers who are not able to effectively canvass potential buyers from abroad on their own.

This paper explores several of the factors driving governments to embrace Internet technologies in China, Malaysia and Singapore: an exploding number of users, the enormous profit potential of electronic commerce, and a growing consensus that Internet and Information Technologies (IT) will be crucial to future competitiveness. We examine the changing nature of Internet censorship in China, Malaysia and Singapore, and conclude by analyzing how the Internet will continue to impact political development in these countries.

II. FROM REGULATION ...

When East and Southeast Asians first began logging onto the Internet in large numbers, most governments in the region reacted with dismay. At a 1996 meeting of the Association of Southeast Asian Nations (ASEAN), it was agreed that means must be quickly found to combat the "perils" posed by "this dynamic and boundless medium" that threatened to undermine member nations' traditionally tight media restrictions.

Several East and Southeast Asian governments translated these fears into action by putting in place nationwide Internet controls. In September 1996, Singapore announced bans on all Internet material that might "excite disaffection against the government" or that dealt with so-called "perversions" such as homosexuality. To ensure the new laws were followed, Singapore instructed the country's Internet Service Providers (ISPs) to install proxy servers that automatically filtered Internet content.

At the same time, China's telecommunications minister announced that "by linking with the Internet, we do not mean the absolute freedom of information." In a campaign against "spiritual pollution," China ordered all Internet traffic to flow through government-controlled "choke points" where content could be carefully monitored and edited by state censors. As a result, Chinese net-surfers were denied access to dozens of Internet sites including CNN, The Washington Post, Playboy, Amnesty International and various Taiwan newspapers.

Malaysia's Information Minister indicated that his government was also considering laws to sieve out "pornography and other nonsense" on the Net. Vietnam refused to allow public access to the Internet altogether. Myanmar took the extreme step of declaring mandatory prison terms of up to 15 years for anyone caught in the unauthorized possession of a networkable computer.

III. ...TO EXPLOITATION

Yet the view of many Asian governments of the Internet as what the *South China Morning Post* called "a polluting influence, full of Western decadent values" has been increasingly tempered with the realization that Internet technologies could well form the basis for future economic growth.

"With our future at stake we cannot afford to be a mere spectator of the information revolution," said Malaysian Prime Minister Mahathir Mohamad. "We need to be a part of it; we need to lead it even." Malaysia's Vision 2020 and Singapore's IT 2000 plans spelled out those countries' intentions to promulgate

Internet use even while seeking to control it.

But as governments in the region rush to embrace Internet technologies, enthusiasm for controlling content seems to be waning. Even in China, Peng Hwa Ang of Singapore's Nanyang Technical University notes that authorities "have retrenched from an apparently hardened attitude to censorship." As a *Time Magazine* Beijing correspondent reports:

> *"From dinner parties hosted by top officials at the Great Hall of the People to bull sessions among young technocrat planners over cold Snowflake Beer in the cafes of Sanlitun, the conversation has shifted from how to control the Net to how best to exploit it."*

Although Chinese authorities continue to monitor their citizens' use of the Internet, fewer sites are now actively blocked. Singapore, for its part, has chosen not to enforce many of its bans against Internet content.

Malaysia's former Deputy Prime Minister Anwar Ibrahim once publicly worried that the "information explosion" brought by the Internet "makes it easier to subvert the system, to obfuscate, to mis-inform, to disinform." Yet even before his abrupt dismissal Anwar dismissed the notion of direct government censorship of the Internet as an "obsolete game in the context of technological change." Today, Anwar's supporters rely on the Internet -- and on the Malaysian government's assurance that the medium will not be censored -- to get their message out and to coordinate protest activities across the country.

What is driving this change in attitude towards controlling the Internet?

IV. THE ASIAN INTERNET JUGGERNAUT

Perhaps one factor is the widespread realization that, as Singapore's Senior Minister Lee Kuan Yew recently said, "new media technology is here to stay and will become more all-embracing with time." Despite threats of censorship, the number of Internet users in the Asia/Pacific began skyrocketing in the mid-1990s and has continued to zoom upwards despite regional economic difficulties. "On the user side, we've seen nothing but a boom in usage," said Randy Salim, Yahoo's director of international business-development and sales. "The number of people coming online from Asia hasn't changed."

In fact, the numbers are expected to continue advancing rapidly. The International

Data Corporation predicts that Internet users in the Asia/Pacific will reach 35.3 million by 2002, up from 12.2 million in 1998. The China Internet Network Information Center recently announced that the number of mainland Chinese Internet users rose by 64 percent between January and July 1998 to nearly 1.2 million. IDC estimates that 9.4 million Chinese will be surfing the Web in 2002, giving the Middle Kingdom the most Netizens in the Asia/Pacific region outside Japan. In Hong Kong, the Internet user base doubled in 1997. Currently, 500,000 people, or 8 percent of the city's population, are online in Hong Kong.

According to a survey by Singapore's National Computer Board, fully one third of all Singaporeans have already gone online. IDC puts current Internet users in Singapore at 250,000. Despite economic uncertainties, Singapore officials hope to be able to offer Internet access to every one of the island-state's 800,000 households by the end of 1998 through the Singapore ONE project. Partly as a result, IDC foresees Singapore Net users climbing to 1.5 million by 2001. IDC predicts strong growth in Internet users in Malaysia as well, going from current levels of 250,000 to 2.2 million by 2001.

With such large amounts of users coming online and Internet traffic increasing exponentially, the ability of state censors to monitor content is becoming increasingly impaired. Ang notes that by 1993, Singapore censors were already faced with a 400% increase in content requiring censorship from the previous decade. According to industry workers in Singapore, the effective vetting of electronic material is becoming especially difficult as the number of Internet sites skyrocket.

V. ELECTRONIC COMMERCE: THE RISKS AND THE REWARDS

Electronic commerce's enormous profit potential no doubt plays a major role in bolstering government enthusiasm for the Internet in Malaysia, Singapore, and China.

Revenue from Internet commerce may reach $3.2 trillion worldwide in 2003, according to high-tech consultancy Forrester Research. International Data Consulting predicts that e-commerce revenues in the Asia-Pacific (excluding Japan) will go from US$146 million in 1997 to US$683 million in 1998 and will reach US$15.4 billion in 2002. At current rates of development, IDC estimates that Malaysia will make approximately US$1 billion in revenue from e-commerce in 2001. At that time, Singapore is expected to generate well over US$800 million.

Governments of these countries are actively seeking ways to meet or exceed these estimates. Twice a year, Singapore's National Computer Board (NCB) organizes an "e-sale" by Singaporean companies to encourage shopping over the Internet. Last November, the Singapore government announced it would provide US$5.54 million in funding for local businesses seeking to exploit e-commerce.

Hoping to lay the groundwork for rapid growth in the field, new laws governing electronic commerce are debuting in both Malaysia and Singapore. In June, Singapore unveiled its Electronic Transactions bill. "The idea is to enable businesses to create new ways of doing electronic business," said Singaporean Charles Lim, senior state counsel and director of the government-owned Computer Information Systems Department. Sponsored by the island-state's National Computer Board, Southeast Asia's first certification authority, Netrust, will contribute to Singapore's development as a hub for e-commerce by ensuring the security of Internet commercial transactions including finance applications, cyber-shopping and e-mail.

Malaysia's current efforts to develop a National Strategic Action Plan and position paper on e-commerce follows a similar rationale. Malaysia's position paper is scheduled to be released in time for the November APEC meeting in Kuala Lumpur, and aims to find ways to develop "local capability to exploit e-commerce for national competitiveness."

VI. Exploring the Link Between Censorship and Competitiveness

To what extent government censorship of the Internet will effect competitiveness in the coming cyber-economy is a topic of much debate -- although officials in China, Singapore and Malaysia are highly cognizant of there being a relationship of some kind. According to Peng Hwa Ang, Singapore regulators have been aware of the need for the free flow of information on the Internet in order to retain competitiveness for some time. Writing in 1995 as Singapore was codifying its rules for censoring the Internet, Ang noted that:

> *"The Singapore authorities have drawn a distinction between information for business uses, which should be as free flowing as possible, and information for non-business uses. Information for the home is seen to be of a less critical nature so censorship of such information is regarded to have not as deleterious an effect."*

Unfortunately for Singapore authorities, this distinction proved to be extremely difficult to make, as well as difficult to justify. Tommi Chen, managing director of NetCentre Pte in Singapore, noted that even if Net censorship is not aimed at businesses, "the lingering side effects of negative public relations stemming from Internet censorship cannot be taken lightly."

In Malaysia, Singapore's censorship laws are seen as a major flaw in the island-state's competitiveness in the IT industry. As a result, Malaysia's Multimedia Super Corridor (MSC) project was developed with a "Bill of Guarantees" for foreign and local investors -- chief among which being a promise of no censorship of the Internet within the project area.

"No censorship is a selling point, almost like a marketing gimmick," said Michael Lim, a young executive for Borderless Marketing at the Multimedia Development Corporation, the quasi-governmental organization tasked with creating the MSC. "Net-savvy people strongly prefer no censorship," said Lim. "Even though there is no direct Internet censorship in Malaysia, we see guaranteeing that their preferences are respected as giving us a competitive advantage over Singapore and other projects like ours in the region. After all, we are competing to be the next Silicon Valley!"

Such sentiments are not lost on officials in the island-state. Coinciding with the September launch of the Singapore Electronic Commerce Masterplan, the Singapore Broadcasting Authority publicly hailed a suggestion to transfer much of the responsibility for monitoring content away from government. "Industry self-regulation" should be paramount, declared the Broadcasting Authority, while the government would practice a "light-touch policy" to policing the Net.

China's secretary-general of the State Science and Technology Commission, Lin Quan, recently indicated that government censorship of the Internet would not be allowed to stop the growth of Net use. In early 1998, Chinese authorities liberalized regulations governing the flow of the information in a move that effectively quadrupled the bandwidth available to the outside world. "The government is betting that PCs and the Net can help competitiveness," said Thomas Lin, a Beijing-based product manager for Microsoft. "Now they want them on every desk."

VII. INVESTMENT IN IT: A STATE LED WAY OUT ECONOMIC CRISIS?

Government investments in Internet infrastructure and education in the region have surged in tandem with the growing recognition of the Internet's potential value.

Malaysia's Multimedia Super Corridor (MSC) project aims to pave the way for a the country's transition to a knowledge-based society by the year 2020. Located in a 15 by 50 kilometer corridor south of Kuala Lumpur, the MSC will boast a state-of-the art IT infrastructure as well as progressive "cyberlaws" designed especially to lure software, multimedia and hi-tech firms. "The world's software products and services industry is worth some US$300 billion," said the executive director of the MSC project, Dr. Othman Yeop Abdullah. "We are aiming for a piece of this pie."

While private companies are expected to shoulder much of the construction costs, the Malaysian government is also springing for a fair portion of the estimated US$40 billion price tag. If all goes as planned, the MSC will serve as a role model for the rest of Malaysia by exploiting IT to change the way Malaysians shop, communicate, and interact with the government. Cyberjaya, at the heart of the MSC, is the first of twelve so-called "smart cities" that will feature a paperless government and even a "Cybercourt of Justice," according to Malaysian Prime Minister Mahathir Mohamad. Cyberjaya will soon be joined by Putrajaya, another "smart city" and the future seat of Malaysia's federal government.

The Singapore ONE project, aimed to be completed by the end of 1998, will provide residents of the island-state with the world's first nationwide broadband network. Singapore ONE ("One Network for Everyone") users will be able to shop electronically using a smartcard, order movies-on-demand, browse the Internet, attend classes, bank, and obtain library material from home.

When Unicom was established as the first competitor in the telephone sector of China, the company was entrusted with China's Golden Projects. These are: the Golden Bridge, a national data network to disseminate information to all regions of the country; the Golden Card clearance system for credit card users; and the Golden Customs for computerized customs services at sea- and airports. These three are China's version of the National Information Superhighway and form the foundation of the China program for linking its universities with Internet facilities.

Rather than retreating from such high-priced ventures in the wake of regional financial crisis, both Malaysia and Singapore have targeted IT development -- and particularly Internet capability development -- as prime sectors for additional state-led funding aimed at pumping money back into their suffering economies.

In addition to its recent decision to provide US$5.54 million (S$9 million) to local businesses to utilize e-commerce, Singapore's government announced a grant worth US$18 million (S$30 million) last July to fund Internet research "as part of a wider plan to boost the electronics industry and ward off recession." Given to Kent Ridge Development Labs, the National University of Singapore and Nanyang Technical University, the grant funds the creation of the Singapore Advanced Research and Education Network (SingAREN). The SingAREN project includes the development of distance learning materials, the implementation of strategies to overcome bandwidth limitations in virtual education, and a high speed network linking Singapore's research community with other research and educational institutions around the world.

The Malaysian government targeted information technology industries and the country's Multimedia Super Corridor project for receiving special added funding as part of its National Economic Recovery Plan. In declaring continued state support for the MSC, Malaysian Prime Minister Mahathir Mohamad stressed that his government views information technologies as being critical to Malaysia's future development. "The current economic recession will not affect our plans in terms of MSC development," said Leo Moggie, Malaysia's Minister for Energy, Telecommunications and Posts. "In fact, we will try and accelerate growth in this area as the government sees in the IT and multimedia industry potential for fresh growth and development."

In July 1998, Malaysian officials announced they would spend an additional US$158 million to assume majority control of the company developing Cyberjaya, Cyberview Sdn Bhd, in order "to ensure that the development of Cyberjaya will proceed without hindrance," according to an MDC spokesperson.

Malaysia's recently released National Economic Recovery Plan also stresses the need to develop national software and electronic commerce capabilities. While the Plan urges Malaysia's private sector to be "proactive and effectively involved in e-commerce," Michael Lim of the MDC concedes that "the government must and will lead the way in e-commerce applications in Malaysia, because local businesses are extremely cautious nowadays."

China has also put its money where its mouth is by making a massive investment in IT infrastructure. Beijing is sinking US$28 billion in a fiberoptic network that already interconnects 85% of the country, and is now laying the Sino-US submarine cable at a shared cost of US$1 billion that will operate at an 80 kbps capacity using wide bandwidth technology.

VIII. A SHIFTING BALANCE

As China, Singapore and Malaysia become increasingly invested in the Internet, it appears that market forces that demand the medium be censor-free are winning out over government concerns of objectionable material on the Net.

However, efforts to police the Internet have not been abandoned altogether. Last August, Malaysian officials tracked down and arrested three people in Kuala Lumpur for spread false reports of race riots in the capital via e-mail. In China, Shanghai authorities recently arrested a man for providing 30,000 Chinese e-mail addresses to an Internet democracy magazine edited in the United States. Charged with "inciting the overthrow of state power," Lin Hai, a 30-year-old software engineer, most likely faces up to five years in prison.

Yet cases such as these are few and far between, and point out the unlikelihood of arrest for the 30,000 Chinese that now have the pro-democracy magazine sent to their in-box.

Indeed, the increasingly freer flow of information over the Internet in China, Singapore and Malaysia promises to eventually impact these countries' controls on traditional media. Already, authorities in Singapore and Malaysia are calling for revised broadcast and print censorship laws in light of the increasing use of the Internet as an alternative news source.

"Information technology, particularly the Internet, is rapidly undermining whatever monopoly control of the media governments might have had," admitted Singapore Senior Minister Lee Kuan Yew at a Los Angeles conference on Asian politics and the news media last October. "Governments that try to fight the new technology will lose," said Lee.

Acknowledging that "present advanced technology" made his country's traditional broadcast and information censorship "difficult," Malaysian Information Minister Datuk Mohamed Rahmat urged Malaysians last June to increasingly practice "self-censorship." Speaking of his ministry's campaign to boost public awareness of information technologies and to "eliminate any phobias and negative attitudes towards IT," Mohamed insisted that Malaysia "must take advantage of new technology, and utilize it properly."

If such IT-led trends towards media openness continue, governments in the region may begin to rely more on educating its population so they can choose for themselves what content is worth accessing and creating and what is worth ignoring. Placing such trust in "self-censorship" would indeed spell a radical shift in how the governments of Singapore, Malaysia and China control information -- but it would be a shift that, given the necessities of the information age, would almost certainly be profitable.

For although the "Asian miracle" has been at least temporarily rolled back, the information industry keeps its growth up due to the dynamics of technology. Indeed, technology powers the cost of production in all industries, adhering to the law of increasing returns and Moore's Law -- which holds that the performance of microprocessors will double every 18 months.

Moreover, the telecommunications industry is less affected by the Asian financial crises than other sectors because of the regional currency depreciation's long term deflationary effects.

As the Internet drives the convergence of content and carrier, further areas ripe for tremendous growth are created, such as Internet Protocol Telephony. Throughout the region, electronic business communities are forging ahead offering the potential for telecommunications investment and growth in the Asia/Pacific region.

Return to Top   View Full-screen

Development of Internet Services in India

Yogeshwar Lal Agarwal

HFCL Group International Division, India

ABSTRACT

Internet is a network of networks. It is based on packet switched digital network technology and client server environment seamlessly linking users in different cities and places all over the globe. Internet facilitates individual users, networks and groups by allowing interconnection and access.

In India, the development of Internet Service has been low so far due to low penetration of PCs, low telephone density, inadequate telephone service, high Internet tariff and only a Government monopoly provider of service viz., Videsh Sanchar Nigam Limited (VSNL). However, due to the increase in general awareness of a variety of services available from Internet and entry of private ISPs a faster growth of Internet Services is expected.

View Full Text

DEVELOPMENT OF INTERNET SERVICES IN INDIA

Internet is a network of networks. It is based on packet switched digital network technology and client server environment seamlessly linking users in different cities and places all over the globe. Internet facilitates individual users, networks or groups to communicate with other individual users, networks and groups by allowing interconnection and access.

2.0 The Internet started as an experimental network in the late 60's by the United States Defence Department's Advance Research Project Agency (ARPA) with a four node network connected with 56 KBps circuits. It was found to be so reliable and useful that it gave way to a three tier hierarchical NSFNET. (National Service Foundation Network) in 1985. The backbone connectivity also increased from 56 KBps to T_3 i.e. 45 Mbps. These networks were basically for Research Development and Educational Institutions. However, commercial and general purpose interest in Internet began in early 90's and with the World Wide Web (WWW) technology . Internet became more user friendly and resulted in dramatic increase in usage. The contemporary Internet is a collection of providers that have points of presence (POP) over multiple regions. These service providers connect at Internet Exchange Points or Network Exchange Points (NAPs.) . The Internet , now has over 119 million users and is estimated to cover 152 countries World wide and consisting of,

- 100,000 networks
- 16 million host computers
- Cumulative growth rate of 100%

ITU estimates that by 2002 there will be 30 Internet users per 100 telephone lines world wide compared to 8.6 now.

3.0 In India, the development of Internet Service has been low so far due to low penetration of PCs, low telephone density, inadequate telephone service, high Internet tariff and only a Government monopoly provider of service viz., Videsh Sanchar Nigam Limited (VSNL). However, due to the increase in general awareness of a variety of services available from Internet and entry of private ISPs a faster growth of Internet Services is expected . The Internet has now been identified as a major catalyst for infrastructure development and accordingly a new Internet Service Provider (ISP) policy has been announced allowing entry of private companies as ISPs and also for building a national Internet backbone and gateways, India is likely to witness a boom in Internet Services as elsewhere in the world. Various projections are being given regarding the Internet growth in India in view of increase from 60,000 subscribers in December 1997 to 120,000 subscriber in June 1998 . It is estimated that the number of subscribers will be 300,000 by December 1998 and 3.5 million by the end of ninth plan i.e. March 2002. Even as a conservative estimate, India's Planning Commission has projected that number of subscribers by March 2002 will exceed 1.5 million.Till now worldwide forecasts for Internet growth have proven conservative and the same can be reasonably expected for India in the next three to five years. Table below gives the growth of Internet Service in India and projection till the year 2002.

TABLE - 1 (In thousands)

Year	1995	1996	1997	1998	1999	2000	2001	March 2002
Internet connections.	20	30	60	300	800	1700	3000	3500

INTERNET GROWTH AND PROJECTIONS IN INDIA

4.0 A high powered Information Technology (IT) task force was set up at the instance of India's Prime Minister and in the interim report the task force has suggested a number of steps and removal of obstacles for the growth of Internet service in India. This report has been accepted by the Govt. and some of the major recommendations of the task force with regard to Internet which are under implementation are as follows: -

a. Internet access nodes will be opened by DoT and authorized ISPs at all District Headquarters and local charging areas in India by January, 2000 . As an interim measure, access to nearest Internet access node will be on local call rates. This facility though not to be misused for telephone traffic.
b. For setting up ISP operations by companies, there will be no license fee for first five years and after five years a nominal license fee of one rupee will be charged;
c. Authorized public/government organizations will be allowed to provide International gateway access to Internet users directly. Private ISPs are also allowed to provide such gateways after obtaining clearance;
d. Providing access to Internet through authorized Cable TV shall be permitted to any service provider without additional licensing;
e. Public Tele-Info Centres having multimedia capability, especially ISDN Services, remote data base access, Government and community information systems, market information, desk top video conferencing, tele-info and Internet/Web access services shall be permitted and encouraged by the, Department of Telecom, Private basic service providers, value added service providers on non-exclusive basis;
f. Mega web-sites shall be created on Internet for promoting marketing and encouraging Indian software products and packages under multiple initiatives.

Creation and hosting of web-sites on servers located in India will be encouraged.

g. Computers and Internet shall be made available in every school, polytechnic college, university and public hospital in the country by the year 2003.
h. The Government shall take necessary measures to develop productionize and use in domestic and global markets indigenous technologies in wireless telecommunications to achieve the national objective of rapid low cost expansion of telephone and Internet connectivity in rural and remote areas. Similarly, promotional measures shall be taken to encourage technologies that bring IT and Internet to the masses through the vast network of Cable TV houses. In the latest measures the Government has even permitted ISP operators to set up their own lease lines for subscribers having 64 Kbps or higher requirements rather than having to take them on lease from the basic service operator.

   It was earlier decided by the Govt. that foreign firms can take 49% stake in an Indian ISP company and that port and leased line charges for the ISPs will be fixed as promotional rates which have been proposed almost 50% of the existing rates.

5.0 The Internet set up could be divided into the following: -

Internet Gateway Service: To provide gateways to interconnect national networks and users with global Internet

Internet Connection Service: To interconnect subscribers and users of Internet to Internet.

Internet Information Service: To provide information in the desired format on the Internet.

As Internet is soon to become an indispensable tool for future businesses and vehicle for growth each and all the three above mentioned areas can be chosen as a profitable business.

6.0 BUSINESS APPROACH

The business approach being adopted by ISPs in general is to have a commercial and operational model designed to give reasonable profitability by reducing expenses and increasing revenues. Broadly two approaches are possible i.e. set up service initially in one or two metropolitan towns along with nearby towns having industrial activity and as the traffic picks up provide service in other towns as well. An approach in which expansion is being partly financed by savings from operations . The second approach can be to set up services initially in as many town areas and develop a large base of subscribers . The second approach will require larger investments and the network may not yield savings in first few years of operations .

A few of the main services to be provided by an ISP operator are the following.

World Wide Web: - To be able to access the graphics-oriented global information system accessed by browser such as Netscape Communicator and Microsoft Internet Explorer.

E-Mail: - To have access to Internet Mail services

File Transfer: - To be able to download millions of files from thousands of servers using the Internet File Transfer Protocol (FTP)

Newsgroups: - To access Internet discussion newsgroups for global discussions regarding a wide variety of topics.

7.0 To provide above services the ISPs are offering following type of connectivity: -

a. Dial up Access Service: - Despite the fact that dial-up customers are in general not very profitable but they provide a customer base, complement the network usage if the ISP is a basic service operator as well. Typical services provided to dial up customers are: -

- Modem connection 28.8 Kbps and 33.6 Kbps
- E-mail Account
- News Feed
- Web Space
- Internet Software and Modem.
- Customer Support
- Authentication

b. Dedicated Internet Access Service: - A permanent connection to Internet is required by business customers to provide access to their employees who are connected to a Local Area Network (LAN). These subscribers require additional and value added services as given below and are connected to Point of Presence (POP) to provide them high quality connectivity . Typical services include: -

- Leased Lines 64, 128 or 256 Kbps up to E_1
- Web Hosting
- News Feed
- IP - Address
- E-mail account etc.
- Secure transaction solutions.
- Installation

c. Value Added Services: - To stimulate Internet usage ISPs are planning to provide Value Added Services as given below. Infact, the projected revenue potential of value added services for India like some of the industrialised countries is that they can generate 25-30% of the total revenue of an ISP operator. The services are ,

- Yellow Pages
- Internet market/meeting place
- Provide business specific solutions for industry
- Tourism
- Internet banking (banking, stock-market, financial transfers etc.)
- Distributed education.

These services can position a ISP as an advanced service provider and secondly major future Internet Business will be in the value added market.

8.0 The revenue generation for an ISP will thus be through the following services:

- Customers who want to access the Internet using dial up connection.
- Customers who want access to Internet using a dedicated connection for an organisation.
- Customers who want to host their Home Page on the Internet
- Customers who want to host their Web Pages on the Host Computer which may be placed at their premises or at the ISP. This can give opportunities to ISP to design and authoring the Web. The site visits to Web sites can also be charged by the ISP.
- Subscribers can be provided with hardware and software required for connecting to Internet
- Revenue will be generated from training conducted on Internet for the customer.

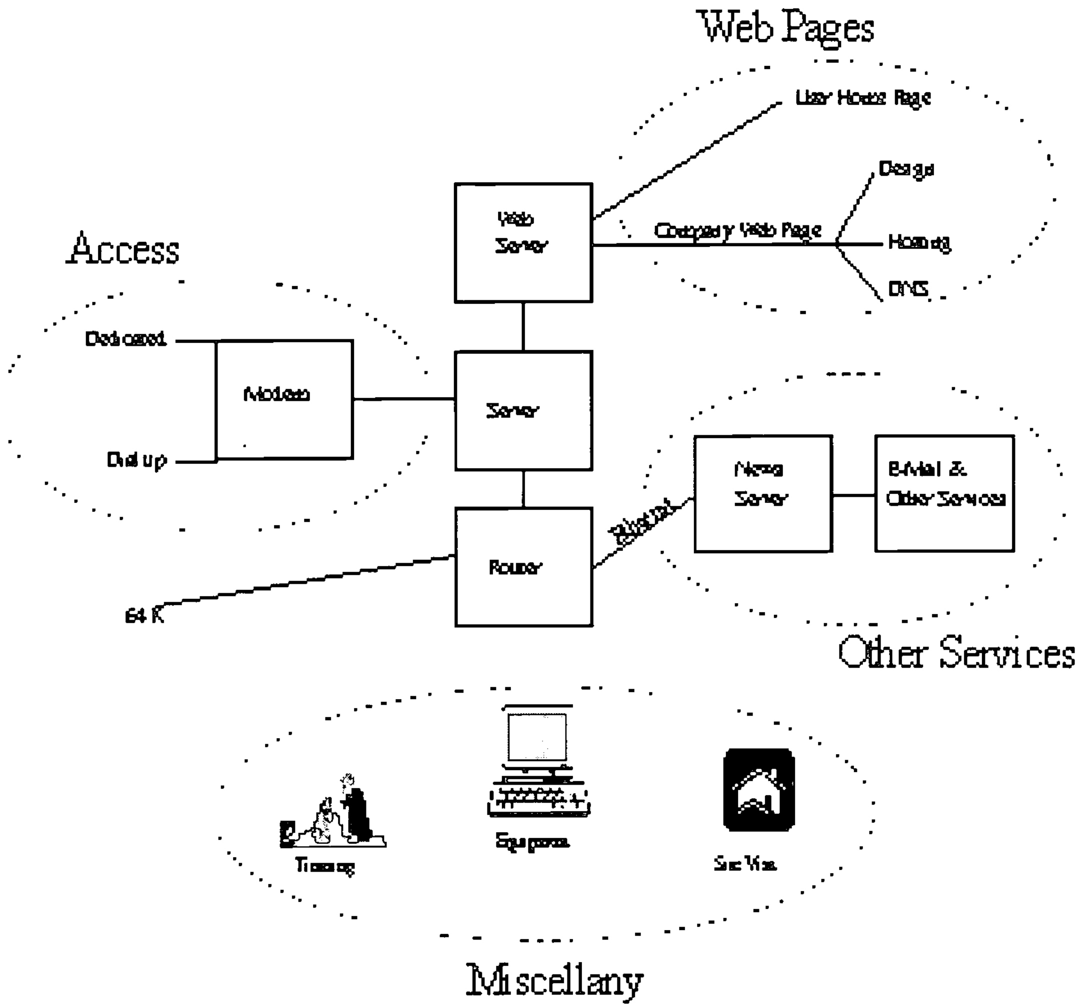
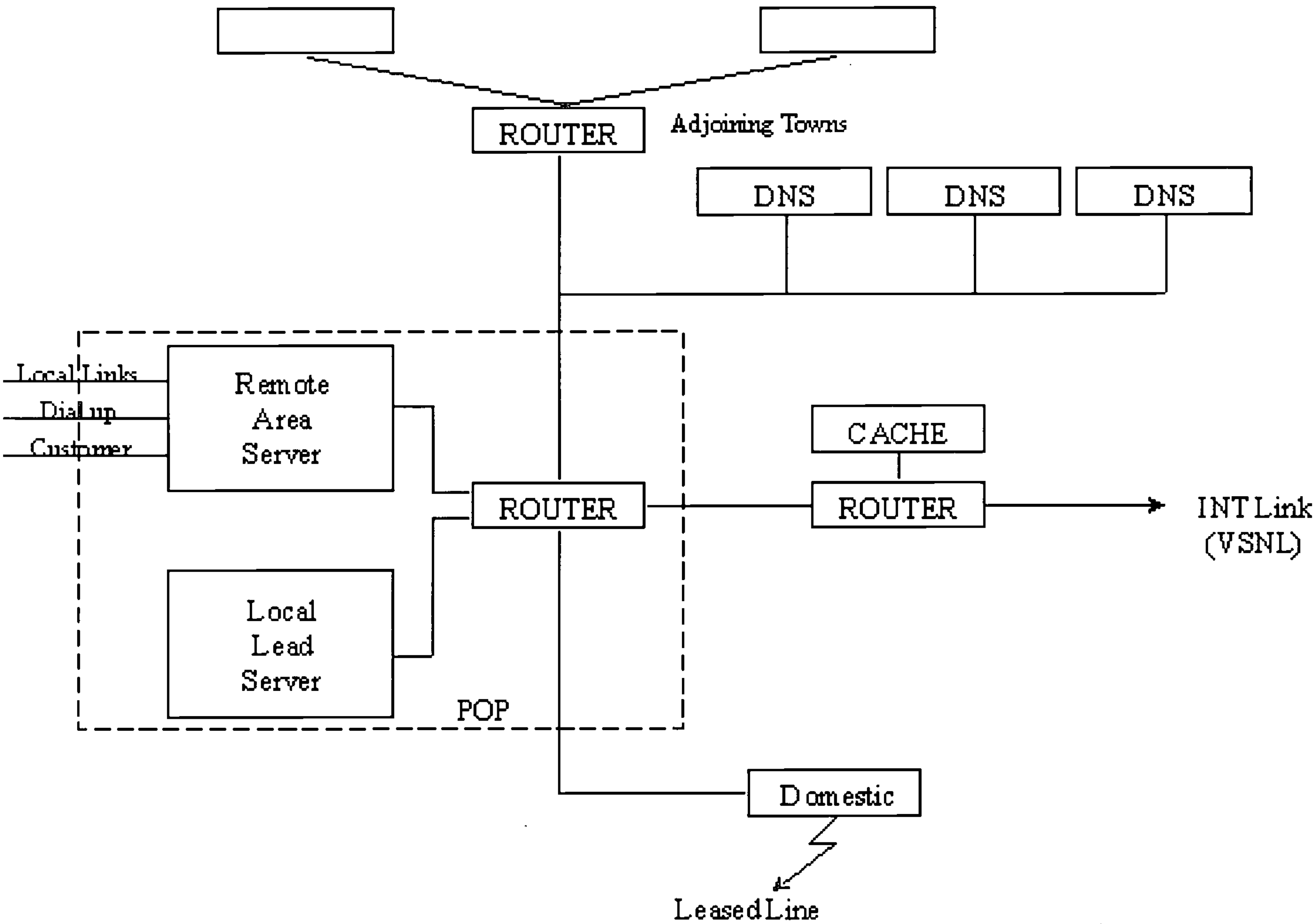


Fig: 1 Internet Revenue Generation

9.0 TECHNICAL CONSIDERATIONS

The ISP market in India is expected to be fiercely competitive and in such an environment only the ISP which operate efficiently with alternative and competitive offerings will thrive. Therefore some of the technical factors which an operator need to consider before selection of hardware are that POP equipment need to be consolidated rather than taking a vast array of equipment from multiple vendors. The POP equipment should be modular (scalable) in construction such that as business grows, hardware is increased. An efficient network management system is installed to facilitate operation and maintenance of network services including remote authentication of dial-in-users service . It is also worthwhile for new ISP to use open standards rather than proprietary technologies . Connectivity of nodes with high speed digital links taken on lease is another technical consideration.

Based on some of the above technical considerations the networks being designed for ISPs are based on decentralized network structure with local access points, initially at a few primary connection points in important cities in India and access points increasing as the subscriber base increases. The network is to be made up of access servers connecting the telephone network directly to the Internet at a local level. The Internet backbone for an ISP consists of hardware such as routers, hubs and servers and application software for support of WWW, FTP, Mail, News, DNS, User Authentication etc. A model network for a city is as shown below in fig.2.



and a typical network with leased line connecting several cities and VSNL port connectivity at the time of initial setting up is as shown below:

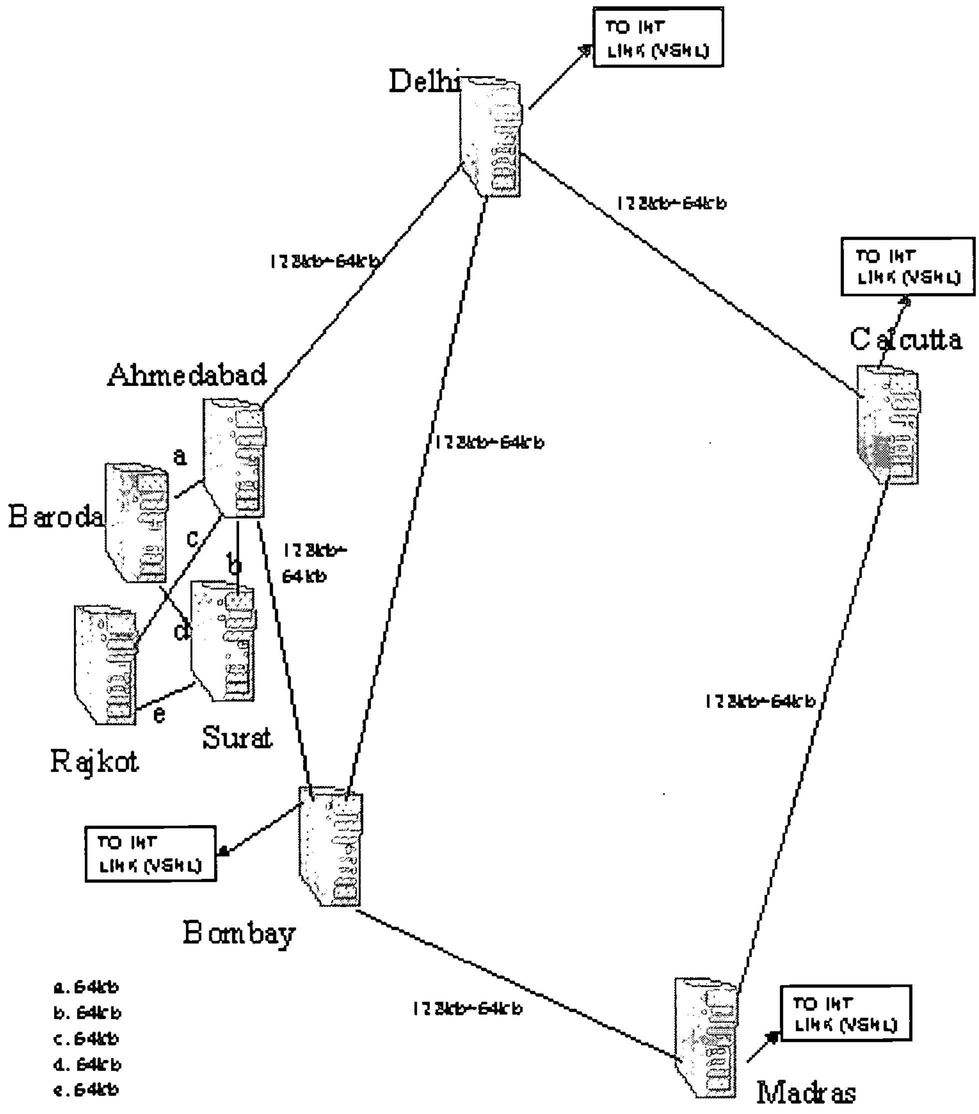


Fig. 3 (Leased Line & VSNL Port Connectivity)

Inter-connectivity of major cities and connectivity directly to VSNL is essential to offer quality service to the end users to provide, roaming facilities. Local e-mail services and value-added services.

The network design is being planned in such a manner that it provides flexibility and scalability. A hierarchy of four different Point of Presence (POP) each with different maximum capacity of providing access to 1000, 5000, 7500 and 10,000 dial up customers is being planned. Based on these dial-up users, leased line users and bandwidth estimates have been done as given in table-2.

TABLE - 2

No. of dial up usres	POP	Note-1 No. of dial-up Ports	Note-2 No. of Leased Line Ports	Note-3 Bandwidth Kbps
1000 Nos.	Small - Small	60	16	410
3500 Nos.	Small	360	48	1836
7500 Nos.	Medium	480	72	2544
10000 Nos.	Large	660	96	3462

Note-1 : It has been presumed that per dial-up port there will be 15-16 subscribers.
Note-2 : The number of leased line ports have been taken as about 1% of the dial up users.
Note-3 : The bandwidth per dial up user is taken as 3.5 Kbps and per leased line as 12 Kbps.

The network management is preferably exercised from a centralized function within the network. The needed equipment is fairly simple and network management work station are based on regular PCs the customer care and billing systems are specially developed by different service providers and are known as (ISMS) Internet Service Management System.

10.0 The Internet competitive Scenario in India.

The new ISP entrants will have to compete with the following organizations, which are at present providing Internet access in India.

- Videsh Sanchar Nigam Ltd.,/ Department of Telecom. .

At present only VSNL is an authorized ISP operator in the country and is providing services in India. It also provides the sole International Gateway for International traffic. Recently three more ISP operations including MTNL have been authorised for Internet Services.

- Education and Research Network of India (ERNET)

ERNET was the first ISP in India which began offering Internet Services to the education and research organizations within India. ERNET connects to VSNL from the major metros within India and also has a direct International Internet Connectivity .

- National Information Centre(NIC).

NIC operates a VSAT based network throughout the country and offers Internet services to the various departments of the Indian Govt. NIC is connected to VSNL & ERNET backbones in the major metros in India.

- INET

Internet access via the Dept. of Telecom. X-25 based , INET is provided in more than 75 cities of India. This network access is slow and unreliable full TCP/IP access is currently not provided.

11.0 Financials:

Various projections of initial investments are being given varying from several million dollars per city to about 10 million dollars for a small network covering several cities and including the cost of equipment and bandwidths for international gateway for a modest number of subscribers initially i.e. about 30,000 . The investments are however dependent on the complexity of the network and the number of cities to be served . However, with judicious planning, it is possible to start getting returns on investments by an ISP operator in the first couple of years itself. The services will have to be started initially at a few places especially in the metro-politan towns and high speed connectivity links can be taken on lease from DoT/VSNL . As the space requirements for installation of equipment and universal power supply is a few square meters in a city with few thousand subscribers all the sites except the metropolitan towns where service is to be launched initially need not be acquired but can be taken on lease. This reduces initial investment costs . All capital expenditure is assumed to be financed through equity, term loans and internal cash accruals additional capital and debt will be used to finance expansions . The debt equity ratio should be managed at around two and provision for free dial-up-time to be given to subscribers to attract new customers is necessary.

Most important factor in attracting customers will be how an ISP operator markets it services to attract new customers and how, he is able to provide a package of hardware/software with training, so that a customer is able to access the Internet and is able to extract information of his/her interest.

12. With the announcement and acceptance by Govt. of the interim recommendations of the IT

task force a great enthusiasm has been exhibited by entrepreneurs in setting up Internet Services in India, if sale of forms and receipt of applications for setting up services are any criteria . Infact, no other public service has been so far agreed to the private entrepreneurs without any licence fee and bank guarantee in India since Independence as the Internet services.

The interest in Internet for browsing / surfing is equally infectious in young students, in business people and in middle aged people though the purpose for all the three is different . The student seeks information, a wealth of which is available through Internet , a business man for marketing his products or seeking information about other products and the middle aged people even the retired people simply look for companionship in the Internet. No one , having a working knowledge of English and bale to afford a P.C. will ever feel lonely once he has access to Internet.

The services being planned by some of the ISPs in India are as follows.

- All customer information in one database scaleable to several 100,000's
- On line identification and authentication process, queries for customer status.
- Flexible tariff setting for
    - Installation fees.
    - Monthly fees.
    - Usage fees
    - Free introductory periods.
    - Free hours per month
    - Time dependent rates
    - Closed user groups
    - Credit cards, direct cards.
    - Multiple accounts.

ACRONYMS

1.	ARPA	Advance Research Project Agency (U.S. Defence Dept.)

2.	NSFNET	National Service Foundation Network (USA)
3.	WWW	World Wide Web
4.	POP	Point of Presence
5.	NAP	Network Exchange Points
6.	PCs	Personal Computers
7.	VSNL	Videsh Sanchar Nigam Ltd.,
8.	ISP	Internet Service Provider
9.	IT	Information Technology
10.	DoT	Department of Telecommunication.
11	FTP	File Transfer Protocol
12	LAN	Local Area Network
13	IP	Internet Protocol
14.	DNS	Domain Network Server
15.	PSTN	Public Switched Telecom. Network
16.	URL	Universal Resource Locator
17.	ISMS	Internet Service Management System
18.	ERNET	Education and Research Network (India)
19.	NIC	National Information Centre
20.	INET	Name of x-25 data network of DoT India.
21.	TCP/IP	Transfer Copy Protocol/ Internet Protocol

Return to Top View Full-screen

Jerry,

Trends in Asia-Pacific Internet Communications

Dr. Mathew P. Dovens

Director International Internet Marketing

Cable & Wireless USA

ABSTRACT:

Deregulation in many, but not all Asia-Pacific countries has created a more competitive marketplace than ever before. The resulting cut-throat competition is particularly pronounced in the provisioning of wholesale Internet services. Internet Service Providers are looking to minimize their cost of transpacific Internet connectivity. This session analyses trends in the industry and the resulting strategies for large international backbone providers.

View Full-Text

Network Planning Issues

Chair: Mr. Duyck Van Gorder

President, Network Technologies International, Inc.

Panelists:

Mr. Mario Pietrogrande - NETPLAN Associates

Mr. Mario Burgassi - CSELT

Ms. Emily Thatcher - GCI

Mr. George Schmelzer - GTE

Mr. Lawrence Paratz - Telstra

Introduction

Public telecommunications networks worldwide are experiencing unprecedented change. Deregulation, privatization and the introduction of competition are opening up public telecommunications markets to new operators and network services. The explosion of Internet traffic is driving a shift towards higher capacity networks optimized for data communications. Advanced technologies including ATM, IP, SDH and WDM offer varying approaches to network expansion, as well as improved network performance, and security. Today, network planners are faced with the daunting challenge of mapping an evolutionary network path under increasingly unpredictable market conditions. This conference session brings together a distinguished set of experts for a panel discussion of major issues regarding network planning. The objective of the panel is to raise audience awareness of network planning activities and concerns.

Network Planning

Telecommunications network planning is a multi-discipline function combining aspects of business and financial planning, with network design, engineering, and operations. As defined by the ITU, network planning "uses scientific methods for optimizing the investment and for dimensioning network equipment in a unified way for the whole country (or network), in order to meet realistic business objectives previously defined by the highest level authorities." As the definition implies, network planning involves determining the optimum network design; one that maximizes network capacity (and revenue), satisfies all network performance objectives and minimizes network investment.

Major issues affecting the planning of today's public telecommunications networks are summarized below. These issues concern the growth and forecasting of traffic, the evolution of network architecture, as well as the introduction of advanced network services.

Traffic Growth and Forecasting

The Internet and an increasingly globalized economy are expanding domestic and international network traffic at a rapid pace. Cellular mobile networks are also adding significantly to traffic growth worldwide. Forecasting long-term network traffic growth has become an extremely difficult task, creating uncertainty for network planners. To further complicate matters, network planners must also predict the amount and distribution of traffic originating in competing, or interconnecting networks (such as other fixed and cellular networks). Traffic forecasts (which often reflect proprietary business plans) may not be shared among competing operating companies. As a result, higher than expected traffic growth can leave network operators with inadequate capacity; causing network congestion and service degradation.

Network Architecture

In addition to expanding network capacity, planners are focusing on simplifying network architectures, as well as improving network performance and reliability. By reducing the levels in the national toll network hierarchy (typically from three or four levels to two levels), operators are establishing larger, more efficient circuit groups that help lower network administration costs. Dual parenting and traffic load sharing are being implemented to improve the reliability of the switching network.

Multi-level bi-directional SDH transmission ring networks are being implemented in both the local and national toll networks. SDH systems are used to expand network capacity, provide fault protection, lower operating costs and improve network management capabilities.

ATM technology offers planners an alternative backbone network architecture. ATM provides high capacity packet (cell) switching, along with real-time alternative routing. Planners are looking to operate ATM over SDH networks. Both technologies offer built-in protection switching against faults. Determining which protection scheme will take precedence is currently an open issue.

Advanced Network Services

Traditionally, demand for advanced network services in most developing networks has been restricted to high telephone density urban areas, with POTS offered exclusively in rural areas. Today, demand for advanced network services, especially high-speed Internet access, has spread to low telephone density areas. Extending advanced network services to areas where network investment may be marginally justified is an on-going challenge for network planners.

Virtual-Path (VP)-based ATM data services are currently being offered in many networks, with Virtual-Channel (VC)-based ATM switched services planned for the near future. These services are driving the formation of ATM network infrastructures. A wide range of Intelligent Network (IN) services are also driving the development of CCS7 signaling networks. IN-based services, along with cellular roaming are significantly increasing CCS7 signaling traffic. Operators are responding by converting integrated STPs to stand-alone units, and in some cases choosing to deploy STPs dedicated to the IN network.

Conclusion

Telecom networks worldwide are evolving rapidly in response to the changing regulatory environment, technology advancement and growing demand for advanced network services. The uncertainty of the future makes it especially challenging for network planners to devise a long-term network development path. Despite the many challenges, more and more operating companies are recognizing the importance of network planning in meeting both their network operations and business objectives.

Return to Top View Full-screen

The Potential Regulatory and Universal Service Consequences of Internet Balkanization

Rob Frieden

Penn State University, U.S.A

ABSTRACT

Because no significant incentive exists to conserve resources, congestion and degraded service has occurred, thereby prompting major Internet Service Providers to prioritize traffic streams by charging smaller ISPs for network access. This demand-based responsiveness soon might include reserved bandwidth that would enhance Internet efficiency and provide higher service reliability, albeit at a higher price, particularly for smaller and rural ISPs and their subscribers.

Instead of a "best efforts," "one size fits all" network topology, the Internet will become an amalgam of networks with different degrees of reliability, service quality, accessibility and cost.

View Full Text

The Potential Regulatory and Universal Service Consequences of Internet Balkanization

I. INTRODUCTION

Throughout the Internet's infancy and adolescence operators favored network connectivity at the expense of short term profits by readily accepting and routing traffic. Such "bill and keep," "sender keep all" strategies work well when traffic flows are nearly symmetrical, or when the incremental cost of handling additional traffic approaches zero with ample unused capacity and congestion-free networks. However the Internet has become more congested with the proliferation of users, applications and service providers coupled with access typically offered on a low, flat-rated, "All You Can Eat" basis.

Because no significant incentive exists to conserve resources congestion and degraded service has occurred thereby prompting major Internet Service Providers ("ISPs") to prioritize traffic streams by charging smaller ISPs for network access. This demand-based responsiveness soon might include reserved bandwidth that would enhance Internet efficiency and provide higher service reliability, albeit at a higher price. Particularly for smaller and rural ISPs and their subscribers.

Instead of a "best efforts," "one size fits all" network topology, the Internet will become an amalgam of networks with different degrees of reliability, service quality, accessibility and cost. This diversification will occur just as policy makers have begun to recognize the Internet's importance and the desirability of ubiquitous access. Likewise the dominant interconnection model for the Internet will shift from one characterized by widespread, voluntary and non-discriminatory interconnection to a hierarchical and discriminatory model dominated by a self-selected group of major, Internet backbone providers accessible only if compensated on a one-way, nonreciprocal basis. Rationalizing Internet access pricing will "balkanize" the Internet into an amalgam of networks, with varying degrees of accessibility and cost of accessibility to other networks. The extent of access to the Internet and degree of competition among ISPs may diminish most notably for "thin routes" that include many Pacific island and rural locales. A dichotomy may develop between large, competitive ISPs, able to charge low, usage insensitive rates on an averaged cost basis, and small, thin route ISPs who must charge comparatively higher end user subscription rates.

II. INTERNET COST STRUCTURES AND INTERCONNECTION

Seamless connectivity among millions of routers, servers and users has promoted ease of use, convenience and the opportunity for serendipitous discoveries in World Wide Web "surfing," i.e., the ability to move from one source of information to another and from carriage over one network to another at the click of a mouse. Likewise it has prompted consumers to perceive the Internet as costing nothing more than one's initial equipment purchase and a low, flat-rated monthly access charge. At least for the time being, the underlying facilities-based carriers and the providers of access to Internet-mediated content have opted not to impose substantial upfront, nonrecurring fees or usage sensitive access fees on end users. The decision to price access on an All You Can Eat ("AYCE") basis makes strategic sense during a promotional period when operators have plenty of available capacity--given its large "chunky" nature –and prospective customers require incentives to stimulate their interest in making the upfront, sunk investment in personal computers, modems, software and Internet access subscriptions.

Absent network congestion the cost to carry or process an additional minute of Internet traffic approaches zero, because the incremental cost is near zero. This pricing system enhances consumer welfare, stimulates usage and revenue generation and accrues positive networking externalities as additional points of communication become available and more users derive greater utility for such expanded access opportunities--all for a flat monthly rate typically below $25. As long as ample capacity remains available, ISPs need not meter traffic and have no reason to refuse to route traffic originating on another operator's network.

Under circumstances of traffic bottlenecking, in terms of bandwidth and interconnection, the incentive grows for ISPs–the major backbone operators in particular--to reduce the number of ISPs with which they will interconnect. This means that large volume, well capitalized operators will "private peer" with only those few other similarly situated operators, keen on maintaining high quality of service and willing to invest in the hardware needed to do so. As these ISPs make the necessary investments, they grow increasingly intolerant of those operators lacking the traffic, subscribership or capital to maintain parity by expanding bandwidth to accommodate growing subscriber numbers and bandwidth intensive applications like video. Such "lagging" ISPs may have become voluntary or involuntary free riders of a sort by contributing to traffic congestion at public interconnection points, commonly referred to as Network Access Points ("NAPs"), "public peering points," or Metropolitan Area Exchanges. Such operators lack the bandwidth needed to provide a reliable intermediary part of a complete link from and to end users.

III. PRIVATE PEERING AND ITS SIMILARITY TO TELEPHONY SETTLEMENTS

Private peering has become the most recent Internet interconnection model and the one most likely to involve some degree of discrimination or entrance requirements. This model involves the overlay of quasi-private Internets unavailable to every ISP or Internet user, or available at a price. Private peering users purposefully deem their networks off limits to outsiders ostensibly to preserve "network integrity" and minimal quality of service levels. However, the migration to private peering also results from the real or perceived need to safeguard a sizeable and expanding investment from the congestive effects of free riders.

As ISPs appear more inclined to interconnect facilities only if transfer payment occur, the Internet appears more like a system of telephone company networks. An understanding of how telephone companies settle accounts and route traffic may provide insight on how the Internet may evolve, despite the fact that private carriers provide service free of traditional telephone common carrier duties.

Interconnection between and among telecommunication carriers constitutes an essential element of what it means to operate as a common carrier. Common carriers have a legal duty to interconnect their facilities with other carriers on fair terms and conditions. No doubt exists whether a telephone company will agree to interconnect its facilities with another carrier, nor whether the interconnecting carrier should receive compensation for providing such access. Telecommunications carrier-to-carrier interconnection agreements typically involve a transfer payment when traffic flows are asymmetrical. The contractual terms and conditions for this "correspondent" or "connecting carrier" relationship primarily address traffic flow and volume without regard to a carrier's market share or size. Once qualified as a carrier, the venture receives compensation for terminating traffic. This arrangement may involve negotiations, application of a uniform revenue division plan, or a per minute access charge.

Historically, the telephony compensation plan has contemplated relative parity in terms of interconnection and negotiation leverage primarily because the parties voluntarily sought to interconnect facilities and expand geographical coverage. Market entry by competitive local and long distance carriers have necessitated legislative and regulatory edicts to mandate carrier-to-carrier interconnection with some degree of government oversight of the terms and conditions for such access. Before the onset of competition, extensive carrier-to-carrier interconnection was certain and the parties focused on what type of cross-subsidies were needed to support a universal service mission.

In the United States the "settlements and separations" cost allocation process between AT&T and both affiliated and unaffiliated carriers constituted a major source of revenues for underwriting the below cost provision of local telephone services. For some rural LECs the toll revenue division process with AT&T Long Lines generated well over half of the carriers' total revenues.

IV. INTERNATIONAL ARRANGEMENTS

In international telecommunications the facilities interconnection process appears to favor more dependent carriers, generating less outbound traffic, and ones with a national monopoly. The international correspondent relationship considers carriers as equals regardless of traffic volumes. International carriers match "half-circuits" and agree to divide a previously negotiated accounting rate initially set to approximate the total cost of completing a call. Carriers often fail to renegotiate downward accounting rates to reflect lower transmission costs thereby creating incentives to retard outbound calling, or to find ways to route such calls without triggering an accounting rate settlement. Despite excessive accounting rates, international carriers have established a framework that favors direct, efficient and streamlined traffic interconnection.

Once correspondents negotiate an accounting rate, regulators and carriers have latitude in determining how to subdivide the complete route for purposes of tariffing and to coordinate among multiple carriers, e.g., different local and national carriers. "End-to-end" routing establishes a single rate for the completed call, while "end-on-end" routing divides the route into separate increments, e.g., local, international gateway and international carriage elements often provided by different carriers, each entitled to a portion of the established international accounting rate.

V. DOMESTIC ARRANGMENTS

In addition to an access charge and Sender Keep All arrangement, Meet Point Billing provides a model that provides a shared framework linking telecommunication carrier settlement arrangements with the Internet's formerly predominant SKA model. The U.S. Federal Communications Commission ("FCC") has defined Meet Point Billing as:

"a method for the joint provision of access service through multiple-company ordering and billing arrangements. The arrangements deal with ordering criteria for each telephone company that provides joint access service with one or more telephone companies, and enable each telephone company to provide service and bill for its portion of access service furnished under its own tariff."

Meet Point Billing makes it possible for end users to have only one point of contact for securing services, including ones that traverse carrier service territories and accordingly require payment to more than one carrier. It promotes seamless connectivity between networks through the physical connection of lines and the integration of billing systems.

Meet Point Billing demonstrates how telephone carriers will cooperate if required by law, regulation or shared interest. For example, two adjoining carriers might agree to provide toll-free calling into the adjacent carrier's service territory thereby providing customers with an expanded geographical region for toll free calling. The carriers might agree to a SKA, zero compensation plan even if demographics, size of the service territory or other factors eliminate the likelihood of symmetry in traffic volume. Alternatively, they might agree to settle accounts and transfer funds on the basis of traffic volume, or the distance a call traversed over each carrier's network.

This model provides a helpful template for achieving network interoperability, including the coordination of billing and collection for services jointly provided by two unaffiliated ventures. It provides a basis for ISPs to migrate from SKA to one that can handle asymmetric traffic flows and differently sized networks.

VI. HOW MIGHT THE INTERNET BALKANIZE?

The Internet already has begun to desegregate into a hierarchy of networks based on available bandwidth, financial resources, number of Points of Presence, and subscribership. This balkanization means that not all ISPs will have direct and seamless interconnection with all other ISPs, primarily because commercial interests favor disconnection of lesser ISPs unless and until they agree to one-way transfer payments upstream to larger ISPs. So far no legislative or regulatory edict has required interconnection like that imposed on common carriers. ISPs, like cable television operators, enhanced services providers, and private carriers can discriminate, refuse to interconnect facilities, deny service and decline to operate in a particular geographical area, on the twin grounds:

- That they do not offer essential public utility-type services; and
- Confidence that normal marketplace resource allocation functions will match willing buyers and sellers.

The lack of an interconnection obligation on ISPs stems in part from the failure of legislators and regulators to rank Internet access at parity with the longstanding public policy objective of universal telecommunications service. However, the Telecommunications Act of 1996 in the United States has expanded the telecommunications universal service mission to include "[a]ccess to advanced telecommunications and information services . . . [throughout] all regions of the Nation." In conjunction with its identification of specific beneficiaries, e.g., schools and libraries, the '96 Act ordered the FCC to convene a federal-state joint board to implement the new and expanded universal service mission. Both a federal-state joint board and the FCC read the new universal service mission to include Internet access as part of as "e-rate" telecommunications discount for schools and libraries. Hence, a future looking view of the longstanding public policy goal of ubiquitous telecommunications access could include Internet and information services access.

If Internet access constitutes an integral part of the a national commitment to universal service in telecommunications and information services, then national regulators may have a basis for considering what affirmative steps the government, ISPs and telecommunication carriers must take to promote the Internet access portion of the universal service mission. The need for heighten attention to parity of urban/rural and high density/low density route access to the Internet stems from ongoing network disaggregation and the likelihood that rural ISPs generally may incur higher costs leading them to exit particularly expensive service locales.

VII. CAN REGULATORS IMPOSE INTERCONNECTION DUTIES ON ISPs?

Balkanization of the Internet may result in reduced and more expensive service to thin route locales based on quite rational business and economic factors. Even if an ISP decided to serve such locations, it might not have the subscribership and traffic volume to qualify for private peering opportunities. Most likely operators of this sort would end up paying for interconnection and incurring transiting costs probably avoidable for most urban counterparts. The lack of competition and inelastic demand for Internet access might well offset such a comparative disadvantage, but higher cost may be unavoidable with the possible consequence of retarding demand and achievement of a universal Internet service objective.

Professor Hal Varian clearly identifies the balkanization quandary:

> *"[A]s the [Internet] industry matures, settlement-free interconnection does not necessarily provide adequate incentives to the industry players [operating the large, high bandwidth national backbone networks]. "Why should I help my competitors by giving them free access to my network?" say the . . . [backbone] managers. But the Internet won't work unless everything is connected to everything else," say the . . . [Internet users and engineers]. Both are right. Interconnection is healthy for the industry as a whole, but the current business model for interconnection may easily generate incentives for individual carriers to [deny interconnection, or to] overcharge their competitors. "*

Professor Varian believes major Internet backbone providers can use interconnection agreements "as a strategic weapon . . . [that] could end up crippling the entire industry." He proposes that the Justice Department and the FCC in the United States require backbone providers to interconnect on "fair, reasonable and nondiscriminatory" terms, the very kind of regulatory safeguard imposed on common carriers by Title II of the Communications Act of 1934, as amended.

Absent a reclassification of Internet access and service providers as common carrier telecommunications service providers, the Justice Department and the FCC do not have jurisdiction to make regular and ongoing assessment of Internet operator interconnection agreements. Given a predisposition not to expand its regulatory wingspan and regulate the Internet, the FCC appears disinclined to deem as telecommunications the traffic carried via the Internet. Accordingly, the single, integrated "network of networks" characteristic of the Internet may migrate into a multiple, tiered system of "true peers," based on the scope of infrastructure owned or leased and the volume of traffic generated and received. True peers self-select which ISPs with which they will interconnect. Such private peering largely segregates key national operators from the larger set of lesser, regional and local ISPs. The major backbone ISPs resorted to this option when the public peering system became congested and unreliable as too much traffic aggregated at public exchange points. What "began as a series of local cross connects between large . . . [ISPs] at the public . . . [peering points] to bypass the congested . . . switches that anchored the public exchange points," has evolved to a point where "lesser" ISPs cannot qualify as a peer of the major ISPs and must pay to secure the privilege of having their traffic transit such networks. Note that after negotiating a one-way transfer payment to the major ISP, the lesser ISP will receive no compensation for terminating traffic originating or transiting the major ISP's network.

VIII. THE REGULATORY PARADOX

Just as the Internet becomes disaggregated into tiers of service providers, the overall utility of the Internet grows as it becomes a medium for real time delivery of audio, video and telephone services in addition to text and e-mail. Even as Internet operators insist they do not provide telecommunication services, the diversification of applications available via the Internet include functionally equivalent services like Internet telephony. This similarity of services raises a number of conflicting, countervailing and paradoxical marketplace and regulatory circumstances:

- As the Internet disaggregates and balkanizes, nations consider it a key vehicle to promote a larger, cohesive universal service mission, even though private peering may foreclose complete connectivity between and among individual networks;

- Many nations have telecommunications policies that require subsidization of telecommunications and Internet access at schools, libraries, rural areas and the residences of the elderly and poor even though Internet service providers persist in claiming no duty to support such mission; and

- Diversifying Internet services now include unregulated features functionally equivalent to what regulated common carriers offer.

IX. RELUCTANCE TO CHANGE THE STATUS QUO IN THE UNITED STATES

In an April, 1998 Report to Congress the FCC expressed discomfort with maintaining a blanket exemption of all types of Internet telephony from universal service funding obligations:

> *"The record currently before us suggests that certain of these ["phone-to-phone" IP telephony] services lack the characteristics that would render them "information services" within the meaning of the statute, and instead bear the characteristics of "telecommunications*

> *services," [as defined in the Telecommunications Act of 1996]. . . .To the extent we conclude that the services should be characterized as "telecommunications services," the providers of those services would fall within the 1996 Act's mandatory requirement to contribute to universal service mechanisms."*

However, the FCC refused to take a definitive stance "in the absence of a more complete record focused on individual service offerings." [30] Still, the analysis in the Report to Congress provides significant insight on future Commission rulemakings and its assessment of how the Internet affects the Congressionally-mandated universal service mission. The Commission considers information services, a means to "buttress, not hinder, universal service," [31] particularly when such services stimulate demand for basic services that make universal service subsidy contributions. On the other hand, information services hinders the universal service mission if providers of such services also offer telecommunication services and do so in a manner that exploits regulatory anomalies and loopholes thereby exempting them from universal service obligations and reducing the funds available for subsidizes. [32]

X. THE DEFINITIONS OF TELECOMMUNICATIONS AND INFORMATION SERVICE

The FCC reiterated its view that the Telecommunications Act of 1996 legislated a regulatory dichotomy between telecommunications and information services much like what the Commission had previously done in its Computer Inquiries [33] regulatory proceeding and what the Modification of Final Judgment [34] established in setting the terms and conditions for the divestiture of the AT&T's Bell Operating Companies. [35] Using historical references to its basic/enhanced services regulatory dichotomy and the telecommunications/information services dichotomy contained in the MFJ, the Commission attempted to maintain a "bright line" distinction between regulated, basic telecommunications and unregulated services that add information processing enhancements. [36] Operators providing the former have a duty to contribute to universal service funding, but providers of the latter do not.

Unfortunately for the FCC such a clean semantic dichotomy cannot operate in a time of rapid technological evolution and convergence. Enhanced service providers are not simply access charge exempt users of telecommunications, because to some extent they provide services to third parties and these services increasingly provide substitutes for services telecommunications carriers provide. Likewise, Congress ordered the FCC to consider the impact of mixed or hybrid services, which have both telecommunications and information service characteristics, on universal service definitions. The Commission expressly recognized that the Internet integrates both telecommunications and information services, but that ISPs "generally do not provide telecommunications." [37] However, the provision of transmission capacity to ISPs does constitute a "telecommunications service." [38] Presumably, any basic telecommunications service routed via such leased capacity by an ISP does not absolutely convert into "information services" as defined by the Telecommunications Act, [39] simply because an ISP offers a blend of services over telecommunications lines.

In it 1998 Report to Congress the FCC also acknowledged the view of Senators Burns and Stevens that regulatory mutual exclusivity cannot work for instances where a single enterprise provides both telecommunication and information services, or for services that combine aspects of both classifications. [40] Nevertheless, the Commission stuck to its reliance on the semantic dichotomies established by the Computer Inquiries and the MFJ, and the pragmatic view that because all information services use basic transport capacity as a building block, it "would be difficult to devise a sustainable rationale under which all, or essentially all, information services did not fall into the telecommunications service category." [41]

Accordingly the Commission reiterated the need for an absolute regulatory dichotomy based on a functional analysis:

> "*Under this interpretation, an entity offering a simple, transparent transmission path, without the capability of providing enhanced functionality, offers "telecommunications." By contrast, when an entity offers transmission incorporating the "capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information," it does not offer telecommunications. Rather, it offers an "information service" even though it uses telecommunications to do so. We believe that this reading of the statute is most consistent with the 1996 Act's text, its legislative history, and its procompetitive, deregulatory goals.* "[42]

XI. INTERNET TELEPHONY AS A TELECOMMUNICATIONS SERVICE

As a result of its decision to stick to mutually exclusive categories, the FCC recognized the duty to categorize Internet-mediated telephony as either a telecommunication service or an information service. Despite its disinclination to regulate the Internet, the FCC acknowledged that the "record currently before us suggests that certain 'phone-to-phone IP telephony' services lack the characteristics that would render them 'information services' within the meaning of the statute, and instead bear the characteristics of 'telecommunications services.'" [43] "Phone-to-phone IP telephony" enables users to access Internet-mediated telecommunication services via ordinary telephone handsets and pay phones instead of specially-configured personal computers. With the ease of ordinary telephone access, [44] the market for Internet telephony may grow substantially. Should this occur the financial demands of a now expanded universal service mission may exceed available funding sources. [45] A real potential exists for significant migration of traffic from customary switching and routing, subject to access charges and universal service funding ("USF") contribution requirements, to Internet-mediated switching and routing heretofore exempt from access charges and USF contribution requirements.

Because Internet telephony has several component parts, possibly offered by different companies, the FCC had to specify which aspects of Internet telephony constitutes telecommunications possibly subject to regulation and the duty to make USF contributions. The Commission stated that the definition of telecommunications contained in the Telecommunications Act of 1996 limits even the potential for regulation to transmitters of voice and data traffic, thereby excluding providers of hardware and software. Accordingly "[c]ompanies that only provide software and hardware installed at customer premises do not fall within this category, because they do not transmit information." [46]

On the other hand, for ventures meeting a four-part test, [47] the FCC stated its tentative conclusion that the service provided constitutes telecommunications, primarily because:

> *"From a functional standpoint, users of these services obtain only voice transmission, rather than information services such as access to stored files. The provider does not offer a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information. Thus, the record currently before us suggests that this type of IP telephony lacks the characteristics that would render them "information services" within the meaning of the statute, and instead bear the characteristics of "telecommunications services."* [48]

Despite its preliminary assessment, the FCC refrained from making "any definitive pronouncements in the absence of a more complete record focused on individual service offerings." [49] The Commission did note that a finding that phone-to-phone

Internet-mediated telephony constitutes telecommunications would trigger a mandatory USF contribution from such operators as required by Section 254(d) of the Communications Act. But even in the face of this financial contribution, the Commission implied that it might not have to subject such operators to the full array of common carrier requirements contained in the Communications Act, because Section 10 of the Act, established by the Telecommunications Act of 1996, [50] permits the Commission to forbear from imposing any rule or requirement of the Communications Act on telecommunications carriers. [51]

XII. SHOULD IPSs CONTRIBUTE TO UNIVERSAL SERVICE MECHANISMS?

On one hand it is clear that phone-to-phone Internet telephony and other Internet-mediated services can reduce overall USF contributions by providing a loophole for functionally equivalent traffic:

> *"If such providers are exempt from universal service contribution requirements, users and carriers will have an incentive to modify networks to shift traffic to Internet protocol and thereby avoid paying into the universal service fund or, in the near term, the universal service contributions embedded in interstate access charges. If that occurs, it could increase the burden on the more limited set of companies still required to contribute."* [52]

But on the other hand a proliferating network of networks, stimulates demand for a variety of telecommunications facilities and services. The FCC acknowledged both outcomes and concluded that for the time being the Internet, and all services available via the Internet, pose no threat to universal service:

> *"For purposes of this Report, we believe that the central issue is whether our decision that Internet access is not a "telecommunications service" is likely to threaten universal service. In other words, will Internet usage place such a strain on network resources that incumbent LECs will be unable to provide adequate service? As we noted in the Access Reform Order, both ILECs and the Network Reliability and Interoperability Council agreed that Internet usage did not pose any threat to overall network reliability."* [53]

If they do not already provide the functional equivalent of telecommunications, it is only a matter of time before the volume of voice traffic handled by ISPs causes the

FCC and other national regulators to reconsider their general predisposition not to regulate the Internet. When an ISP provides long distance telephone service, accessed by telephone and terminated to a telephone, the intermediary transmission using the Internet Protocol does nothing to refute the view that but for the Internet option such traffic otherwise would transit conventional routes and trigger the payment of access charges and USF contributions by the interexchange carrier.

ISP provision of functionally equivalent long distance telephone service, while a positive arbitrage and competitive force, [54] has the potential to trigger two significantly adverse impacts on the universal service mission:

- ISPs may trigger a migration of long distance telephony traffic from telecommunications carriers thereby reducing the sum of funds available to support the universal service mission even as the Telecommunications Act of 1996 expands the reach and cost of this mission. Similarly, telecommunication carriers may offer their own Internet telephony services that qualify for an exemption from access charge and USF payments in response to traffic migration and despite the impact such cannibalization will have on financial margins; and

- The decision by major ISPs to restructure interconnection arrangements in a manner analogous to conventional telephone carrier-to-carrier settlements would will shift costs downstream to smaller ISPs. While financially justified, imposing transit payments on small ISPs might trigger an industry consolidation and bring an end to flat-rated, averaged cost retail charges. Reduced competition may result in unserved, primarily rural areas, or at least the potential that ISPs will no longer charge a single rate regardless of user location.

In less than two years Internet telephony has evolved from a hobby to a business. Major incumbent telecommunications carriers like AT&T, Deutsche Telekom and MCI have embraced the technology, despite the potential for cannibalization of higher margin, conventional circuit switched services. A variety of new ventures, including VocalTec, Delta Three, IDT, and RSL Communications already offer services that substantially undercut, retail telephony rates. For example, RSL Communications recently announced international Internet telephony prices at one-half the retail rate, including a 29 cent per minute rate from the United States to Hong Kong. [55]

Currently the volume of Internet-mediated telephony is insignificant. Domestic United States long distance telephone rates have declined to only a few cents above the access charge payment made by interexchange carriers to local exchange carriers. Accordingly, unless Internet telephony provides a more efficient routing option, rather than an opportunity to evade regulator imposed charges, the Internet may not present much of a competitive challenge to dial up, domestic consumer services. However, with expanded Internet commerce opportunities arising, the potential exists for an Internet-mediated calls to customer service representatives and for corporations to diversify their Internet investment to include voice telephony in lieu of wide area telephone service lines, private lines and other circuit switched options.

XIII. ISPs MAY CONSTITUE TELEPHONE COMPANIES LACKING A UNIVERSAL SERVICE MANDATE

Unlike their telecommunications carrier counterparts ISPs have no universal service mission, nor do they bear any of the rights and responsibilities incurred by common carriers. Even though the terms and conditions for Internet operator network interconnection, traffic routing and revenue settlements now parallel how telephone companies do business, the FCC does not consider ISPs to be telecommunications carriers. Accordingly, ISPs may refuse to interconnect lines with other operators. They may discriminate among operators and consumers. And they have no obligation, as do local and interexchange carriers under the '96 Act, [56] to average costs and provide rural consumers with the same services available in urban locales at comparable rates.

Despite visions of a ubiquitous national information infrastructure, [57] the potential exists for information superhighways to bypass rural and high cost areas absent the kind of subsidization that has supported universal telecommunication service. The goal of eliminating free riding by smaller ISPs has resulted in higher transit costs borne by downstream "client" operators. No one can object to efforts by upstream carriers, which have invested in greater bandwidth and geographical reach, to recoup infrastructure investments from non-peer operators unable or unwilling to make similar investments. But the consequences of such transit and interconnection charges may likely include market consolidation and the elimination of averaged, flat-rated consumer access to the Internet. Already the number of ISPs has significantly dropped as local and interexchange carriers seek to accrue economies of scope and as some ISPs seek to achieve a national footprint and accrue economies of scale. Recently America On Line raised its unlimited, monthly rate from $19.95 to $21.95. A small, rural ISP, facing higher transit fees from upstream ISPs may not be able to generate profits even if it could match the AOL flat rate, or AOL's higher charge for rural users who access the service via a more expensive wide area telephone service ("WATS") lines in lieu of a local number.

The combination of market consolidation and higher transit costs for client ISPs may reduce or eliminate service options for users in rural locales. Nothing forecloses such an ISP from charging higher rates in markets lacking robust competition. If rural consumers incur higher costs to access the Internet--as financially justified as this may be--then the differential in market penetration rates between urban and rural areas will expand. The universal service support mechanism currently in place can only subsidize Internet access in schools and libraries and not from individual residences. Hence, we may see declining opportunities for low cost Internet access at the very time Internet services and features proliferate.

XIV. CONCLUSIONS

Technological and marketplace conditions favor increased reliance on the Internet as the preferred medium for both interactive information and telecommunications services. In advance of legislative and regulatory responses to the Internet's maturation, ISPs already have revised their interconnection and settlement agreements to reflect a hierarchical infrastructure more akin to the telecommunications industrial structure than a flat and democratic "network of networks." Many ISPs now offer the functional equivalent of telecommunications services and they have implemented a financial settlement system that accounts for the use of each other's facilities for "transiting" traffic.

Already the foundation exists for the Internet to merge with, or become indistinguishable from the various carrier networks that provide telecommunications. Most incumbent telecommunications carriers already provide Internet services and increasingly ISPs provide telecommunications services, often via the transmission facilities of incumbent local and interexchange carriers. This technological and marketplace convergence will necessitate legislative and regulatory responses to eliminate asymmetrical regulations and other anomalies that distort the marketplace. Until such adjustments occur, we cannot easily determine whether an Internet-mediated, packet-switched telecommunication service operates more efficiently than conventional circuit switched services. Regardless of its comparative efficiency, the Internet will become the preferred medium for routing telecommunications traffic, simply because both carriers and consumers can evade having to pay access charges and contribute to universal service funding.

State and Federal regulators have often used asymmetrical regulation to incubate technologies and to stimulate competition. Clearly the Internet has thrived in a mostly unregulated environment ISPs currently enjoy. But at some point, the Internet will have matured and diversified to a point where a preferential regulatory status unfairly tilts the competitive playing field and creates unnecessary marketplace distortions. The Internet has the capacity and versatility to become a one-size-fits-all telecommunication and information services medium. As it becomes an essential medium, it likewise will become the focal point for universal service initiatives, even as ISPs now avoid financially supporting this mission.

Return to Top View Full-screen

Data Exchanges and Peering in an Age of Competition

Eric Lee

Abstract:

Not available

Monitoring the Effective Use of Online Services

John Burke, Supriya Singh, Ross Kelso, Choong Chin, Sarah Miller and Claudia Segers

Centre for International Research on Communication and Information Technologies, Australia

ABSTRACT

This paper reports on a feasibility study of monitoring Australia's progress towards effective use of online services. A prototype of an ongoing structure for acquiring and presenting information, across a number of key sectors – government services, business, education, health, residential, and groups with special needs – has been developed as a Web site for critical review. This site can be viewed at www.circit.rmit.edu.au/monausol/. The approach taken in the feasibility study is outlined with key conclusions about the development of an ongoing process. A core issue in the study is the consideration of the concept of "effective use".

View Full Text

Monitoring the Effective Use of Online Services

I. INTRODUCTION

Governments and industry in many countries have a major commitment to the use of online services. Much of what is happening is, however, still exploratory. How can we understand and share this experience? What assessment can we make of the effectiveness of strategies to promote the use of these services? What gaps and needs for action can be observed?

This paper reports on a feasibility study of monitoring Australia's progress towards effective use of online services. A prototype of an ongoing structure for acquiring and presenting information, across a number of key sectors - government services, business, education, health, residential, and groups with special needs - has been developed as a Web site for critical review. This site can be viewed at www.circit.rmit.edu.au/monausol/. The approach taken in the feasibility study is outlined in the following sections with key conclusions about the development of an ongoing process.

A core issue in the study is the consideration of the concept of "effective use". This term has been adopted to indicate sustainable and valuable use of services. Value should be present for the key elements of the delivery chain - users, content service providers (government agencies, businesses, schools, etc.), and communications service providers.

Much of the available data focuses on measures of access to services (through ownership or other means), and volume or nature of use of services. However, access to services does not necessarily mean they are used, using them does not mean they are used effectively - access and use are necessary but not sufficient conditions for effective use.

II. OBJECTIVES OF A MONITORING PROCESS

Initially the project was conceived as the development of a "report card" on Australia's progress towards effective use of online services. The term "report card" has negative connotations in various sectors, particularly in the context of national-state relationships, and its use has gradually been reduced. It also suggested a critical appraisal of the state of development, against some identified standards or expectations, or even State to State. In contrast, the value of a monitoring process has increasingly been seen in its contribution to development, the engendering of a learning process about the use of online services.

The objectives of a monitoring process are to assist the evaluation of national, state, and organisational strategies through:

- Providing a comprehensive map of the state of development
- Comparing and benchmarking against international developments, and
- Charting paths and stages towards desirable outcomes

While all of these objectives are seen as relevant, the first two have inherent difficulties in establishing stable bases of comparison over time and context. The latter has been emphasised in consultations, leading to an intended focus on identifying and monitoring:

- Change issues and guidelines for strategic approaches to "effective use",
- Primary indicators of effective use to monitor these approaches over time, and
- Models and approaches, as guides for general improvement.

Conclusion 1: Monitoring process as a developmental, evaluative activity

An ongoing monitoring process should emphasise developmental aspects, rather than critical appraisal.

A primary contribution of a monitoring process should be to support the evaluation of national and state strategies for development of online services.

III. RELATING TO NATIONAL STRATEGIC OBJECTIVES

A desirable starting point for monitoring the outcomes of strategies is to utilise understood and accepted statements of strategic objectives. Australia has had a number of vehicles at the national level for the development, expression and implementation of online, interactive services development in recent years. For various reasons they have either not set objectives or these objectives have not been sufficiently supported to be taken as bases for assessment.

An examination of statements of vision and objectives from various sources led to the following as a point of reference for this project:

The use of online services in Australia should

- Extend the range and accessibility of services available to citizens,
- Improve the efficiency of governments, businesses and other organisations, and

- Enhance Australia's international competitiveness

in order to improve the social and economic well-being of its citizens.

More explicit, and best described as instrumental or intermediate, objectives can be found among agencies in different sectors; one being the objective of 90% of businesses in targeted industries being online, another being the reasonably general objective of all government departments and agencies having a web presence and the capacity to conduct some/all of their transactions online.

There are arguments for and against explicit policy objectives. There is probably no argument, however, that if we are to seek to monitor progress on strategies we wish to do more than gather all the interesting information that is possible. There is a clear task to agree upon a framework of objectives that should be monitored.

Coincident with the production of this report, the Ministerial Council for the Information Economy has released a statement *Towards an Australian Strategy for the Information Economy (July 1998)* as a basis for consultation. This includes a mission statement:

To ensure that the lives and work of Australians are enriched, jobs are created, and the national wealth is enhanced, through the participation of all Australians in the information economy

values and vision statements, and statements of strategic priorities, objectives and proposed actions.

It provides a source of relatively detailed objectives, such as:

- Making high communication bandwidth available at low cost,
- Access by all Australians to this capability wherever they live or carry on business,
- Raising awareness of online business systems, so that by the year 2000 every Australian business is aware of the benefits of doing business online,
- Delivering all appropriate government services online by 2001, and
- Students leaving Australian skills with the online skills and knowledge they need to benefit from employment and other online opportunities.

Through this structure a set of long- and medium-term national objectives is becoming apparent. The integration of this set with the framework of this report is a clear next stage of development.

It has been made clear to us in many discussions that focusing on online services - the technology enablers of activities - is unduly reductionist. Organisational strategists and managers are recognising that online services provide one channel for delivery of, or access to, other "consumable" products and services. The use of online services needs to be examined in association with other more traditional physical or electronic channels, in a context of broad business, economic and social objectives.

Conclusion 2: Relationship of a Monitoring Process to National Objectives

A monitoring process needs to be related to a concise statement of a national strategy for online services development. This strategy should have

- A broad vision of the use of online services
- A strong set of "intermediate objectives" which are monitorable and which recognise
- Online services as one of a number of delivery/access channels,
- The need for cooperative endeavour between government at all levels, industry, business and community to build a national base of expertise, and the need for commitment to continuity of national purpose and implementation approaches.

The consultation document *Towards an Australian Strategy for the Information Economy* now serves as the basis for this development.

IV. FRAMING THE SEARCH FOR INFORMATION

A significant part of this feasibility study has been the development of a framework for identifying potentially useful information. We have:

- Adopted a broad definition of online services, which is seen to include email and World Wide Web, EFTPOS, IVR, videoconferencing and other forms. While much of the focus of the report, and the available data, is around the Internet, an ongoing framework should be broader than this to recognise the changing profile of services and their use
- Distinguished between access, use and effective use as aspects to measure, with the following general orientation:

- Access to services:	Equipment enabling service delivery has been purchased or the service can be subscribed to; or without purchase, it is physically possible to gain access to such a service or enabling equipment.
- Use of services:	Quantification of the actual use or operation of the service, eg. in terms of usage volume or frequency of use.
- Effective use of services:	A measure of the actual or perceived value gained from use of the service, eg. satisfaction, affordability, return on investment, value for money, usefulness, extent of repeat use.

- Sought available information on access, use and effective use within sectors. If we are to discuss "effective use" we need to be able to describe ***how*** services are being used. Our approach has been to identify key "applications" or activities within each sector as the elements for detailed analysis. Some examples are:

Applications by Sectors

- **Business (including electronic commerce)**

  Market Presence

  Consumer / Client Management

  Supply Chain Management

  Work Group Collaboration

- **Government services**

  Electronic Services Delivery (ESD)

  Inter & Intra-Department/Agency Communications

  Whole-of-Government Information Locator (or Directory)

- **Education**

  Classroom/remote delivery

  Development of learning resource materials

  Management of learning

  Collaborative projects

  Professional development

  Information for prospective clients

  Administration

- **Health services**

  Health Information Management

  Professional Development and Continuing Education

  Clinical Consultation and Diagnosis

- **Residential**

  Family/Social

  Money

  Shopping

Education

Entertainment

Health

Transport

Compliance

- Identified primary indicators of effective use as:

From the point of view of

Users	Usefulness (meets needs) Affordability Ease of use
Content service providers (business, government agencies, schools, etc)	Achievement of business/organisational strategy through, e.g., increased productivity, increased range of services, increased market access
Communications service providers	Return on investment, extension of range and quality of service, and market access/market share

Our primary focus has been on the consideration of the points of view of the first two groups of stakeholders, with the approach to addressing the questions about value to communications service providers an outstanding matter.

- Emphasised the need to focus on "change issues" – approaches to barriers - for the achievement of effective use. These change issues may be the focus of intermediate policy objectives, and hence their identification and clarification is highly desirable

- Sought illustrative examples in application areas where there is a focus on effective use, or on particular change issues.

A general framework for consideration of possible measures is included as Attachment 1.

Overall, we have found relatively few attempts to assess aspects of effective use; the focus being at this stage more on the preconditions of access and use. We have, however, found a general recognition of the appropriateness of an objective of effective use, tempered only by some observations that political and other strategic imperatives to be online may override consideration of the issues of value.

A focus on effective use is one way of beginning to understand the relationship between the use of online services and broader objectives. Figure 1 illustrates conceptually how the "value to content service providers" and "value to users" dimensions may relate to the broader economic and social objectives that the use of online services may be intended to serve.

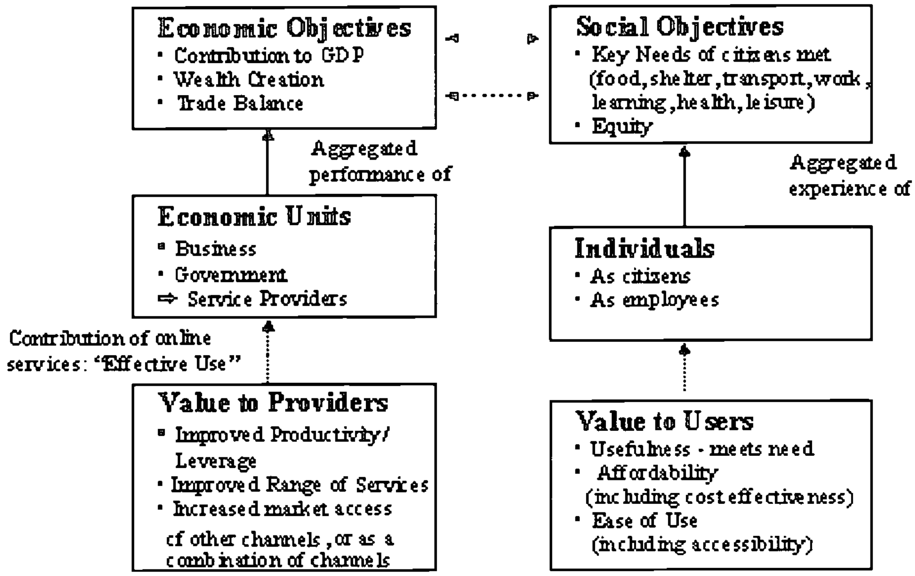


Figure 1: Relationship between Macro Objectives and "Effective Use"

Conclusion 3: Effective use as a long term objective; change issues as a primary focus

An objective of effective use of online services should be an integral part of national, state, and organisational strategies. It is, however, a long term objective. Intermediate, more monitorable, policy objectives are likely to be expressed in terms of access or use; their expression may be influenced by recognising the nature of longer-term objectives.

A primary focus of any policy review process should be on the informed identification and analysis of the change issues to be resolved to achieve effective use. These change issues should also form a basis for identifying intermediate policy objectives.

V. Sources of Information/Evidence

As part of the project we conducted a survey of the range of Australian and international data sources. In examining potential sources of information we distinguished a variety of ways in which data may be obtained. These sources include:

1. ***Services related***

An increasing amount of data is available from the systems underlying the services themselves; e.g., the kinds of transactions, time of day, etc., for government electronic service delivery, or usage statistics associated with websites. While these are clearly useful sources of information, there needs to be greater clarification of the meaning of certain statistics (e.g., number of hits or pages opened on websites).

2. *Studies*

There are a variety of studies from which information can be obtained, and which have characteristic differences. They include:

a. *Samples of total populations*

The most broadly based and regular are those conducted by the Australian Bureau of Statistics (householder and small business).

b. *Online surveys*

Various organisations specialise in online surveys of users of the Internet. These provide valuable information about online users, but inherently provide a skewed sample of the total population of users and non-users.

c. *Qualitative research/case studies*

More intensive studies of particular groups, based on interviews or observation, are conducted by a number of organisations.

d. *Panels*

A number of questions will be best addressed by the views of expert panels. These will generally need to be formed for the purpose.

In practice a mix of these approaches will be desirable. Linkages between them will provide some powerful sources of information. Measures of access and use are likely to be obtained from population surveys and services-related data gathering measures. The issues of value in effective use are likely to be best considered through qualitative, case study and panel approaches.

2. *Issues of Comparability/Integration*

In seeking to obtain information from a number of different sources some clear issues of comparability of measures arise.

Taking the example of residential use of the Internet:

- Is the unit of measure of access (availability) to be households or individuals?
- Is the access to be within the home or any location (including work)?

- Is use to be considered for all individuals, or identified age groups (e.g., over 5, over 18)?
- Is use by individuals to have components of frequency (e.g., daily, weekly, monthly) or recency (e.g., within the last week, month, year)?

It is from the approach to data collection and to questions such as these that significantly different statistics emerge. There is much data we have chosen not to present because of issues of this nature, particularly in the international domain. Is it, for instance, useful to compare Australian statistics of numbers of individuals using the Internet for online banking in the last year (0.3%) with available international data on time spent on the Internet on online banking (2.0% US)?

3. Data Availability

We have only used data available from public sources, or proprietary data which has been made available. There is a considerable amount of proprietary data being collected, but the pursuit of such data would require greater clarity of requirements.

Conclusion 4

While there is a limited amount of data available in the form sought to populate the frameworks in this report (access and use in the residential and business sectors being best served), there is a significant network of data gathering and research organisations who are already gathering information, are prepared to extend their current focus, or who could contribute special expertise to assist ongoing monitoring.

Some relevant data could be available reasonably simply through building data-capturing procedures into systems design.

The Australian Bureau of Statistics has a key role to play in further developing its established focus on usage statistics. It should continue its consultative process to establish commonly recognised measures.

VI. INTERNATIONAL APPROACHES AND DATA SOURCES

In examining international approaches, we have found few instances of attempted systematic monitoring of objectives. We have assembled elements of data from a wide range of different sources.

An important point of reference has been the project conducted by Spectrum Strategy Consultants for the UK Department of Trade and Industry. Focusing on the use of information and communication technologies by business (particularly small and medium), this study is now in its third year. Initially based on secondary sources, it now largely utilises a primary survey conducted by the National Opinion Poll of businesses in the UK, US, Japan, Germany, and France. While we have endeavoured to take a broad cross-sectoral approach, there are important commonalities with the Spectrum project; particularly in their recognition of multiple paths to the "information society", their increasing focus on effective use and barrier or change issues, and their integration of various data sources.

The Australian Bureau of Statistics is actively involved in promoting the gathering of comparable international statistics through the OECD Information, Computer and Communications Policy (ICCP) Committee. From this engagement they have confirmed the dearth of comparative points of reference.

Conclusion 5: International links

Comparison of experience with other countries is an underlying requirement for effective monitoring of strategies. To this end:

- Close relationships should be sought with the UK Department of Trade and Industry/Spectrum project as a source of interaction about the issues in monitoring progress and for the development of comparable measures in the business sector. (The substantial outcomes from continuity and progressive development of the UK study should be noted and the merit of applying similar endeavour in Australia recognised.)
- The active involvement of the Australian Bureau of Statistics in the OECD Information, Computer and Communications Policy (ICCP) Committee.should be recognised and strongly supported. The International Telecommunications Union (ITU) is a further source of international comparative material.
- Other possible sources of collaborative benchmarking should be investigated further.

VII. PROTOTYPE WEB SITE

The structure of the material from this study, and the audience for whom it is initially intended, is suited to presentation online. A prototype Web site has been developed to encourage critical review. This site provides reports on each sector, reviewing the overall status of development and access and usage measures where available. For each application considered the nature of indicators of effective use is examined. Since, generally speaking, data is not readily available to assist the understanding of effective use, trial measures are suggested.

The government electronic service delivery application provides the following examples of suggested measures for users and government agencies. In this application particular reference is made to the activities of the Victorian Government in utilising the *maxi* system and the Australian Capital Territory Government in developing the *Austouch* system.

Table 1: Government Electronic Service Delivery - Trial Measures of Effective Use: Users

Indicator	Trial Measures	Available Data*
Usefulness (in meeting needs): • Quality • Timeliness • Trust	• Satisfaction with relevance/accuracy of data • Availability of record of information or transaction • Willingness to use compared with physical channel • Convenience of hours of operation • Waiting time to gain physical access • Time to resolve matter (to gain information, transact service) • User trust in reliability of service; confidentiality of information (eg. personal data) imparted/security of transaction • Willingness to use service again/repeat usage • Incidence of repeat attempts to resolve same matter on one occasion	• Number of users finding service to be useful; motivation for use • Number of transactions by time of day, channel • Characteristics of repeat customers
Affordability of service (incl. cost effectiveness)	• Cost of access (for ownership, non-ownership); also expressed relative to pre-online service delivery alternatives • Cost of resolving matter (to gain information, transact service)	
Ease of Use: • Physical Accessibility, Comfort • Ability to use interface • Social/ organisational preparedness to use	• Location of service terminal/interface in relation to demand • Ability to deal with more than one agency in same access attempt • Unambiguity of operational steps • Multi-lingual capability • Availability of different channels for same service	• Number of transactions by locality

* *Data of this nature is presently collected for the maxi and Austouch systems but the results are not in the public domain.*

Table 2: Government Electronic Service Delivery - Trial Measures of Effective Use: Government Agencies

Indicator	Trial Measures	Available Data*
Improved productivity/leverage	• Cost of providing each transaction; also expressible relevant to pre-online service delivery alternatives • Service availability (in system terms) • Response time to complete transaction • Restructured process arising • Realisation of business strategy of dep't/agency	• System availability • Response to complete an entire transaction
Improved range of services	• Customer satisfaction (according to business user, consumer) with range of services available • Ability to deal with more than one agency in same access attempt • Provision of new service option	• Number and reason for help desk calls • Number of users indicating future intention to use which service
Increased market access	• Growth in number of effective transactions (based on number of transactions, by type, dep't/agency, time of day, physical locality) • Number of incomplete transactions and reason for such an outcome • Changed demographic of user group (measure of new audience)	• Number of transactions by channel, transaction type, agency, time of day, locality • Number and reason for major incomplete transactions • Demographic features of users

* *Data of this nature is presently collected for the maxi and Austouch systems but the results are not in the public domain.*

VIII. REVIEW AND DEVELOPMENT OF THIS APPROACH

We have sought confirmation of this approach through ongoing consultation with funders and other interested parties. We have sought to develop panels of experts to review each sector, and conducted workshops and seminars in most sectors. The significant interest shown suggests the merit of further development of this process.

However, there have been limitations on cooperation in obtaining information. Some of these are time limitations of busy people; others are more fundamental. It is apparent that an ongoing process will need to have characteristics of:

- **Legitimacy**

  Within a number of sectors, while interest is clear, the view has been expressed that the provision of detailed information is dependent on the acceptance of the bona fides of the process as a legitimate vehicle for review of strategies.

- **Ownership**

  Even if conducted under the auspices or endorsement of key bodies, the monitoring process is unlikely to be successful unless there is an appropriate degree of ownership within the sectors. Bodies with interests in the development of online services in each sector are identified as possible owners of this process.

  The process of establishing ownership will need to deal with some tension that appears to exist between central agencies promoting online strategies and service agencies in the same jurisdiction, and in a somewhat competitive form between different jurisdictions. The monitoring process has been positioned as a co-operative, developmental activity, which will need continual reinforcing and interpreting.

- **Integration**

  Contributions of information are also unlikely to be readily forthcoming if they impose additional resource requirements. The process of development and maintenance will need to be closely integrated with existing, or desirable new, initiatives.

- **Critical Review**

  With this ownership and integration could come, however, limitations on the maintenance of a critical reflection of developments. This should be nurtured through review fora and other processes.

Conclusion 6: Developing an ongoing process

An ongoing monitoring process should be developed and owned by the National Office for the Information Economy and supported by the Ministerial Council for the Information Economy and the Online Council. It should be closely associated with the development of the National Strategy for the Information Economy.

Specific bodies should be approached to develop and oversee monitoring activities in the different sectors.

Consideration should be given to inclusion of other sectors; in particular a focus on cultural and other information and entertainment applications.

Individual States have their own potential use of a monitoring process for evaluation and development of strategies, as well as being important contributors to a national monitoring process. Common frameworks and approaches linking state and national developments are likely to be of value.

Attachment 1: Framework for Measures by Sector

ACCESS (Access by members of group to specific services)	USE (Use of specific services)	EFFECTIVE USE (Value in relation to particular kind of use/application)
By identified group: No. (%) who - have (own/subscribe to) services - have, without ownership i. Unlimited ii. Limited access to services (define levels) **Change/Barrier issues** (identify relevant issues and define indicators for sector); e.g.,	**By service** Amount of use of service **Change/Barrier issues; e.g.,** Awareness Skills Ease of use Availability of support staff Demand	**By application/activity:** Measures of the following nature as appropriate for activity Users Meets needs/Usefulness (satisfaction with outcome of activity) Affordability/value for money Accessibility Content Cost (relative to physical/traditional) Service Productivity/leverage Provider Extension of range and quality of services

Location Cost Infrastructure availability		Market access Comms Return on investment Provider Extension of range and quality of services Market access **Change/Barrier issues; e.g,** Organisational acceptability - e.g., timetabling Personal acceptability - e.g., security, trust Technology - e.g., effectiveness of resource discovery tools Policy/regulatory - e.g., applicability of Medicare

Return to Top View Full-screen

Separation of IP Routing and Forwarding via Tag Switching and MultiProtocol Label Switching

Tom Downey

Cisco Systems, Inc., U.S.A

ABSTRACT

Networks are evolving to combine network layer routing and link layer switching to provide advanced services at high speeds. Unlike ATM, IP protocols and procedures require routing and forwarding be combined. Tag switching and the emerging MultiProtocol Label Switching (MPLS) standard are new techniques to enable the routing of IP packets to be distinct from the forwarding operation, thus opening IP to many capabilities only found with link layer technologies and enabling a closer integration between IP protocols and advanced link layer network technologies such as ATM. This paper presents an overview of tag switching technology and how it can enable such new capabilities.

View Full Text

Separation of IP Routing and Forwarding via Tag Switching and MultiProtocol Label Switching

I. INTRODUCTION

Rapid growth of the Internet and of enterprise intranets presents a challenge to network operators to keep up with the demand for bandwidth and connectivity. At the same time, these networks are beginning to offer advanced IP services, including multicast, quality of service (QoS), and virtual private networks (VPN). Tag switching provides a new technology for addressing these issues. In particular, tag switching provides:

- IP+ATM integration: Tag switching enables network operators to build large, high-speed IP networks with ATM switching technology in the backbone. By separating the routing and forwarding operations in IP, tag switching enables IP protocols to be used with cell relay forwarding, essentially turning ATM switches into routers and avoiding the scalability problems that come with trying to connect large numbers of routers across an ATM virtual circuit mesh. Tag switching also enables ATM networks to provide advanced IP services, including IP multicast, IP QoS, and future IP capabilities. Instead of mapping or converting the IP protocols to ATM protocols, tag switching enables ATM switches to directly support IP protocols and features.

- Explicit Routing: Tag switching enables new traffic engineering capabilities on current IP routers, a capability only found on frame relay and ATM switches today. This will enable network operators to improve WAN link utilization and better manage their network during link outages.

- Virtual Private Internetworking: By separating the routing control plane from the packet forwarding operation, tag switching enables networks to support multiple, overlapping IP address spaces. This capability can be used by network operators to provide VPN services, or to provide communities of interest based on defined policies.

II. TAG SWITCHING OVERVIEW

Tag switching achieves the separation of routing and forwarding by assigning "tags" to multiprotocol frames for transport across packet or cell-based networks. It is based on the concept of "label swapping," in which units of data (e.g., a packet or a cell) carry a short, fixed length label that tells switching nodes how to process the data.

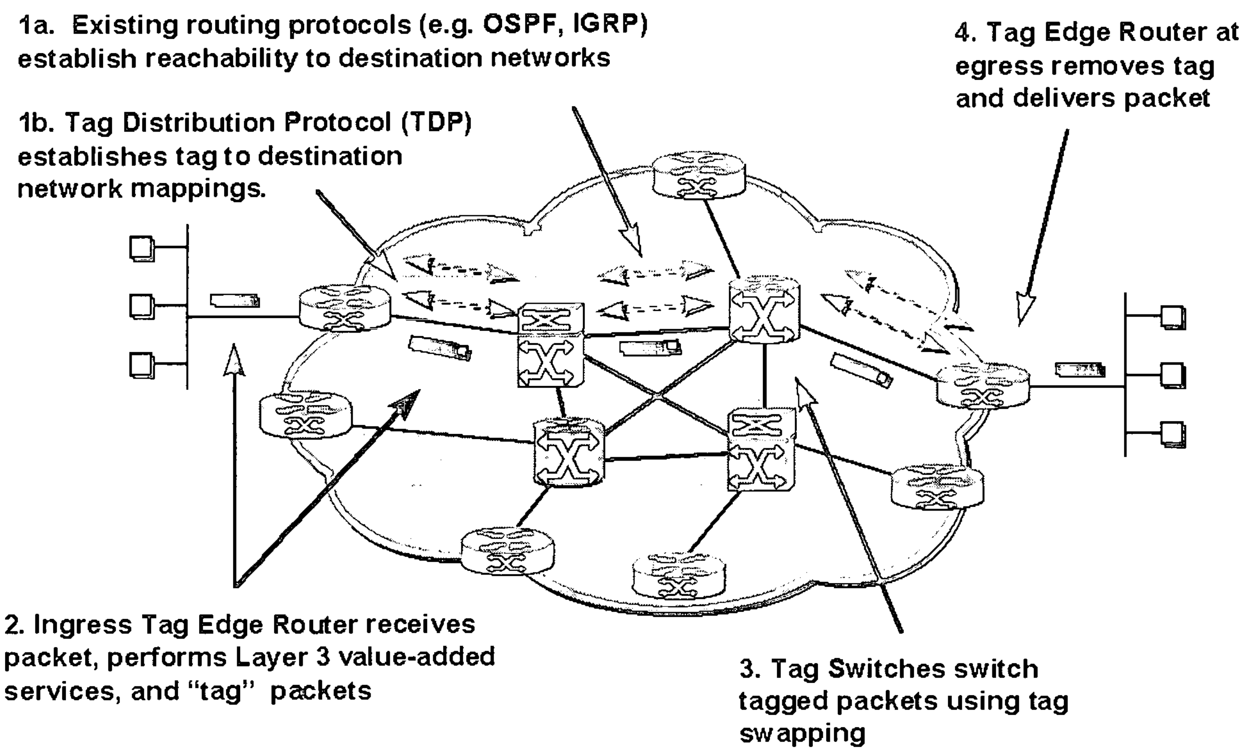
In IP networks, routing protocols determine the destination for packets by looking at the destination IP address in the packet. The nodes along the path from the source to the destination also look at the destination IP address in the packet to figure out where to forward the packet next. In contrast, ATM networks use the ATM address in signalling messages to identify the destination of an ATM virtual circuit (or use configuration via a network management system for permanent virtual circuits), but use the VPI/VCI field (a "label" placed on each cell) in the ATM cells to control the actual forwarding of cells. This separation of the ATM address used for routing from the VPI/VCI field used for forwarding is part of the power and flexibility of ATM. By extending this label switching concept to IP packets, tag switching can extend many link layer capabilities to IP, and can more tightly integrate IP protocols with link layer forwarding engines such as ATM switches.

A tag switching internetwork consists of the following elements:

- Tag edge routers: located at the boundaries of an internetwork, tag edge routers perform value-added network layer services and apply tags to packets.
- Tag switches: switch tagged packets or cells based on the tags. Tag switches may also support full Layer 3 routing or Layer 2 switching, in addition to tag switching.
- Tag distribution protocol (TDP): in conjunction with standard network layer routing protocols, TDP is used to distribute tag information between devices in a tag switched Internet.

The basic processing within a tag switching internetwork is as follows:

- Tag edge routers and tag switches use standard IP routing protocols (e.g., EIGRP, BGP, OSPF) to identify routes through the network. These fully interoperate with non-tag switching routers.
- Tag routers and switches use the tables geneated by the standard routing protocols to assign and distribute tag information via the tag distribution protocol (TDP). Tag routers receive the TDP information and build a forwarding database, which makes use of the tags.
- When a tag edge router receives a packet for forwarding across the tag network, it analyzes the network layer header, performs applicable network layer services, selects a route for the packet from its routing tables, applies a tag, and forwards the packet to the next hop tag switch.
- The tag switch receives the tagged packet and switches the packet based solely on the tag, without re-analyzing the network layer header. This provides the essential separation of routing and forwarding referred to earlier.
- The packet reaches the tag edge router at the egress point of the network, where the tag is stripped off and the packet delivered.



III. EDGE ROUTERS

Tag edge routers are full-function Layer 3 routing devices located at the edge of a tag switching network. They apply tags to incoming packets and remove tags from outgoing packets. As full-function routers, tag edge routers also apply value-added Layer 3 services, such as security, accounting, and QoS classification. Tag edge router capability does not require special hardware and is implemented as an additional set of software features, allowing existing installed routers to be software-upgraded with tag edge router capabilities.

A key part of a tag edge router's job is to examine incoming packets and apply the proper tag to the packet before forwarding the packet. Because tag switching separates the forwarding operation in IP nodes from its reliance on the destination IP address, tag switching provides great flexibility in the algorithms and techniques it supports for mapping tags to packets. Examples include:

- Destination prefix: In this method, the tag edge router uses the normal router procedure of matching the packet's destination IP address against the destination prefix entries in the router's forwarding tables, which determines the next hop for the packet. In a tag edge router, this lookup will also yield a tag value to apply to the packet. This technique allows traffic from multiple sources, going to the same destination, to share the same tag (in addition, multiple destination prefixes can share the same tag value). Tag switching greatly economizes on the number of tags required, relative to the number of source/destination IP address combinations seen by a router, and is a key to the scalability of tag switching. This is particularly important in public Internets, where the number of source/destination address combinations can be enormous.

- Forwarding Equivalence Classes (FEC): This is a generalization of the previous method. When a router receive a packet, it must decide how to forward that packet. All packets forwarded the same way can be said to be in the same FEC, and this would form the basis for mapping tags onto packets and determining how to tag switch a tagged packet. One way to define FEC's is by destination prefix, as described above, but there are many other ways. An alternate means is to consider packets to be in the same FEC if these packets have to traverse through a common router/tag switch.

- Explicit routing: Packets can be tagged such that they flow along specified routes, allowing network managers to balance the load across trunk circuits between nodes or cope with unbalanced network topologies during a node outage. This is analogous to the use of virtual circuits in pure Layer 2 devices for Internet traffic engineering, but, as will be discussed below, can be implemented on Layer 3 routers using tag switching.

- Application flows: This method looks at both the source and destination address, as well as other Layer 3 information. This can be used to provide finer granularity in processing the tagged packets and maintain a given quality of service through the network for a specific source/destination flow of packets.

- Multicast: Tags can be assigned based on the IP multicast trees created with protocols like Protocol Independent Multicast (PIM).

- Quality of service: Tags can be assigned to individual RSVP flows, to aggregated RSVP flows, or to differentiated services classes. The tags would then be used by intermediate network nodes to properly queue tagged packets to deliver the required quality of service.

- Virtual Private Internetworking: Both the physical port (or logical port, in the case of a frame relay or ATM virtual circuit) on which a packet is received by a tag edge router, as well as its destination IP address, can be used to assign tags. By defining which ports are in a particular VPN, proper assignment of tags can create a connectionless virtual network between those ports. Since backbone nodes look at tags and not IP addresses when forwarding tagged packets, packets from different VPNs with overlapping address spaces can be accommodated.

IV. TAG SWITCHES

Tag switches are the core of a tag switching internetwork. Tags are short, fixed length labels, enabling tag switches to do simple and fast table lookups. This enables tag switches to implement the lookup and forwarding capabilities using fast hardware techniques, including ATM cell switching.

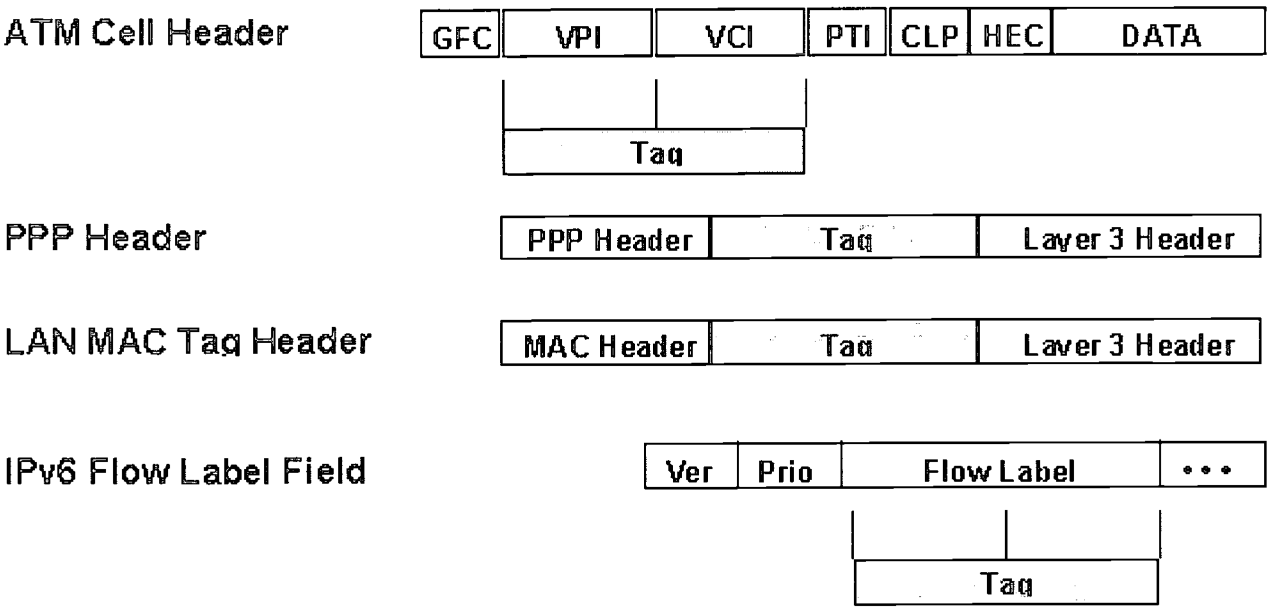
Since tag switching decouples the tag distribution mechanisms from the data flows, a wide variety of methods of associating a tag with a packet can be used and will interoperate in a tag network, including:

- In the Layer 2 header (e.g., in the VCI field for ATM cells)
- In between the Layer 2 and Layer 3 headers (e.g., for PPP or LAN applications)

This enables tag switching to be used over a wide variety of media, including ATM links, Packet-over-SONET (POS) links, Ethernet, etc. Tag switching is also not specific to IP. Since the routing protocols are separate, and are standard, tag switching can be used to support multiple Layer 3 protocols.

When outfitted with tag switching software, standard routers can act as tag switches. By supporting the tag distribution protocol, and adding the ability to switch tagged packets based on the tag values, Internet core routers can participate in a tag network backbone. For current routers, this brings the explicit routing capabilities of tag switching to pure router Internets, a significant enhancement over today's capabilities. No separate Layer 2 switching backbone is required to gain these traffic engineering benefits.

ATM switches can also be used as tag switches. To act as a tag switch, an ATM switch will implement the appropriate, standard Layer 3 routing protocols, as well as the tag distribution protocol. Tags will be placed in the VPI/VCI fields of cells by the tag edge routers, and the ATM switch will switch cells based on the VPI/VCI values, as it does for all cells. A key difference between tag switching and ATM is that standard ATM uses a connection setup procedure to allocate VCI's and program the ATM switching hardware, while tag switching uses standard routing protocols and the tag distribution protocol. The result is that ATM switches performing tag switching do not need to handle high call setup rates.



Since tag switching and ATM Forum-complaint ATM can coexist on the same ATM switch, ATM switches can provide both Internet service and ATM services on the same platform. Tag switching avoids the use of switched virtual circuits (SVC's) for highly dynamic IP packet flows and frees CPU processing power for P-NNI and the needs of longer-lived ATM virtual circuits, such as real-time voice or video flows.

V. TAG DISTRIBUTION PROTOCOL

The tag distribution protocol (TDP) provides the means by which tag switches exchange tag information with other tag switches and with tag edge routers. The tag edge routers and tag switches build their routing databases using standard routing protocols (e.g., EIGRP, BGP, OSPF). Neighboring tag switches and edge routers then distribute tag values to each other using TDP, for storage in a tag information database (TIB). Unlike standard ATM, there is no call setup procedure.

Tag information in the TIB is established prior to packet flows traversing the network. This topology-driven approach means that all packets of a flow of packets can be tag switched, and that even packets on short-lived flows can be tag switched.

Another advantage of using standard routing protocols and TDP in a tag switched network is seen when an IP Internet is built from a core of ATM switches surrounded by edge routers. In this configuration today, the edge routers are mesh connected by VC's through the ATM switches, which means that the edge routers are all peers of each other, from a routing protocol perspective. This topology will scale only up to a limited number of routers before the large number of peers causes problems with the routing protocols. The problem is that the ATM switches are transparent to the routers, and not routing peers. In a tag switched network, the ATM switches, acting as tag switches, participate fully in the hierarchical routing protocols and act as peers to the tag routers at the edges. This means that the tag edge routers see far fewer peers, and hence the size of the network, measured in number of routers, can scale to much larger sizes.

VI. TAG SWITCHING EXAMPLES

The following figures illustrate more fully how a tag switching network operates. As a baseline, figures 3 and 4 show how a standard IP router network operates. In figure 3 (see Figure 3), the routers exchange routing information via one of several standard IP routing protocols. Each node then builds routing tables that indicate how to reach specific destinations. From this information, forwarding tables are built.

In figure 4 (see Figure 4), a packet arrives on the left, and its destination IP address is looked up in the forwarding table, which indicates the output port on which to send the packet to progress it towards its destination (other information, such as MAC-layer rewrite information, is excluded here to focus on the routing and forwarding decisions). Each intermediate node, as well as the router connected to the packet's destination, all perform the same operation: look up the destination IP address from the packet's header in the forwarding table, and forward the packet as indicated.

Figures 5-7 show the same operation in a tag switching network. In figure 5 (see Figure 5), the routing table is constructed via standard IP routing protocols and algorithms, just as in the non-tag switching case. In figure 6 (see Figure 6), however, TDP is used to assign labels to the entries in the forwarding tables. In this example, downstream allocation of tags is used (i.e., the router receiving a packet from its "upstream" neighbor is responsible for selecting the tag for a route and communicating that to its neighbor). Note that tags have only local significance, just like frame relay DLCI's or ATM VCI/VPI's.

In figure 7 (see Figure 7), the same packet arrives from the left. The edge router does the normal IP lookup, just as before, to find the outbound link on which to send the packet. In this case, however, the forwarding table indicates that the next hop is a tag switch-enabled router, and indicates the tag to use for forwarding packets on this route (i.e., for packets that match a specific destination prefix). A tag header is added to the packet, in between the IP header and the link layer header (e.g., PPP), and the packet forwarded. Intermediate nodes forward the packet by looking up the tag in the forwarding table; they do not need to look up the IP address. The router at the right strips off the tag prior to delivering the packet to its destination outside the tag-enabled network.

Figures 8-10 illustrate this same operation in an ATM network. Creating the routing tables happens just the same as in the previous examples. What is worth pointing out here is that the

ATM switches are running IP routing protocols and communicating with the edge routers as IP peers. This is different from the normal ATM case, where PNNI is used to route ATM virtual circuits. In figures 8-9 (see Figure 8-9), TDP is used to allocate tags to routes, with a difference. In the ATM case, tags are allocated via downstream-on-demand, which means that upstream tag switches request tags from their downstream neighbors, and the downstream neighbors select tag values and reply. This difference is required to enable current ATM switching fabrics, which cannot provide multipoint-to-point merging of virtual circuits, to keep the cells from different packets distinct.

Figure 10 (see Figure 10) then show the forwarding operation for tag switching with ATM. The packet arrives on the left, a normal IP lookup is performed by the tag edge router, and the next hop is determined. Since the next hop is a tag-enabled ATM interface, the packet is segmented into ATM cells, and the tag is placed in the ATM cell header. Subsequent ATM tag switches forward the cells using the standard cell relay actions of their switching fabrics, although in this case the switching fabrics are set up based on IP routing tables, instead of on ATM signalling. At the right-hand edge router, the packet is reassembled and a normal IP packet delivered to its destination.

VII. TAG SWITCHING AND STANDARDS

There are many different proposals for combining layer 2 switching and layer 3 routing, and this proliferation is likely to lead to confusion in the industry and a general delay in deployment. To speed up adoption of this new technology area, a single, formal, multivendor standard is needed.

To this end, the Internet Engineering Task Force (IETF) has formed a new working group to standardize technology in the area related to tag switching. Called Multi Protocol Label Switching (MPLS), this new group is blending the best ideas from several proposals into a single standard. Several vendors are contributing to this effort, including Cisco, IBM, Toshiba, Bay Networks, Ericsson, and others. References to many of the working group documents, as well as to Internet drafts on tag switching, are provided at the end of this paper.

Currently the working group is creating the basic MPLS documents, including the architecture specification, the label distribution protocol (LDP), the encapsulations for different media types, procedures for ATM MPLS, and a specification for using RSVP with MPLS. The goal is to complete work by the end of 1998 or in early 1999. The encapsulation, ATM, and RSVP documents are quite stable, and the latest draft of the LDP specification (August 1998, as of the writing of this paper), has made major strides towards the level of specificity required to support interoperable implementations, and is in good enough shape to support interoperable implementations for a subset of its features.

VIII. SUMMARY

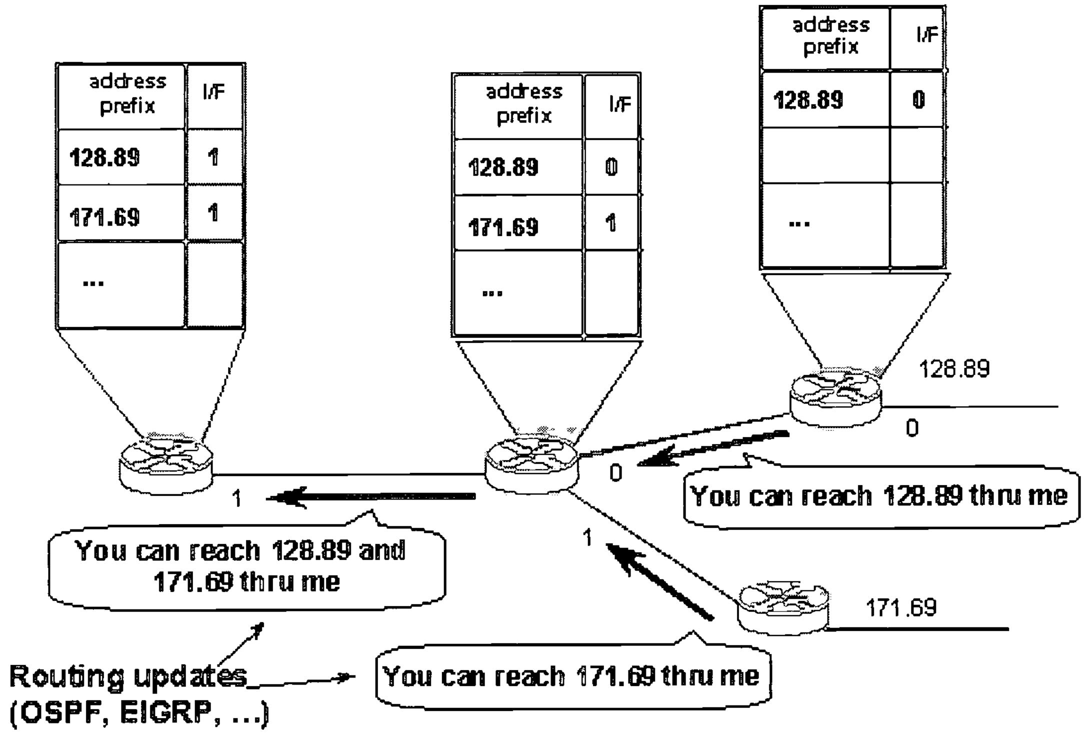
Tag switching is a new technology based on the concept of label swapping. It provides scalability through integrated support of ATM switches within an Internet core, enables IP features on ATM switches, and provides traffic tuning capabilities on both ATM switches and on standard Layer 3 routers. The IETF MPLS working group is now developing standards for label swapping with significant input from Cisco on tag switching.

IX. REFERENCES

1. Rekhter, et. al., "Cisco Systems' Tag Switching Architecture Overview", RFC 2105.
2. Callon, et. al., "A Framework for Multiprotocol Label Switching", draft-ietf-mpls-framework-02.txt
3. Rosen, et. al., "Multiprotocol Label Switching Architecture", draft-ietf-mpls-arch-01.txt
4. Andersson, et. al., "LDP Specification", draft-ietf-mpls-ldp-01.txt
5. Rosen, et. al., "MPLS Label Stack Encoding", draft-ietf-mpls-label-encaps-02.txt
6. Davie, et. al., "Use of Label Switching with ATM", draft-davie-mpls-atm-01.txt
7. Davie, et. al., "Use of Label Switching with RSVP", draft-ietf-mpls-rsvp-00.txt
8. Rekhter, et. al., "Carrying Label Information in BGP-4", draft-ietf-mpls-bgp4-mpls-01.txt
9. Davie, et. al., "Explicit Route Support in MPLS", draft-davie-mpls-explicit-routes-00.txt
10. Heinanen, et. al., "VPN support with MPLS", draft-heinanen-mpls-VPN-01.txt
11. Doolan, et.al., "Tag Distribution Protocol", draft-doolan-tdp-spec-00.txt
12. Lin, et. al., "Tag Switching Support for Classes of Service", draft-lin-tags-cos-00.txt

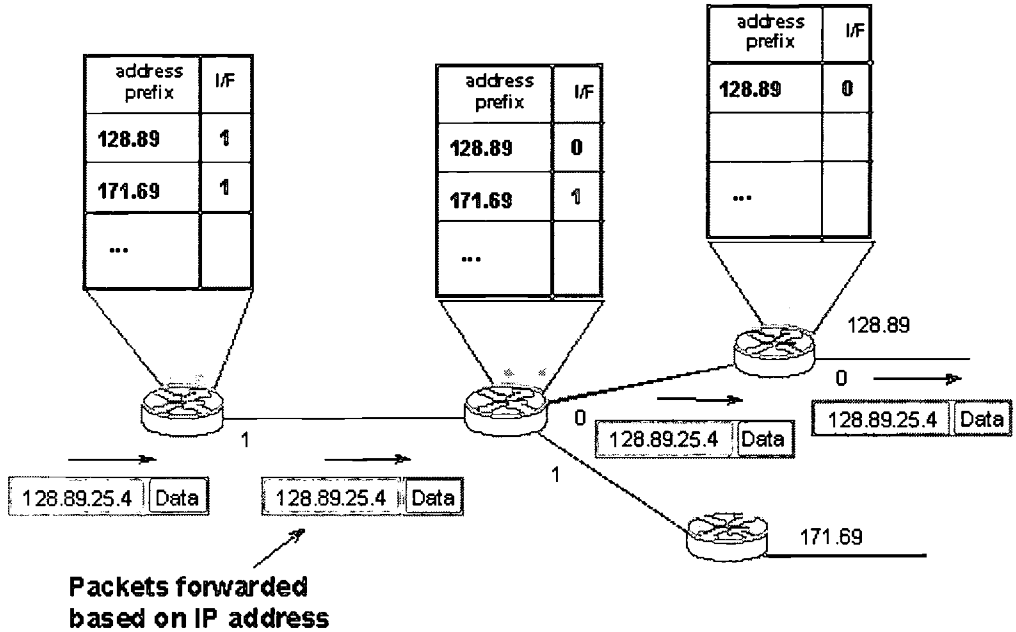
Return to Top View Full-screen

Figure 3: Distributing Routing Information



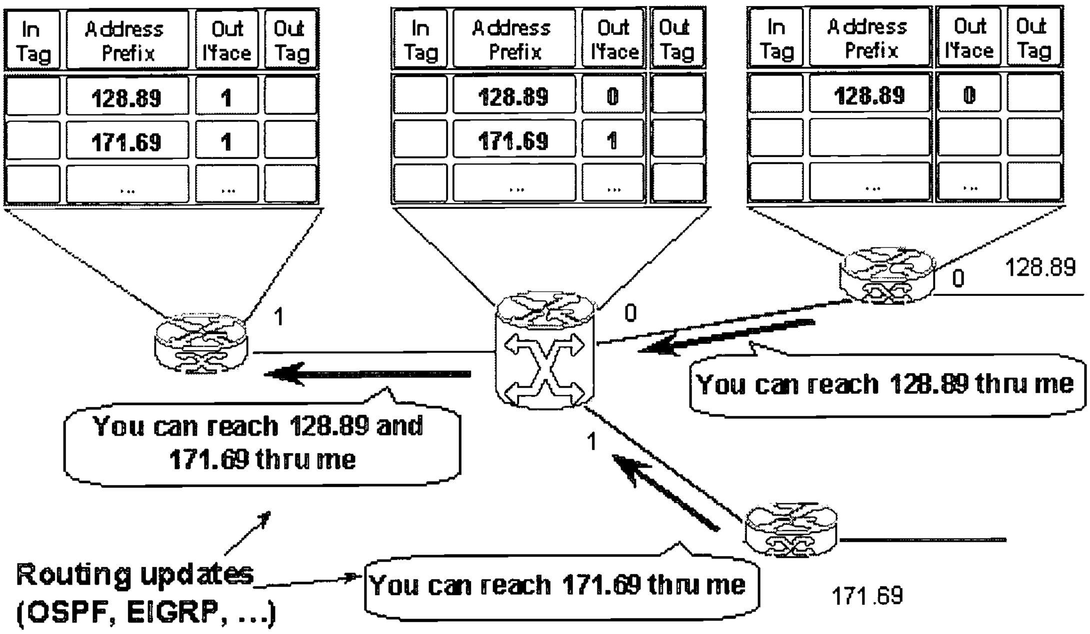
Go Back

Figure 4: Forwarding Packets



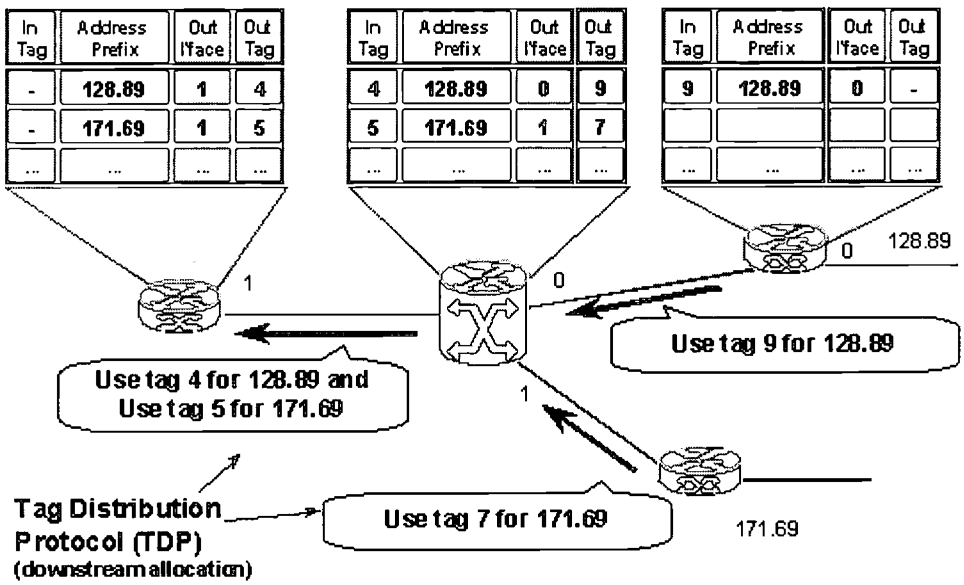
Go Back

Figure 5: Routing Information Distribution with Tag Switching



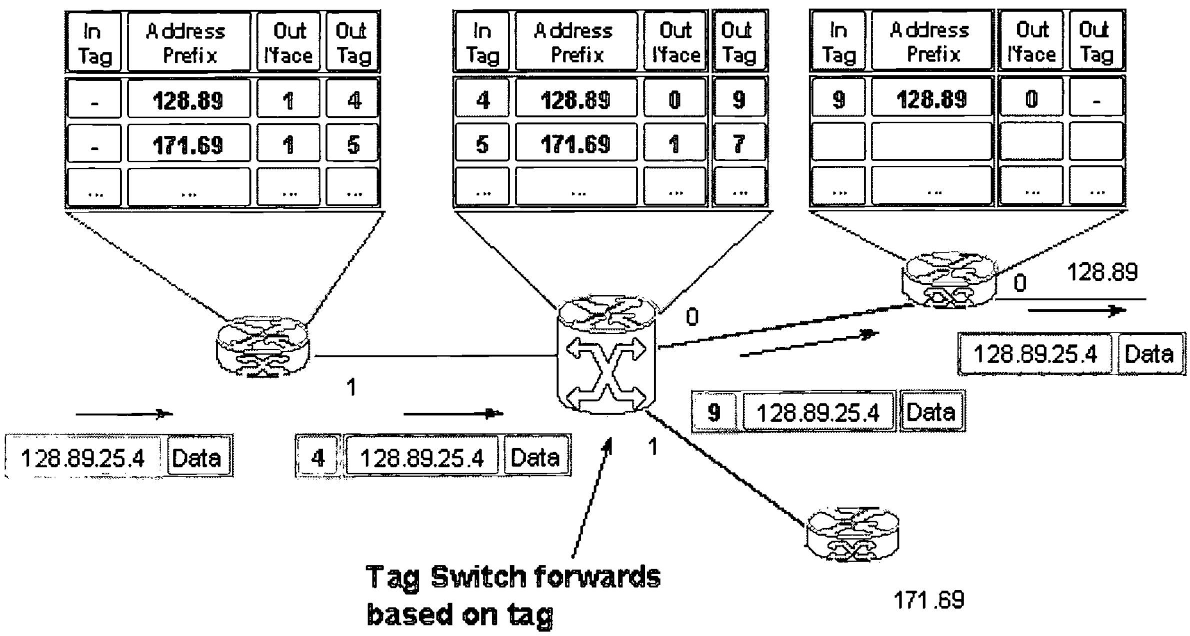
Go Back

Figure 6: Assigning Tags



Go Back

Figure 7: Forwarding Tagged Packets



Go Back

Figure 8: Requesting ATM Tags

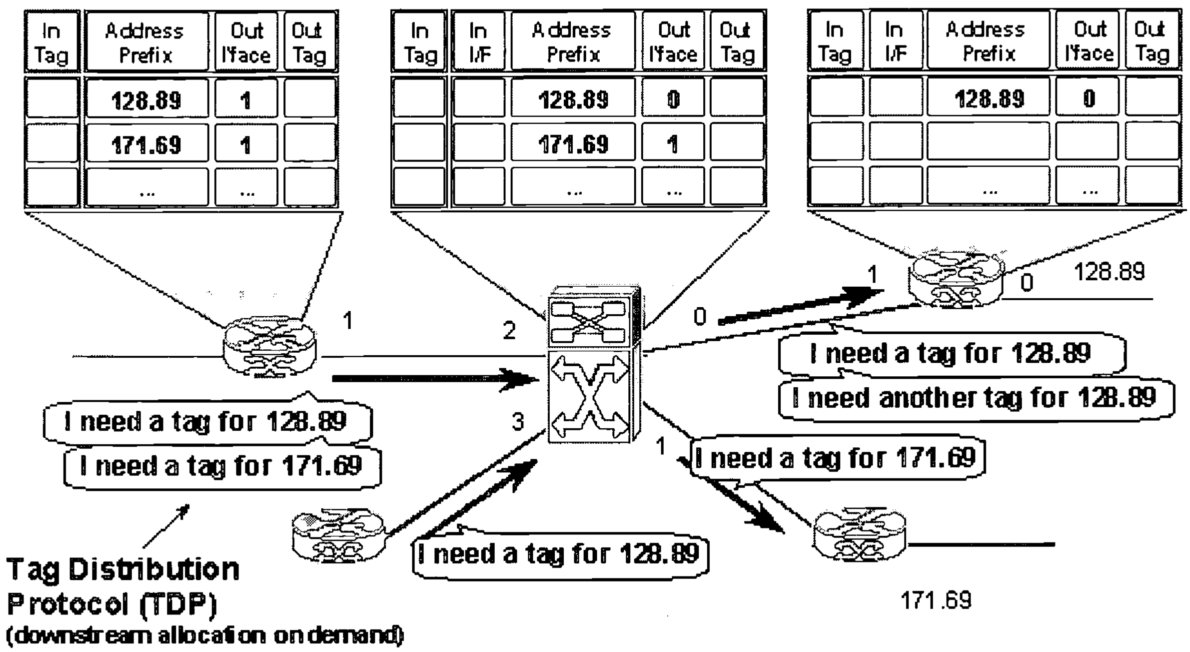
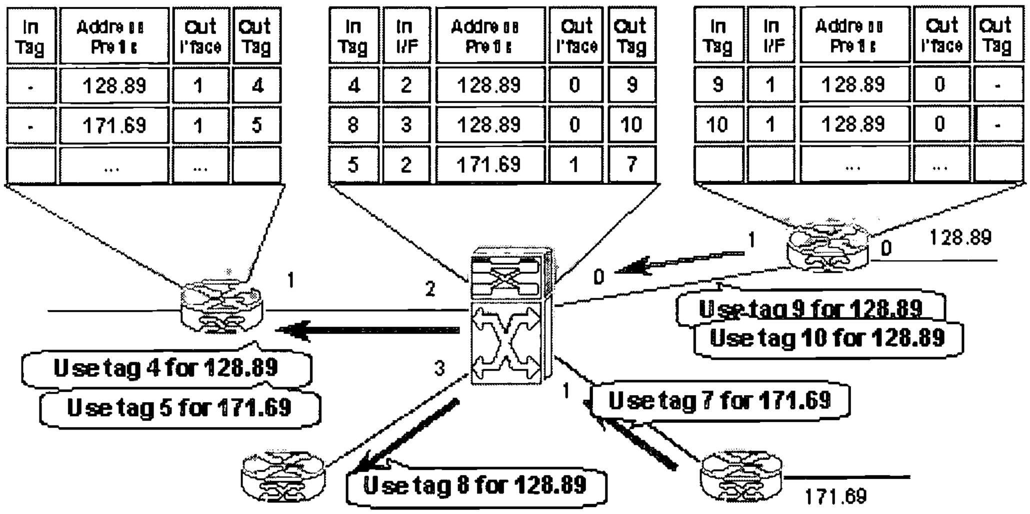
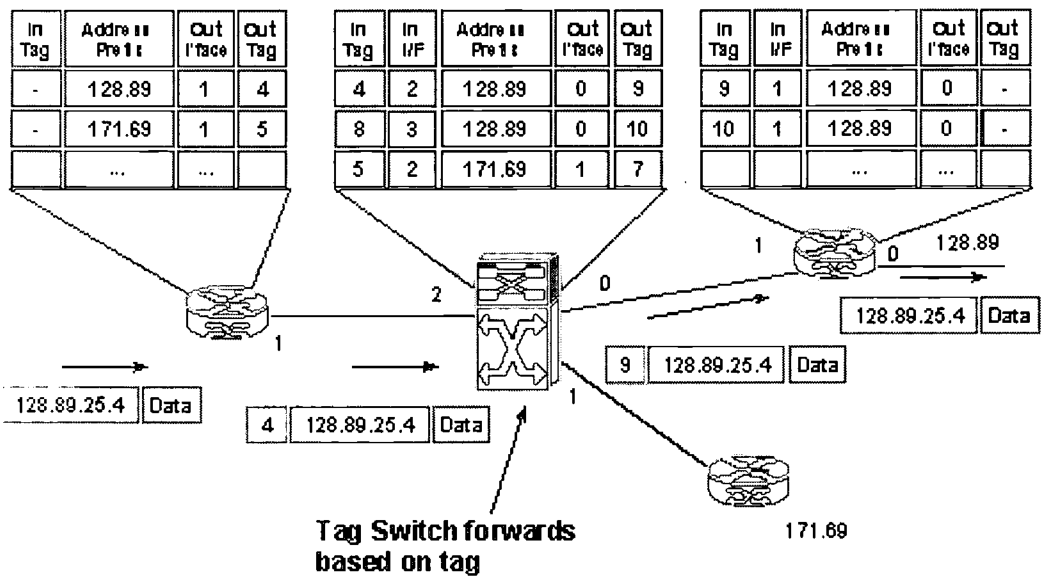


Figure 9: Assigning ATM Tags



Go Back

Figure 10: Packet Forwarding with Tagged Cells



Go Back

On Pricing Scheme and Traffic Monitoring Method in ATM Networks

Atsuo Hatono

Hitachi, Japan

ABSTRACT

This paper discusses a pricing scheme and a traffic monitoring method in asynchronous transfer mode (ATM) networks which is an indispensable infrastructure for multimedia communication. This paper shows that in ATM networks the per-cell pricing might benefits high busty traffic with high peak cell rates and/or large burst sizes and the monitoring method for burst sizes and peak cell rates for pricing to reflect the influence of these two traffic parameters. This proposed monitoring method is based on the duel leaky bucket recommended by ITU-T.

View Full Text

On Pricing Scheme and Traffic Monitoring Method in ATM Networks

I. INTRODUCTION

Recent technology progress in both computers and electronic communications drives evolution of multimedia communications. In multimedia communication, information are mingled with both delay sensitive information such as voice and video and loss sensitive information such as data. Furthermore, the volume of information to be transmitted varies with terminals and/or information source situations. These two characters of multimedia communications strongly require the variable bit rate(VBR) services based on guaranteed performance to communication infrastructures.

The asynchronous transfer mode (ATM) networks which attempt to provide guaranteed performance to VBR services is expected to be one of indispensable infrastructure for multimedia communications. The conventional networks have been constituted with the telephone networks and the packet networks for data communications. The telephone networks have guaranteed performance but only to circuit-switched services. On the other hand, the packet networks for data communications have provided VBR services but only on a best effort basis which cannot guarantee performance. The ATM networks integrate the circuit switched networks with the packet switched networks.

To establish the ATM networks as the infrastructure of multimedia communications, we shall examine not only their technological aspect but their economical aspects. Particularly, it is indispensable for the above purpose that the examination of the pricing scheme for depreciation of network resource. However, pricing scheme have not well examined for the guaranteed VBR services provided by the ATM networks.

The pricing scheme should depend on the characterization of user information streams, and the desired quality of services(QOS). The conventional networks have adopted the time pricing and the per packet pricing. The time pricing is for the telephone networks on which terminals occupy the transmission lines all through their call duration. The per packet pricing is for the packet networks on which terminals use the transmission lines by individual packets. These two pricing schemes reflect with fidelity the characterization of the telephone networks and the packet networks.

In the ATM networks, the guaranteed VBR services are achieved through statistical multiplexing of heterogeneous traffic. To examine the pricing schemes for the guaranteed VBR services, we shall analyze the dependence of QOS on the characterization parameters of user information streams under the statistical multiplexing. This analysis is considered to be difficult owing to explosion of calculations in cell loss approximation models[12]. However, I have developed an individual cell loss approximation for heterogeneous traffic[6] which can describe explicitly the dependence of QOS on the characterization parameters of user information streams under statistical multiplexing of heterogeneous traffic. Thus, based on this approximation, this paper discusses a pricing scheme and a traffic monitoring method for the guaranteed VBR services.

In Section II, we showed that in ATM networks the per-cell pricing might benefits high busty traffic with high peak cell rate and/or large burst size through an individual cell loss approximation for heterogeneous traffic[6]. Furthermore, we also proposed a pricing scheme which can reflect the bursty nature influenced with burst sizes and peak cell rates. In Section III, we proposed the monitoring method for burst sizes and peak cell rates based on the duel leaky bucket recommended by ITU-T

In this paper, the $<v_i>$ denotes the sustainable cell rate of the i-th traffic type. The v_i denotes the peak cell rate of the i-th traffic type. The N_i denotes the multiplexed call number of the i-th traffic type. The $1/\mu_i$ denotes the mean burst size of the i-th traffic type. The C_{i2} denotes the squared coefficient of variations of the i-th traffic type. The V denotes the capacity of the output line. The V denotes the capacity of the output line. The?denotes the load of total traffic. The x_0 denotes the buffer size. TheSdenotes the sum of traffic types.

II. PRICING SCHEME

1. *Cell Loss Approximation*

The ultimate goal of pricing is to depreciate for network resources constituted with transmission lines and switching nodes. The pricing scheme shall depend on the demanded network resource quantity to achieve the desired quality of services(QOS).

To implement guaranteed VBR services, the ATM networks separate user information into small fixed-length packets called ‘cells’. These cells are sent through shared transmission line and routed by switching nodes with shared buffer. Thus, the network resources for the guaranteed VBR services is two dimensional quantity which consists of bandwidths of transmission line and buffer lengths in switching nodes. Furthermore, the characterization of user information stream can be identified with three dimensional quantity which consists of a peak cell rate, a sustainable cell rate and a (maximum) burst size[10]. In multimedia communication, traffic sources have two traffic periods which switch alternatively: the active period and the silent period. During the active periods, the traffic sources generate cells at a peak cell rate. During the silent periods, the traffic sources generate nothing. The peak cell rate and cell numbers generated depend on terminals and/or information source situations during the active periods. Thus, to examine the demanded network resource quantity on the guaranteed VBR services, we need a cell loss approximation model which can 'explicitly' describe the dependence of QOS on the characterization parameters of user information streams under statistical multiplexing of heterogeneous traffic.

In recent years, many cell loss approximations have been proposed, based on the conventional operational research(OR) approaches[16-17]. However, the these works[12-14] cannot be practically extended to the statistically multiplexed heterogeneous traffic which consists of different burst traffic types. This extension brings the explosion of dimension of variables to model with fidelity multiplexed heterogeneous traffic as a Markov process. Thus, these methods cannot satisfies the above requirement of the characterization for pricing.

I have developed the individual cell loss approximation for heterogeneous traffic[6] under statistical multiplexing of heterogeneous traffic. To break thorough the limit of the conventional OR approaches, this approximation adopted the large deviation principle[2] and the subspace and orthogonal projection approach[4-6] based on the linear filter theory[1]. This approximation can be applied even if burst size distributions are General distributions, though burst interval distributions still remain to be restricted to exponential distributions.

Therefore, the individual cell loss probability P_k is approximately given by

$$P_k?H_0\{0.4\exp(?3\text{ß}_0\, x_0)?0.6\exp(?\text{ß}_0\, x_0)\}$$

$$?H_k\{0.4\exp(?3\text{ß}x_0))?0.6\exp(?\text{ß}x_0))\}\quad(2.1)$$

where theß denotes the exponential parameter for the maximum queue fluctuation mode in burst level, theß$_0$ denotes the exponential parameter for the maximum queue fluctuation mode in cell level, the H_k denotes the individual burst overflow probability and H_0 denotes the cell overflow probability.

In Eq. (2.1), theß is given by

μe (???)

ß?-------, (2.2)

(1-V/S Nivi)

(1- <vi>/vi)(1+Ci2)

SNi<vi>----------

? ?μi

----?---------------. (2.3)

μe SNi<vi>

Likewise, theß0 is given by

μ0 (???)

ß0?---------, (2.4)

(1?1/S Ni)

1 S Ni <vi>(1- <vi>/V)(1-vi/V)/2

----?----------------. (2.5)

μ0 S Ni<vi>

the individual burst overflow probability Hk is approximately given by

m V

Hk?S {1- -----}m?k{M/Max}r {1- M/Max} m-r (2.6)

rvq>V-vk rv+vk

B(m,p,r)= m?r{M/Max}r {1- M/Max}m-r (2.7)

$m?\ Int(M\{M_{ax}?M\}/s_2+1)$ (2.8)

$v\ ?\ M_{ax}s_2/M\{M_{ax}?M)\}$ (2.9)

$M_{ax}?SN_iv_i?v_k$ (2.10)

$M\ ?\ SN_i<v_i>?<v_k>$ (2.11)

$s_2?\ SN_i<v_i>\{v_i?<v_i>\}?<v_k>\{v_k?<v_k>\}$ (2.12)

through the generalized Edgewoth expansion[3]. Likewise, the cell overflow probability H_0 is approximately given by

$H_0?\{1/2\}?\{1-1/S\ N_i\}$. (2.13)

Comparisons with simulation results for heterogeneous traffic multiplexed with high, medium and low speed traffic showed that cell loss probability were within or close to 95% confidence intervals for large buffer switches. Figure 1 showed the results for burst traffic of which burst sizes generate exponential distributions. Figure 2 showed the results for burst traffic of which burst sizes generate deterministic distributions. Figure 3 showed the results for burst traffic of which burst sizes generate Gdistributions. These figures showed that cell loss probability were within or close to 95% confidence intervals for large buffer switches.

It is the advantage of this model that can describe explicitly the dependence of cell loss probability on both switch node parameters(bandwidth and buffer length) and user information characterization parameters(sustainable cell rate, peak cell rate and burst size) under statistical multiplexing of heterogeneous traffic. This explicit approximation enable us to examine the demanded network resource quantity to achieve the desired QOS.

2. *New Effective Bandwidth*

This section proposes a pricing scheme for the guaranteed VBR services based on the individual cell loss approximation described in the previous section. This approximation shows that the cell loss probability not only depends on sustainable cell rates but on burst sizes and peak cell rates. This result implies that high busty traffic with high peak cell rates and/or large burst sizes can obtain unreasonable benefits under the per-cell pricing which only reflects the influence of sustainable cell rates. The pricing scheme should reflect not only the influence of sustainable cell rates but also the influence of burst sizes and peak cell rates in ATM networks.

The ultimate purpose of pricing schemes is to charge fairly depreciation for network resources with individual information sources[11]. Pricing schemes should be based on an additive quantity reflected with influences both from user information and network resources.

The conventional packet networks have adopted the per-packet pricing. This pricing scheme is additive with respect to transit packet numbers. However, in the guaranteed VBR services, the demand network resources depend on required QOS and burstiness of information even for the same transit packet numbers. The high QOS increase the demand network resources. The high burstiness also increases the demand network resources. Furthermore, in the ATM networks, cells are discarded not only in bit error rate but also multiplexing processes in switching nodes. Thus, accumulated cell numbers in input ports is not equal to the transit cell numbers on ATM networks. For the above reason, the per-cell pricing scheme is not suitable for the guaranteed VBR services. A new pricing scheme should be required to charge fairly with individual information sources the demanded resources depend on required QOS and burstiness of information.

The effective bandwidths have been proposed as a pricing scheme for guaranteed VBR services[11]. It should be a one dimensional quantity converted from the multi-dimensional manifolds of the guaranteed VBR services constituted with four dimensional influences of characters of user information and two dimensional influences of bandwidths and buffer lengths. The effective bandwidth scheme should be additive with respect to individual network resources when buffer lengths are large enough. In other words, the sum of the effective bandwidth of individual sources is equal to the bandwidth allocated with statistically multiplexed heterogeneous traffic. This additive property ensures the theoretical ground of pricing.

Many conventional traffic models have been found to have approximations of effective bandwidth[12-15]. However, all of them have obtained under the ideal situation where statistical multiplex gain comes to saturation[12-14]. These conventional approximations of the effective bandwidth is not safe approximation and is too complex to use in real network operation. Furthermore, these conventional models[16-17] can be applied only to the ideal traffic of which burst intervals and burst sizes are exponential distributions. However, burst sizes of data traffic[7] and video traffic[8] exhibit a bipolarized distribution(a mixture of more than two distributions). The conventional approximations of the effective bandwidth can not satisfy the above requirement of multimedia traffic. Then, from the individual cell loss approximation described in the previous section, this paper derive a new simple safe approximation of the effective bandwidth under statistically multiplexed heterogeneous traffic.

Since effective bandwidths are valid for large buffer switching nodes, the individual cell loss approximation of Eq.(2.1) can be folded back to only one exponential function as this:

?k? 0.6Hk exp(?ßx0) (2.14)

which corresponds to the maximum fluctuation mode.

The statistical multiplexing effect consists of bandwidth effect and buffer effect. The bandwidth effect result from peaks of one traffic source coinciding with the valleys of another sources, since the sum of instantaneous rates of statistically multiplexed traffic sources tend to be smaller than the sum of the peak cell rates of individual sources. The buffer effect result from the buffering of traffic sources. Buffers reduce the burstiness of traffic by smoothing out the uneven arrivals of bursts, and thus less bandwidth required to serve the same amount of traffic after buffering.

As illustrated in Figure 4 , the buffer effect becomes the dominant factor for QOS in real network operations. Let the vertical axis be the logarithm of cell loss probabilities and the horizontal axis be the buffer lengths. In this case, the bandwidth effect is expressed with an intersection of a cell loss probability curve with the vertical axis. On the other hand, the buffer effect is represented with the asymptote of the cell loss probability curve. In real network operations, cell loss probabilities will be suppressed below 10^{-11}. Furthermore, buffer length will be more than 1000 cells. In this case, neglecting of the bandwidth effect becomes a safe approximation. It gives cell loss probability at 20% short buffer lengths. Thus, for real network operations, neglect of the bandwidth effect does not bring considerable degradation in accuracy.

Based on the above concept, we can neglect the bandwidth effect among the statistical multiplexing effects. In Eq.(2.14), the buffer effect is represented with the exponential function and the bandwidth effect is represented with the burst overflow rate. To substitute the H_k representing bandwidth effect with one which the upper band of probability, the upper band of cell loss probability P_u becomes as this:

?u?0.6exp(?ßx0). (2.15)

Then, the Eq. (2.15) can be solved with respect to the bandwidth. It is given by

(SNivi) µe x0

V?----{?---?1±vD }, (2.16)

? A

where the A is defined as this

A=?ln?u + ln0.6 (2.17)

and the D is defined as this:

µe x0 µe x0(SNi <vi>)

D ?(---?1)2?4--------. (2.18).

A A (SNi vi)

Since effective bandwidth works for large buffer switches, we can also assume as this:

?µe x0 »A. (2.19)

Then, we expand Eq.(2.18) and contributions of higher than the second order Taylor terms, we obtain the approximation of vD such as this:

µe x0 (SNi <vi>)

2 --------

µe x0 A(SNi vi)

vD ?(---?1){1?----------}. (2.20).

A µe x0

(---?1)2

A

Further, we expand Eq. (2.20) and neglect contributions of higher than second order terms since

(A/µe x0)«?. (2.21)

Finally, We obtained an approximation of the new effective bandwidth as this:

V ?(SNi <vi>){?? (A/µe x0)}

<vi> (1+Ci2)(?ln?u+ ln0.6)

?SNi<vi>{??(1?--) ---------- }. (2.22).

vi ?µe x0

Effective bandwidth schemes should be additive with respect to individual network resources. Then, let the individual terms under the sum notation be defined as this:

<vi> (1+Ci2)(?ln?u + ln0.6)

Vi ? <vi>{??(1?--)------------}. (2.23)

vi ?µe x0

Then, the equation (2.23) implies that the sum of the Vi which is a function of traffic descriptors of individual information sources is equivalent to the bandwidth allocated with statistically multiplexed heterogeneous traffic. Therefore, I conclude that the Vi expressed in Eq.(2.23) represents the demanded network resource quantity allocated to individual information sources to achieve the desired QOS and can be used for pricing.

III. PROPOSAL OF MONITORING METHOD

1. *Limit of Conventional Methods*

As described in the previous section, the pricing scheme based on the new effective bandwidth requires monitoring methods for of both peak cell rates and burst sizes. However, the observation of peak cell rates and burst sizes have been considered to be difficult[9].

The conventional monitoring method adopted a counting process of cell arrival in a constant period called ' window'[9]. As the same manner of the observations in signal processing, these methods are classified with the moving window and the jumping window depending on their movement ways of windows [9]. However, as illustrated in Figure 5, this method cannot distinguish the state in which only one burst extends over two observation windows with the state in which more than two bursts exist in one window. This phenomenon cannot be solved from adjustment of window sizes. Narrowing of the window sizes bring the increase of the false probability for which only one burst extends over two observation windows. On the other hand, extension of the window sizes bring the increase of the false probability for more than two bursts exist in one window. These false probabilities are expect to be more serious under intensified fluctuations of cell intervals in statistically multiplexed bursts. Thus, these proposed monitoring methods cannot provide observation values of peak cell rates and burst sizes.

2. *Burst Synchronous Method*

To monitor peak cell rates and burst sizes, observation periods should be synchronized with both burst arrivals and burst termination. As described in the previous section, the conventional method cannot satisfy the requirement of the pricing scheme based on the new effective bandwidth. Thus, this paper proposes a new monitoring method which can detect burst arrival and burst termination. This new method called 'the burst synchronous mechanism'. To reduce additional cost for ATM switching nodes, this new method can shared the duel leaky bucket mechanism[10] with the usage parameter control (UPC) .

The leaky bucket mechanism[9] is the most popular traffic monitoring method.

In this mechanism, a token pool is counted up for each cell arrival and is counted down periodically to absorb bearable fluctuations of traffic. Unbearable fluctuations can be detected with overflows of the accumulated value beyond a threshold in the token pool. However, the leaky bucket mechanism is not equipped with ways to obtain observation vales.

The dual leaky bucket mechanism recommended by the inter national telecommunication union telephone section (ITU-T) cascades two leaky buckets. The first bucket is for peak cell rates. The subtraction rate of the first bucket is selected to be close to a peak cell rate. The second bucket is for sustainable cell rates. The subtraction rate of the second bucket is selected to be close to a sustainable cell rate.

In addition to a duel leaky bucket, the burst synchronous mechanism that I proposed in this paper can be constituted with a bucket depth differential monitor and a burst counter. The second bucket depths are stored to a shift register in the bucket depth differential monitor. The burst counter is counted up in every cell arrival and is clear to zero when the bucket depth differential monitor detects burst termination.

To detect burst arrival and burst termination, this mechanism uses behavior of the second bucket. As illustrated in Figure 7, the accumulated value in the second bucket alternates from decrease to increase in new burst arrivals and switched from increase to decrease in burst termination. Based on this behavior, the bucket depth differential monitor can detect both burst arrival and burst termination with comparison of the current depth with the previous depth.

The observation periods of the shift register should select to be close to the half of minimum burst interval to observe more than equal to two cell arrive in one period while a burst is alive. Therefore, the relations between burst situations and the bucket depths are as followers:

- More than equal to two cell arrivals in one period

  This implies that the burst is still alive and that the depth of the bucket increases.

- Only one cell arrival in one period

  This implies that the burst has terminated in this period. In this case, the depth of the bucket increases by one(+1) or keeps unchanged(+-0).

- No cell arrival in one period

  This implies that the burst had already terminated in the previous period. In this case, the depth of the bucket keeps unchanged(+-0) or decreases by one(-1).

These behaviors still keep unchanged even for fluctuating burst traffic in cell intervals. Thus, the burst arrival can be detected with the trigger that one cell arrives when the burst counter = 0. The burst termination can be detected with the trigger that the bucket keeps unchanged(+-0) or decreases by one(-1). In this way, the observation periods should be synchronized with both burst arrivals and burst termination.

In the burst synchronous mechanism, burst sizes can be obtained from the accumulated cell arrival number in the burst counter. Peak cell rates can be obtained from the accumulated cell arrival number in the burst counter, burst arrival time and burst termination time. Therefore, the burst synchronous mechanism can observe both peak cell rates and burst sizes.

Sustainable cell rates can be obtained from the of the accumulated non-zero depth number in a constant periods and a subtraction interval. The leaky bucket mechanism is equivalent to a kind of queueing simulator. The token corresponds to a transaction of queueing systems. The accumulated value of the token pool corresponds to a queue length. The subtraction interval corresponds to a service time. Thus, the accumulate non-zero depth number corresponds to idle time of the sever.

Based on these discussions, the burst synchronous mechanism can provide observation vales of burst lengths, peak cell rates and sustainable cell rates without heavy burden to hardware of switching nodes. In this way, the pricing scheme based on the new effective bandwidth can be implemented. Therefore, the pricing scheme can depend on the demanded network resource quantity to depreciate for network resources constituted with transmission lines and switching nodes.

IV. CONCLUSIONS

This paper discusses a pricing scheme and a traffic monitoring method in asynchronous transfer mode (ATM) networks. The pricing schemes for the granted VBR services require monitoring of both peak cell rates and burst sizes. This paper proposed the burst synchronous mechanism as a monitoring method for lengths and peak cell rates. This monitoring method can be implemented only to supply a burst counter and a bucket depth differential monitor with the duel leaky bucket recommended by ITU-T.

V. REFERENCES

1)L.A. Zadeh and C.A.Densoer,"Linear System Theory", McGraw-Hill(1963)

2)A J. A. Bucklew, "Large Deviation Techniques in Decisions, Simulation, and Estimation," John Wiley & Sons, Inc. (1971)

3)K. Takeuchi, "Approximation for Probability Distributions" Kyouiku-shuppan (1975) (in Japanese)

4)A. Hatono,"Evolution of the Subspace Method to ATM Traffic Analysis", Proc. ICC'96, pp 1596-1600

5)A. Hatono and K. Kawakita, "Cell Loss Approximation for Heterogeneous ATM Traffic Based on the subspace and Orthogonal Projection Approach",Trans. IPS of Japan , Vol.38, No.3, pp339-409 , March 1997 (in Japanese)

6)A. Hatono and K. Kawakita, "An Individual Cell Loss Approximation for Heterogeneous ATM Traffic Based on the Linear Filter Approach" , Trans. IPS of Japan , Vol. 39, No. 1, pp 111-122, Jan. 1998(in Japanese)

7)J. F. Shoch, et al., "Measured Performance of an Ethernet Local Networks", Comm. ACM, Vol. 23, No. 12, pp 771-721, December 1980

8)D. M. Lucanttoni, et al., "Methods for Performannce Evaluation of VBR Video Traffic Models", IEEE/ACM Trans. Netwoking, Vol. 2, No. 2, pp176-180, April 1994

9) E. P. Rathgeb, "Modeling and Performance Comparison of Policing Mechanisms for ATM Networks ", IEEE JSAC, Vol. 9, No. 3, pp325-334, April 1991

10) ITU-T Recommendation I.371

11) S. Jordan and H.Jiang, "Connection Establishment in High-Speed Networks", IEEE JSAC, Vol. 13, No. 7, pp1150-1161, Sept. 1995

12)R. Guerin, et al., "Equivalent Capacity and its Application to Bandwidth Allocation in High-speed Networks", IEEE JSAC, Vol. 9, pp. 986-981, Sept. 1991

13)G. Kesidis et al., "Effective Bandwidth for Multiclass Markov Fluid and other ATM Sources", IEEE/ACM Trans. Netwoking, Vol. 1, pp.424-428, Aug. 1993

14)A. I. Elwalid et al., "Effective Bandwidth og General Mokovian Traffic Sourecs and Admission Control of high Speed Networks", IEEE/ACM Trans. Netwoking, Vol. 1, pp. 329-343, June 1993

15) A. Hatono et al.,"A Performance Analysis Model for Shared ATM Switches by a Fluid Approximation"

IEICE Technical Report, SSE90-105, Dec. 1990(in Japanese)

16) K. Heffes et al., "Markov Modulated Characterization of Packtized Voice and Data Traffic and Related Statistical Multiplexed Performance", IEEE JSAC, Vol.SAC-4, No.6, pp856-868, Sept. 1986

17) D. Anick et al., "Stochastic Theory of a Data-handling with Muiltiple Sources", BSTJ Vol. 61, No. 8, pp. 1971-1894, October 1982

Return to Top View Full-screen

Environment Adaptive Service using Dynamic Director

Yasunari Kishimoto and Teruhiro Kubota

NTT Information and Communication Systems, Japan

ABSTRACT

This paper proposes a new type of application service that adapts to a user's computer environment in a computer network. It is called an "Environment Adaptive Service". First, the necessity for an Environment Adaptive Service for computer networks and realistic service issues are discussed. Then, the necessity for the unified management of a user's computer environment information is looked at and management using directory systems such as X.500 and ldap is proposed.

View Full Text

Environment Adaptive Service using Dynamic Directory

1 Introduction

Lately, computer prices and communication costs have been dropping and this has resulted in an increase in the number of users who use computers in various ways and in various network environments. Because of this, the computer environment has been changing dynamically and it is desirable that application services be flexible and adaptable to the user's computer environment. For example, it is useful if a WWW server compresses image files or changes the size of the image according to what kind of communication interface the client uses before it transmits them to a WWW client.

First, this paper looks at the necessity for an Environment Adaptive Service using dynamically changing information, what a user's computer environment is, and realistic service examples. Then it looks at the method used for managing dynamically changing information about a user's computer environment by using directory systems such as X.500 and ldap, which have been used to manage relatively static information such as telephone numbers and e-mail addresses.

2 Environment Adaptive Service

In the case where a user uses several computers and communication media, the user's computer environment is dynamically changing. Here, a user's computer environment means the user's computer hardware and software (such as CPU, memory, hard disk, communication interface, operating system, application program, and so on). The case where a user uses a high-performance PC in his office and a PDA when he is out is a good example of this dynamic change. In this example the CPU power changes. There is also the case where a user connects to a network using a LAN interface in his office and using a mobile phone when he is out. In this example the communication interface changes.

Most existing application services on networks are built the same way. That is without regard to this change. This is in spite of whether user wants it or not. This results in two problems, explained in the following by using real examples.

The first problem is that if a user's computer environment changes with respect to ability, and the contents and quality of the application service do not change, the environmental change has much influence on the application service, for example response time. We consider the case where a user downloads a 100 Kbytes still image file. If the user downloads the still image file using two different communication interfaces, a 10-Mbps LAN interface and a 28.8-Kbps modem interface, for the former it takes about 0.1 secs to finish the download, but in the latter about 28 secs. If a user's computer environment changes from the former to the latter, the user will clearly notice that the download time is longer. If the server presents its service in the same way without regard to the user's computer environment, it cannot shorten the download time.

The second problem is that if an application service sends data, it cannot present the data in a form that will adapt to the user's computer. For example, consider the case where a user reads e-mail from a POP3 server and assume that this e-mail has an attached file. If this file format is not supported by the operating system on the user's computer, the user cannot read the attached file.

To resolve these problems, it is important to modify application services according to user's computer environment. For the first problem, the transmitting time was shortened when the server compressed the image file or changed the size of the image according to communication speed. This decrease in the size of the image file resulted from a change in the user's transmitting policy, giving transmitting time higher priority than image quality. For the second problem, the POP3 server should convert the file format to one usable by the user's operating system. We call an application service that changes according to the user's computer environment, an "Environment Adaptive Service". By generalizing the above-mentioned problems, we can see that there are two types of Environment Adaptive Service.(1) An application service that changes in quality according to user's quality policy and the ability of the application service; for the case where a user's computer environment changes.(2) An application service that presents accompanied data in a form acceptable to user's computer.

In the following, two realistic service examples are shown. In these examples, an application service is adaptable to the communication interface used by the user's computer. The first example is an image file compression service by a WWW proxy server. This service enables a WWW proxy server to automatically compress image files from WWW servers and send them to a user's WWW browser when the bandwidth between the user's computer and the network on which the WWW proxy server exists is narrow. The second is an e-mail message filtering service using a POP3 server. This service enables a POP3 server to automatically separate the attached files from an e-mail message and send only the message body to the user's mailer when the bandwidth between the user's computer and the network on which the POP3 server exists is narrow. Figure 1 shows the former image and Figure 2 shows the latter image.

1. Computer Environment Information Management using Directory

Application service servers need to get information about user's computer environment in order for the Environment Adaptive Service to work. Hence, management of user's computer environment information and access interfaces to the information is necessary for this service to work. This section describes how to manage a user's computer environment information.

First, we consider management form for a user's computer environment information. The following three forms are considered (refer Figure 3).(1) The user's computer manages its environment information by itself.(2) Each server, which presents application services, manages the user's computer information.(3) A special server manages the user's computer environment information in a unified way.The first form has the problem that user's computer has a heavy load because it must present its environment information to the server to which a user requests an application service. The second form has the following problems. It wastes computer resources because several servers have the same user's computer environment information. And every server has to implement a management function and has to register the information. Comparing these two management forms, the third form solves the first form's problem by removing management of the computer environment information from a user's computer. And it also solves the second form's problems by unifying the management. Thus, we selected the third form to manage computer environment information.

Next, we consider the method managing computer environment information in a computer network. We use directory systems such as X.500 and ldap for the following reasons.(1) Directory systems have enough interfaces to manage information.(2) Various data types for computer environment information can be managed using directory systems because it can handle general data types.(3) Directory systems have been used to manage a network user's information such as e-mail addresses, etc.Directory systems have been used to manage only relatively static information such as telephone numbers, e-mail addresses, etc. But lately, they have been used for dynamically changing information such as IP addresses given by a DHCP server. Directory systems that manage dynamically changing information like this are called "dynamic directory systems".

When a user's computer environment information is managed using directory systems, one of the most important subjects is how to register dynamically changing information. There are the following two problems with this.(1) When should a computer's environment information be registered?(2) How should a computer's environment information be registered?The solution to the first problem depends on how frequently the computer environment information changes. If it is limited to information such as the communication interface, which does not change once a user's computer is connected to a network, it should be registered when the user's computer is connected to the network. But, if it is information such as battery life, which expresses the status inside the user's computer, it must be registered when the information changes for something or for a certain time interval because it frequently changes while user's computer is connected to the network. In this paper, we consider only information that does not change after a user's computer connects to a network. We show the registration method, where information is registered by a server which the user's computer automatically uses when connecting to a network, such as a PPP server, DHCP server, etc (refer Figure 4). In the case of a PPP server, the registration procedure is the following. First, a user's computer connects to a PPP server. Next, the PPP server authenticates the user and gets his computer environment from his computer or by itself. Last, the PPP server writes the information in a directory. In the case of DHCP, the registration procedure is the same as that of the PPP server.

4 Summary

This paper proposes an Environment Adaptive Service which changes according to the user's computer environment, and explains how to manage the user's computer environment information, which is required by this service, through the use of directory systems.

Hereafter, we plan to develop an actual service and examine how to implement it.

References

1) The Directory: Overview of Concepts, Models and Services. ITU-T X.500, 1993.

2) M. Wahl, T. Howes, S. Kille, Lightweight Directory Access Protocol(v3). Request For Comments (RFC2251), December, 1997.

Return to Top   View Full-screen

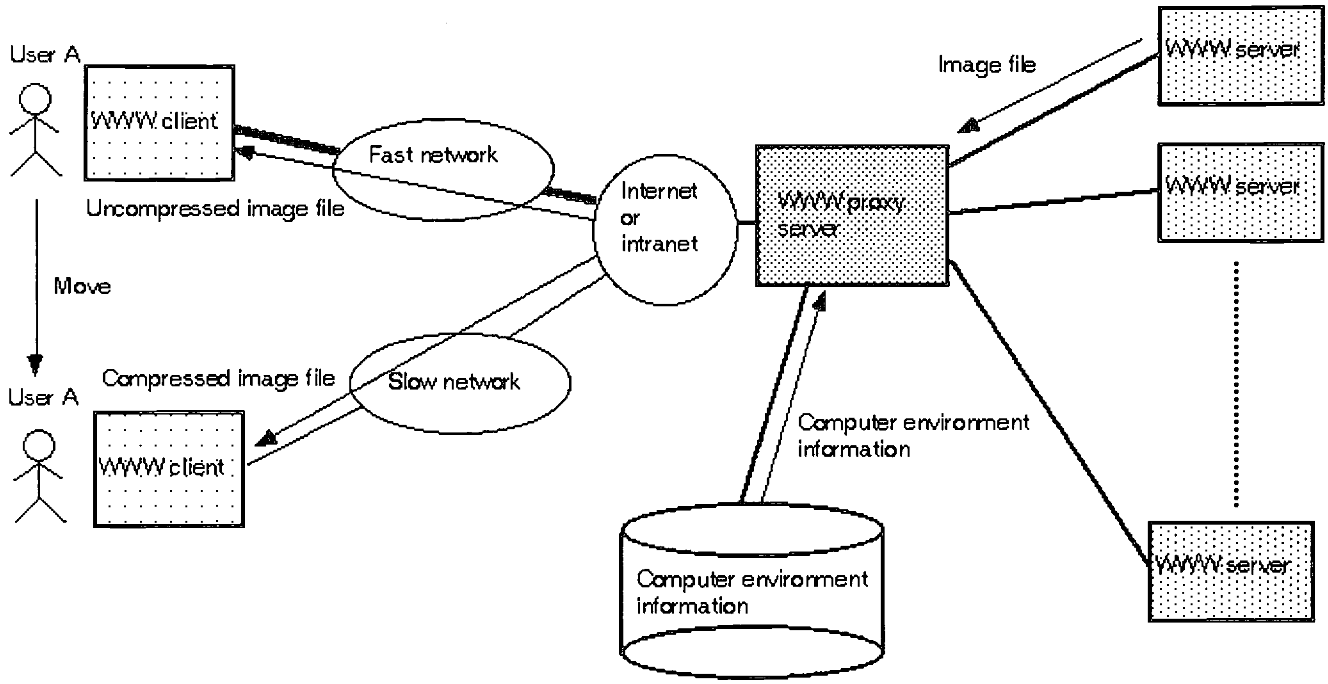


Figure 1: Image Compression service using WWW proxy server

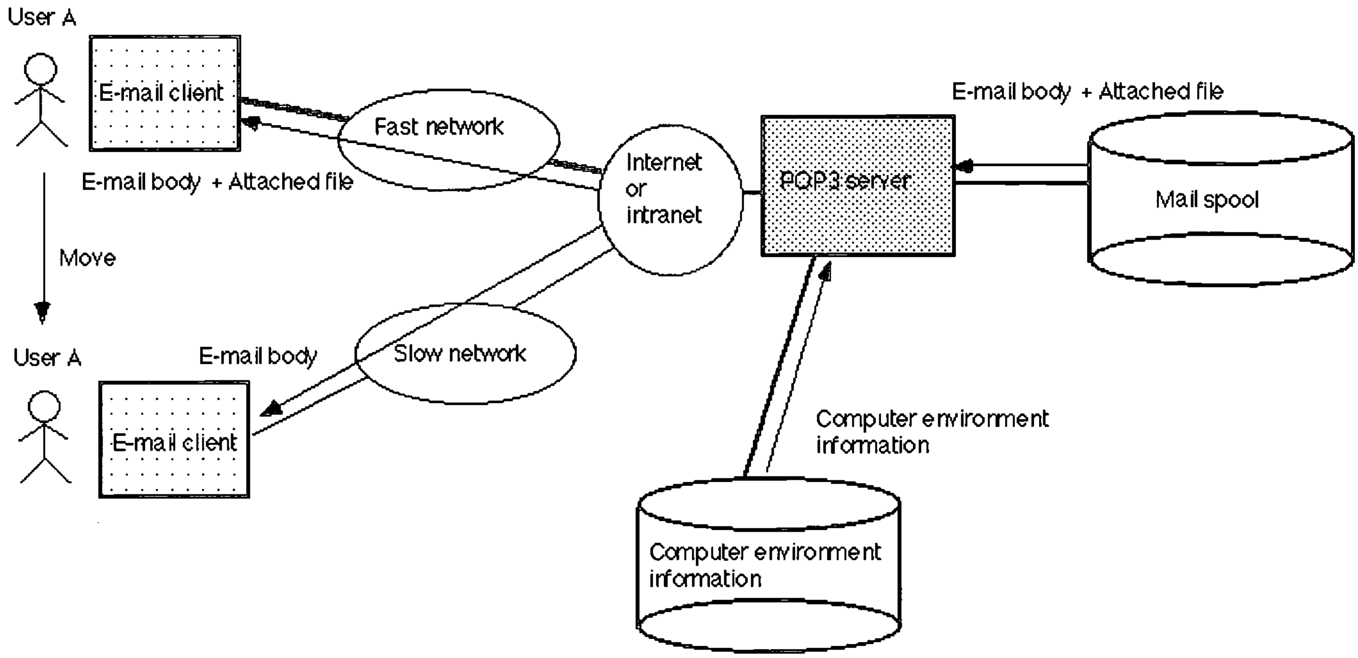


Figure 2: E-mail filtering service using POP3 server

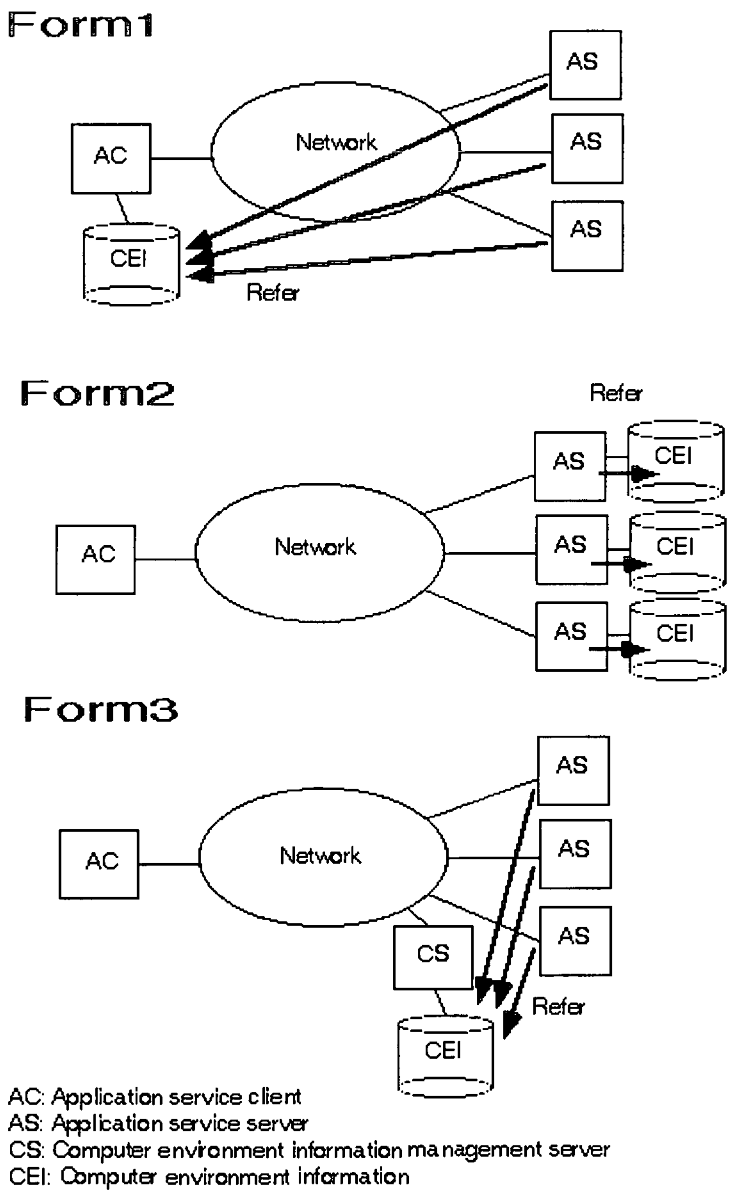


Figure 3: Management forms for a user's computer environment information

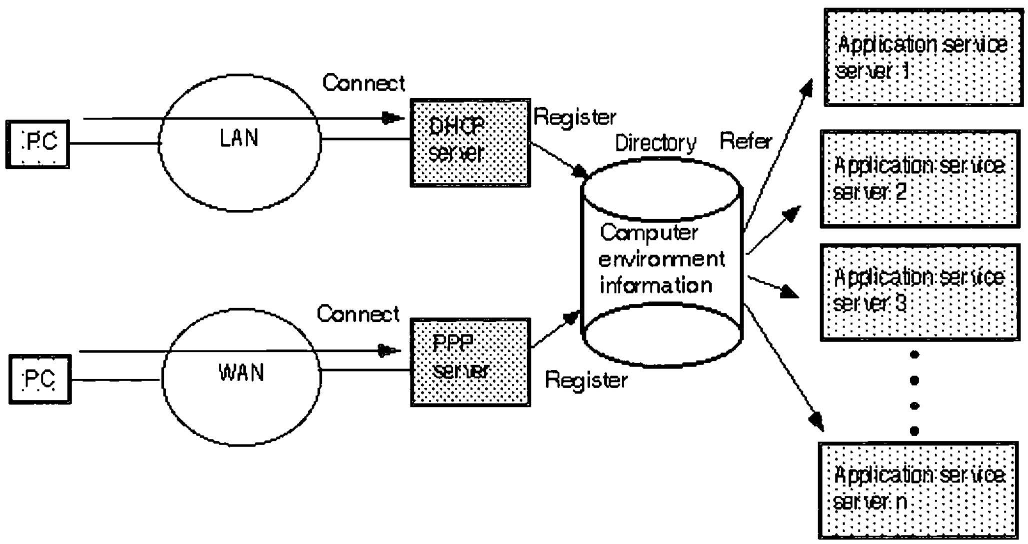


Figure 4: Computer environment information management using a directory system

ACTIVE NETWORKS

The Integration of Directory Services with Networking

for User-Centric Telecommunications

Kurt Dahm and Alain Mignot

Cisco Systems Inc., Australia

ABSTRACT

Active Networks are the result of the application of Directory Services to Networking. Directory Services are becoming the corner stone for creating Intelligent Internets by allowing the integration of users, applications and networking into a cooperative end-to-end infrastructure. Telecommunications Users or Providers will have to rely on directory technologies imbedded into the network. Today's directory technologies were built mainly for administrative applications. To respond to the need of both customers and infrastructures, a new paradigm for directory services is required. The directory must be transformed for a dumb "warehouse" to an authoritative, distributed intelligent repository of information for services and applications.

View Full Text

ACTIVE NETWORKS

The Integration of Directory Services with Networking for User-Centric Telecommunications

I. INTRODUCTION

Active Networks are the result of the application of Directory Services to Networking. Directory Services are becoming the corner stone for creating Intelligent Internets by allowing the integration of users, applications and networking into a cooperative end-to-end infrastructure.

The last three years have seen a rapid growth in Internet customers, applications and Internet business or residential services. Internet as a new business tool has also met with tremendous success: Intelligent and interactive web sites, the integration of data, voice and video services delivered increasingly on the same outlet from a single multi-media infrastructure creates the need for a closer interaction between the user, the application and the network.

In order to reconcile and coordinate the massive amount of information and resources that are required to:

- Associate users and their applications,
- To provide to the applications the network services they require to operate,
- To control and manage the network and its resourcesÖ

Telecommunications Users or Providers will have to rely on directory technologies imbedded into the network.

Todayís directory technologies were built mainly for administrative applications. To respond to the need of both customers and infrastructures, a new paradigm for directory services is required. The directory must be transformed from a dumb ìwarehouseî to an authoritative, distributed intelligent repository of information for services and applications.

As we see the rise of an ìinternet-edî society, the Active Network concept is the catalyst that will change the way user and applications will interact through a new generation of user-centric telecommunications services. Active Networks will enhance the capabilities of the individual, be it as a corporate citizen, or as a private individual.

II. DRIVERS FOR ACTIVE NETWORKS

2.1. Evolving Telecommunications

Until recently, the Telecommunications world was very much driven by technology and the evolution of telecommunications services relied on a lengthy process of technology development, thorough evaluation and programmed implementation. As the result, users were constrained in their use of telecommunications by the capabilities of telecommunications technologies and by the speed of implementation of these technologies.

A monopolistic environment, combined with the duty for universal services obligation imposed on the Telecom, resulted in an infrastructure-driven telecommunication industry. The Infrastructure dictated which services would be defined and the services, mainly a limited range of basic transmission services were offered with little differentiation to the users. We were dealing with ***connectivity services***.

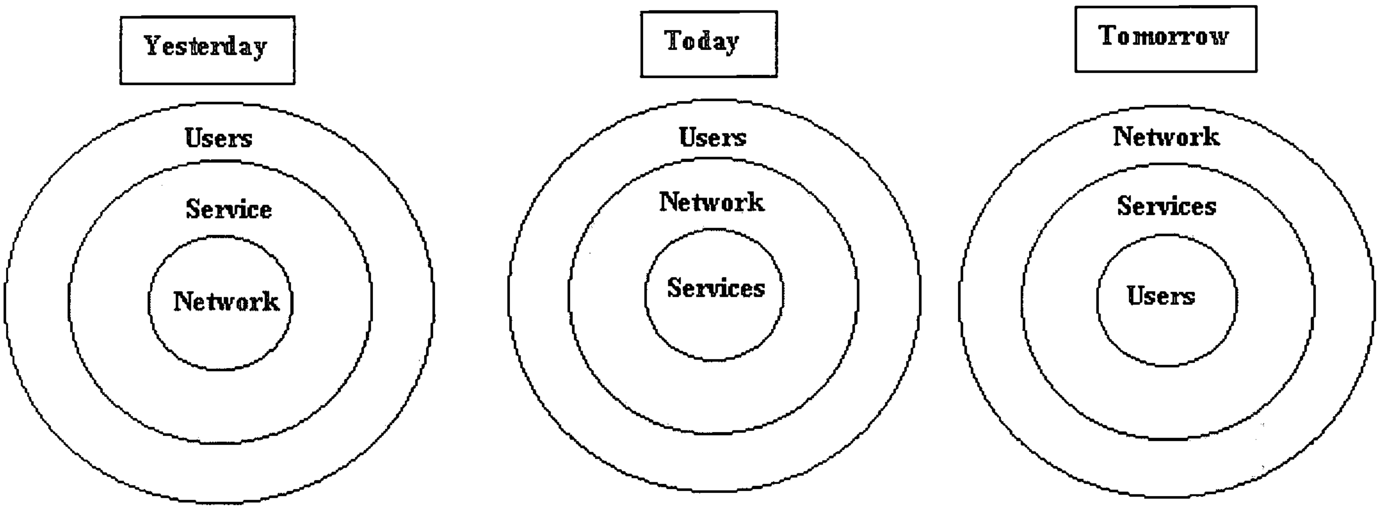


Fig. 1 Evolution of Telecommunications Services

Today, deregulation and the demand from enterprises for Data services have motivated Telecoms to start defining Value Added services. Today, these services include LAN to LAN interconnection, Virtual Private Networking and Internet access, essentially a managed package of transmission and CPE. The service is defined, the network built to support the service and to deliver to the user. We are moving into an era of ***infrastructure services***.

Tomorrow, we will see a growing customer demand for customized and personalized services under the impact of pervasive IP/Internet networking in all aspects of our daily private or business lives and the need for a new generation of multi-media applications to leverage the network to function successfully. This will be the era of ***content services***. The need of each individual will be (to a certain extent) recognized and drive how the user will access and use the content and applications, and use the network resources configured ìJust-In-Timeî to deliver end-to-end the telecommunications services required to make each user-application association succeed.

2.2. The changing Enterprise Demand

For the last 15 years, enterprises have been able to enjoy the benefit of integrated business operations thanks to the implementation of enterprise data networks that have enabled a closer communication between the different sections and gave individuals easier access to function-critical resources. Organizations of all types have realized that in a market becoming increasingly global, in a society increasingly interconnected, the telecommunication networking function is key to long term viability and commercial success. Today, enterprises are therefore looking at extending the reach of their internal systems to all internal and external stakeholders like customers, suppliers, regulators, government and industry bodies.

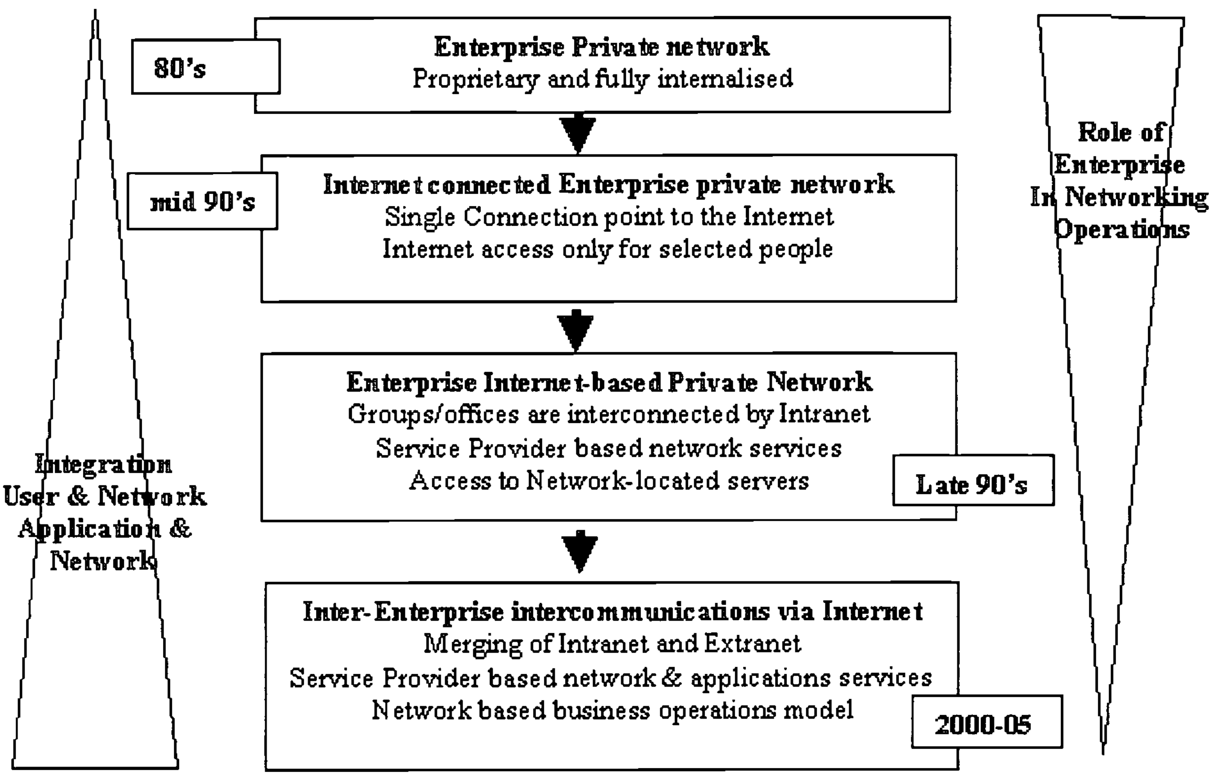


Fig 2. Evolution of Enterprise Networking

While this process occurs, they are looking at:

- New ways to empower further each employee with information and resources that are critical to their function, regardless of where these resources are located but within the limit required by their function as to achieve maximum productivity from the networking facilities
- The possibility to move to service provider based networking services, refocusing their in-house networking function on the strategic use of networking to support the business function
- Internetwork their business support systems, under strictly defined policies, with the ones of associated organizations closely involved in their business

To achieve these objectives, the organization requires a tighter integration of the user, the application and the network services. Increasingly, the border between the internal and external network will disappear to create a unified networking environment where users, be it from inside the enterprise or from associated organizations will transparently receive controlled and managed access to the applications and services required for their individual function.

2.3. Changing Traffic Patterns and Nature

More significant than the number of people connected to the Internet and the impact of enterprise networking services, the biggest challenge for the telecommunications and Internet industries is the rapid change in the nature and patterns of network traffic.

Until recently, voice traffic represented by far the largest volume of traffic to be carried by a telecom. Data and video traffic were running on different networks. These networks were built on a circuit switching based infrastructure, using the infrastructure DS0-based architecture.

Today, in most of advanced countries, we see data traffic reaching the same volume as voice traffic and it is anticipated that data based traffic will consistently exceed traditional voice traffic by 2001. Today, we start to see voice, data and video traffic transported on a single network through a single telecom access link. This integrated network is increasingly packet based but the voice, data and video traffic are still transported in separate virtual circuits or individual flows.

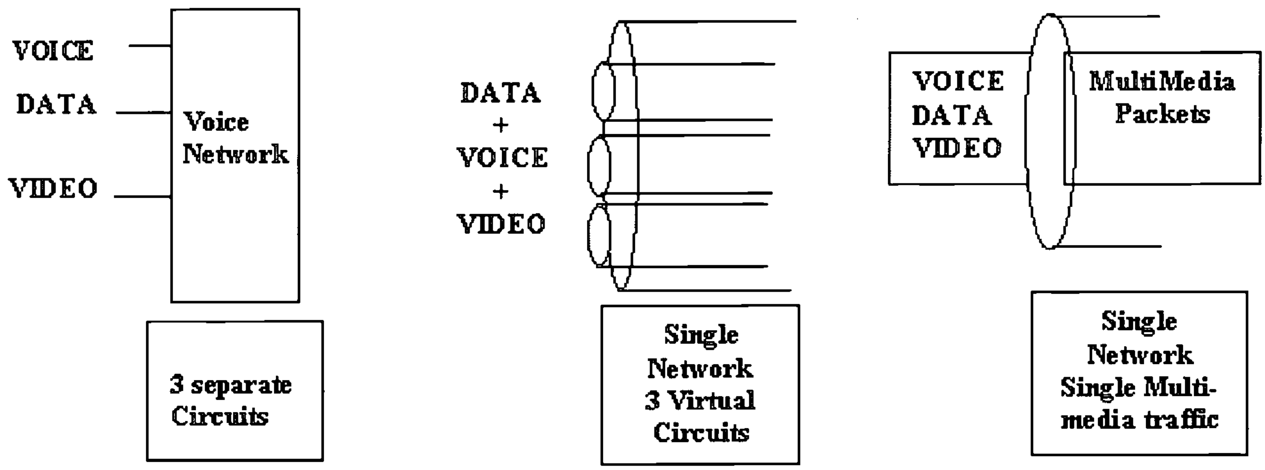


Fig. 3 Evolution of network traffic

Tomorrow, voice, data and video traffic will all be integrated into multi-media communications and documents, and no distinction will be possible even at the VC level between these different contents. The packet will have to be treated differently whether they contain only data or multi-media content. The applications that will generate these packets will be responsible for requesting communication transport services and policies that will ensure proper delivery of this traffic.

As a result, the need for high bandwidth, the availability of network services and the use of policy-based networking will be increasingly critical to the success of the network in supporting the demands of users and applications.

2.4. User Profile

Be it corporate citizen or private person, the profile of the typical computing and networking user is changing rapidly. The impact of the Internet and its easy access to information and resources through the simple Web browser interface has certainly given individual users the opportunity to become more demanding in term of the quality of the access to applications and the network.

Users have rapidly moved from simple Email to more complex communications between individuals and groups or between user and server. The increasing availability of multi-media tools for information and education, and the impact of multi-media Web pages to convey quickly and efficiently a large amount of information have created an expectation about the quality and efficiency that the new generation of tools and communications will have to support to meet user satisfaction and commercial success.

Users increasingly expect:

- Ease of access to information and resources throughout the network
- Information and content to be easy to use and access regardless of the complexity of underlying infrastructure required
- Enjoy personalized services that acknowledge its needs and interface constraints
- Be given the same class of service, regardless of the location on the SP network: campus, remote office, telecommuting or transit hotel room.

2.5. Implications for Networking and Telecommunications

The trends we have just reviewed indicate clearly several important implications that will determine the evolution of networking into the next century:

- There will be a tighter integration between applications and networking to meet the demand of users;
- User connectivity profiles will be an important element to recognize in the delivery of personalized services;
- User access to the content and applications will be required with the same COS/QOS from any point of the service provider network;
- The applications will become increasingly bandwidth intensive and multi-media in nature and will rely on the end-to-end availability of services on the network;
- The network services will have to be available from end-to-end to guarantee their consistency and reliability for the usage by the applications, requiring a unified control and management ;

- The network services will require the definition of access, security and traffic management policies to support the needs of users and applications;

- The effective and reliable delivery of the network services will require dynamic configuration of each individual systems along the path of the packet ; and

- The network infrastructure will be too complex to be managed on an element basis.

The key to satisfying the needs of customers, applications and service providers resides with the application of directory services to the network infrastructure.

The directory will be the foundation of the intelligent network infrastructure. The end-to-end support of content and applications will require that from desktop to server, the network be configured appropriately to deliver the services required. This configuration, often dynamic, takes place on-demand when the user logs onto the network from any of a number of possible locations. Only when management information about the user, the network devices and the services involved is available in a single, authoritative location will it be possible to actually manage these new classes of applications.

The framework of activities to port directory services to the network infrastructure is covered under the industry initiative called Directory Enabled Network (DEN).

III. DIRECTORY ENABLED NETWORKING

3.1. Goals and Objectives of DEN

The goal of the Directory Enabled Networking development work is to:

- Provide support for applications that have the ability to leverage the network infrastructure transparently on behalf of the end-user;

- Provide a robust, extensible foundation for building network-centric applications;

- Enable end-to-end network services on a per-user basis;

- Enable network-wide service creation and provisioning; and

- Enable network-wide management.

The initiative defines the problem domains, information model, usage and detailed directory schema for integrating directory services with networks. In these networks, the network resources (devices, operating systems, management tools and applications) use the directory service to:

- Publish information about themselves;

- Discover other resources; and

- Obtain information about other resources.

The directory becomes the hub around which the distributed systems of the network turn resulting in enhanced cooperation between network components and distributed applications. The outcome is a network where the services to the user are predictable, repeatable and security is strengthened and management easier.

3.2 Requirement of Active Networks

Simply managing individual devices, applications and users will no longer be sufficient. Network administrators will no longer be able to deal with the large number of sub-systems level configuration and management tasks in an environment where end-to-end configuration must be made on demand, almost for each individual traffic flow. The complexity of a large number of services, customized for each user or group of customers, accessing content and applications generating various types of multi-media traffic can only be managed through the use of policies to control the network and its resources in a distributed, yet logically centralized manner.

The network managerís role will therefore become to define and manage the policies. In general term, a policy defines what resource a consumer (a user, a device, an application, a service) can use in the context of a given application or service.

Defining and managing policies requires a common store of information about the network and its resources: users, applications, content, protocols, media, devices and the relationship among these elements. This repository will contain information that defines the network as well as information about the network.

It is therefore the role of DEN to provide an environment in which the information published in the directory can be leveraged by applications to provide intelligent services. Applications, users and networks interact using an ***integrated information model***. The information model is an abstract representation of each element and structures the knowledge about users, networks and applications.

IV. INFORMATION MODEL FOR ACTIVE NETWORK DIRECTORY SERVICES

The interaction of users and applications with the network elements and services, and the management of network elements and services are defined in the information model. The information model is a robust, object-oriented model that defines the behavior and interaction between network elements, network services, users and applications.

The information model consists of a schema for defining objects and rules governing how objects interact with each other. The schema consists of "classes" arranged in a hierarchy that represents subtype relationships.

Rules are defined by the implementer, who uses the properties and methods of each class to control how each class will interact with other classes. The information model is simple and consists of:

- Eight base classes that form the basic framework;
- An extensible schema based on inheritance and aggregation for modeling application-specific properties and information; and
- A simple mechanism for establishing relationships among object instances.

In all there are eight basic classes, which are abstracts. The models starts with the X.500 defined classes: ***Person*** and ***Device***, and adds to these classes: ***Application, Protocol, Media, Policy, Profile*** and ***Service***. The X.500 definitions are augmented to enable them to be used to describe and control the interaction between users, applications, network elements and services.

The information model provides a common framework that enables disparate applications to share a common namespace and schema, along with common rules on how these objects interact between each other. This model facilitates significantly the work of applications developers. With that model, applications that have completely different purposes but act on the same element can share and exchange information about the element. For example, an application that describes the specific characteristics of a network could populate the common schema with information that could be shared by a provisioning application and a third application could use that information for network management.

4.1 Information Model for Network Elements and Services

Describing and operating on network elements and services is much more complex than performing similar operations on users of the network and servers residing on the network. This is because network elements and network services are inherently more complex objects and exist in an environment that changes constantly.

Therefore, Classes are insufficient to describe a network element or network service. Instead, it is necessary to ***model*** network elements and services. A model is an abstraction of something and is used for the purpose of understanding it. Models help classify knowledge based on structural or behavioral similarities.

There are three aspects to modeling complex systems:

- ***Object models*** are used to describe the static structure of the systems: i.e. data, attributes, operations and relationship to other components;
- ***Dynamic models*** are used to describe the temporal relationships between different elements of the system and how each element is controlled as a function of time; and
- ***Functional models*** are used to describe relationships among values and how functions, mappings and constraints are used within the system to define the

final value of an item.

For complex systems like network elements or network services, it is necessary to define as much as possible these three types of models.

4.2 Exchange of Model Information

A common model describing the structure, behavior and operation of a network element or service must exist so that network elements can exchange information that is, in itself, self-describing. Once network elements are bootstrapped into the network, they will exchange a set of queries and responses describing their features, their configuration, service available and supported protocols and APIs.

There are four types of information that are necessary to model the structural information of network elements and network services.

- ***Intrinsic.*** This category represents information that is essential to represent a particular element or service. The characteristic of intrinsic data is that it describes uniquely the device or service.

- ***Configurable***. This category represents information that controls the operation of a device or helps to determine how that device or service operates. This data remains static until the configuration is explicitly changed and still it is changed generally according to a list of defined values.

- ***Operational***. This information describes how a device or service interacts with its surrounding environment. This information is derived from the operational environment of the device or services and changes as the result of operational conditions such as network load. A differentiating characteristic of operational data is that it summarizes how the device or service functions without manual intervention.

- ***Contextual***. This category represents information defining how the device or service relates to other components in the context of a larger, network-wide context. A differentiating characteristic of contextual data is that it must be used with lower-level device information, especially intrinsic and operational data in order to be meaningful.

4.3 The Class Hierarchy

The DEN schema consists of abstract base classes from which all other network-specific classes are derived.

The base classes are defined by specialization from the basic model representing network elements, services, consumers etc. The base schema is shown in Figure 4.

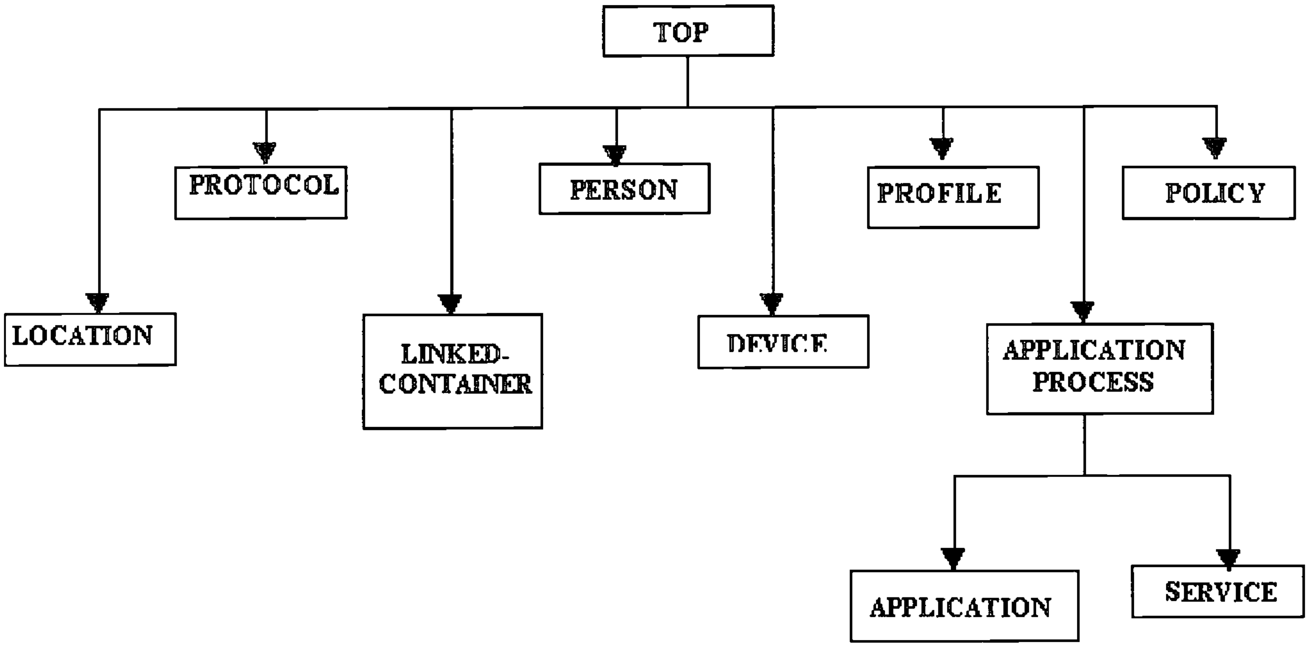


Fig 4. Information Model class hierarchy

The abstract base classes are based on:

- ***TOP***: an X.500 base class that forms the starting point of all other classes;
- ***Device***: an X.500 base class that represents a physical device (router);
- ***Location***: a class defined by DMTF-CIM V1, a geographic location where a physical device can be installed (rack);
- ***Protocol***: a class used to represent different protocols;
- ***Profile***: a class that encapsulates information governing the characteristics and needs of a specific principal (user, application, network element). This can be further specialized to characterize what a particular object can do in a particular context, subject to one or more applicable policies;
- ***Policy***: a class that encapsulates information governing the use of network resources in a particular context and how different resources interact with each other;
- ***Application-Process***: X.500 based class for services and applications:
  - ***Applications***: An application that consume network resources
  - ***Service***: a service offered on the network (Packet filtering);
- ***Person***: an X.500 based class for a human user; and

- ***Linked-Container***: a container that implements a forward link, allowing containers to be arranged as forward-linked list.

For the sake of giving an example, we will map the ***Policy*** class.

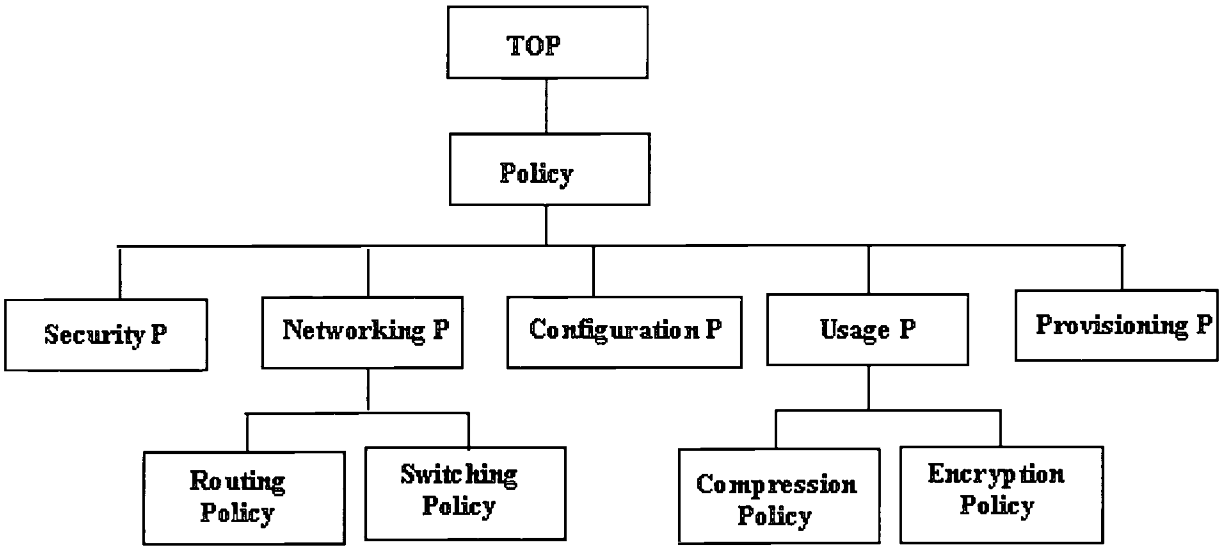


Fig 5. Example of Class hierarchy: Policy Class

4.4 Containment Model for Profiles and Policies

Profiles and policies can be applied to many different requests from network services. Users (and other service consumers) may have different profiles and some profiles may be shared by many users. Likewise, policy objects may apply to various combinations of service consumers and offered services.

Policies and profiles can therefore exist with many-to-many relationships with services and consumers. DENís information model and schema provide a mechanism for establishing these relationships in a scalable manner using the *Linked-Container* class.

In the Figure 6 example, the *Person* object contains the Distinguished Name (DN) of ìContainer 1î holding Profile objects that apply to that user. ìContainer 1î holds the DN of ìContainer 2î. ìContainer 2î does not hold any DN and therefore is the end of the chain.

Starting at *Person*, a network service follows the DN links to the first container and searches for applicable *Policy* in that container. Determining the applicability of a given policy is application specific. If none is found, the network service follows the DN link to the next container, and so on. The search is controlled by the Forward Links. The containers searched for *Policy* that applies to a given object are controlled by the DN values in the object itself.

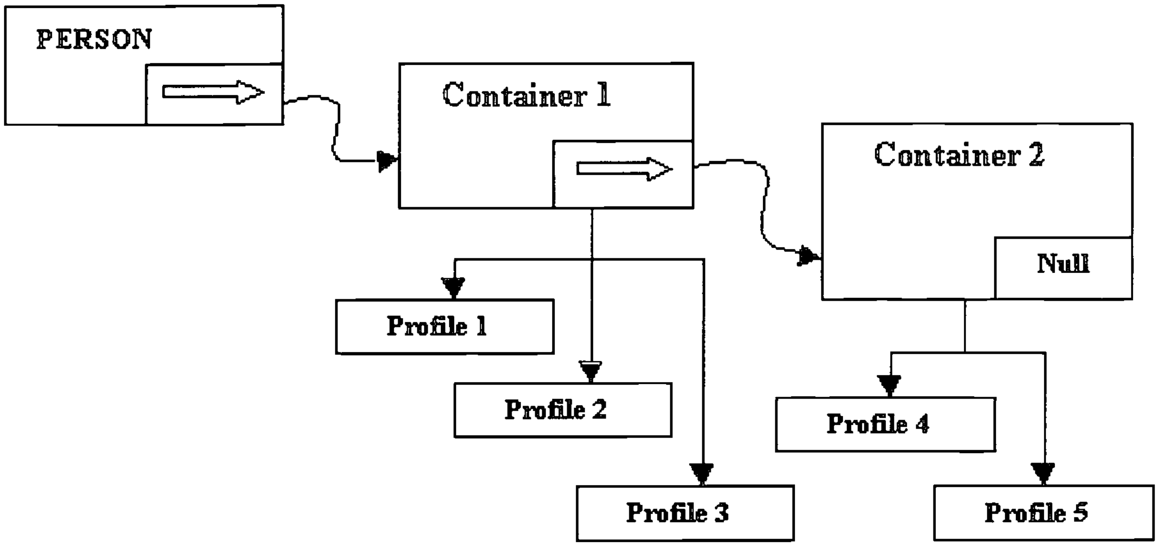


Fig 6. Example of Containment function

V. APPLICATIONS AND BENEFITS OF ACTIVE NETWORKS

5.1 Physical Locations and Connectivity

Knowledge of physical network structure can be useful in a variety of ways. For example, it can be used for asset tracking, access list control or fault isolation.

Letís use the asset tracking for example.

Asset tracking applications can benefit of the schema by simplifying the asset tracking task and integrating it with the network management function.

The asset tracking number is stored as an attribute of a *Hardware Asset* object, the base class for all hardware devices. Searches for asset can be performed based on an asset tracking number to locate a particular piece of equipment. Once a *Hardware Asset* object has been found, reference to containing objects may be followed. The hierarchy may start at the *Chassis* that contains the object, then to the *Rack*, then to the *Room*, *Floor*, *Building*, *Campus* etc.

With asset tracking unified with network management, the engineers moving the hardware will maintain the information on the location of the asset for their own purpose, as per usual procedure. This information can also be used by the asset tracking application and by the network management application. A single entry by the field engineer will contribute to the efficiency of many other systems and applications at no extra cost.

5.2 Access and Usage Control

DEN enabled active networks will address many areas of access and usage control, including filtering, ACLs and network address translation; and the services, policies and profiles required to model and manage these elements.

To demonstrate the application and the benefits of DEN-based active networks in the areas of access and usage control, letís take the example of a distributor of pharmaceutical products that employs a large team of travelling sales representatives.

The firm wishes to offer dial-in access to their sales reps, as well as VPN access to contractors and remote access to finance and administration people travelling overseas.

In order to manage and account for their users, the use of their network access servers and L2 tunnel servers, the firm uses the Radius protocol. However, given the large number of users that need to be managed, the firm seeks a Radius solution that is integrated in their existing LDAP based directory service. This will allow the network administrator to edit the userís Radius attributes with the same user interface as they use to edit any other user attribute, as well as eliminating the need to maintain multiple stores of user information.

As part of this service, the firm wishes to implement a number of access policies that need to be centrally managed through the directory. Their requirements include:

- Sales reps require high-speed dial-in access; however, access to resources may vary from location to location due to various constraints. Policies stored in the directory will help manage and coordinate the access service.
- Hardware resources are limited and risk oversubscription. The firm will provide restricted use of ISDN ports to sales reps from 1:00 to 5:00 PM and permit use of multilink during that period.
- Contractors should only be given access to the relevant group of servers with a set of restricted logon privileges. The firm wants to enforce special filters and access restriction to contractor traffic and logon times.
- Finance roamers need secured access to highly confidential information over the VPN. Strict authentication via Smartcard and encryption of traffic using 128-bit encryption will be used for extended security.

The information on users, applications and policies stored in the directory schema will enable the effective implementation of these access and usage policies. Any change to these policies or to user access privilege can easily be made from a central location by changing the appropriate directory information.

5.3 Service Provisioning

The goal of enhancing networking through the integration of DEN is to enable applications to receive the Quality Of Service (QOS) appropriate to their mission.

QOS addresses the requirement of the application for defined network transit services that will guarantee the performance of the application even under high network load. Multi-media traffic needs minimal transit delay and jitter, and therefore requires high priority and reserved network bandwidth to operate properly.

As a result, the network needs dynamic configuration end-to-end to respect the transmission requirement of the application regardless of the level of network congestion, the WAN media or the type of equipment.

Using the information stored in the DEN schema, the network services will automatically find the access and transport policies relevant to the application profile (also stored in the schema) and will configure end-to-end the network to deliver the services requested. Further flexibility can be obtained by taking into account the profile of the users and application policies. Here is another example.

The pharmaceutical firm made available to its sales force, multi-media based product demonstration clips that can be downloaded from a central server to the sales office. The usage and access policies implemented are as follows:

- Sales Reps can use the RSVP reservation between 9:00 AM and 5:00 PM, Monday through Friday;

- Sales Reps are permitted a maximum of two demonstration flows at any point in time; and

- Demonstration flows are limited to 3 Mbps peak rate for a 100 Mbps LAN-based demo, 500 Kbps peak rate for a 10 Mbps LAN-based demo and 40 Kbps peak rate for a remote office-based demo over a 256 Kbps WAN link.

Using the application profile, the user profile and the network location attributes available in the directory service, the network will automatically regulate the access and usage of the demonstration facility.

5.4 Management and Modeling Tools

Management and modeling tools and applications need a centralized place to access in order to find needed information. These tools and applications require access to secure information in order to change the access list of a router and to enforce a ìnetwork administratorî mode that will only enable authorized personnel to perform critical configuration and security changes on the network.

It is also necessary to store key information that describes the topology and configuration of the network. This information is critical in the debugging of end-to-end connectivity and reliability problems, in addition to validating the effectiveness of security policies implemented via routers, route filtering, ACL and firewall policies.

Today, much of the information required to troubleshoot and manage a network is often disseminated in different independent repositories. The effectiveness of the complex management and modeling tools that are becoming available is only possible when all information about the network is stored in a single central location.

The integration of network and directory services will make a tremendous contribution to the ability of a service provider to effectively maintain its network at its maximum productivity level and ensure consistent and reliable delivery of the network services.

VI. STATUS OF THE DEN INITIATIVE

Cisco Systems and Microsoft joined efforts in September of 1997 to start the DEN initiative. The cooperation aims at promoting consistent modeling of network elements and services across heterogeneous directories. The DEN efforts will provide software developers with a platform to begin developing new classes on intelligent, network-aware applications. The DEN specification focus on:

- Abstraction of the eight major network objects: Device, Protocol, Media, Services, Application, Profile, Policy and User, with additional subsidiary classes to be defined as needed;
- A usage model for the schema within the selected problem domains; and
- Vendors can build specific products based on the foundation schema and information model described in the DEN specification.

To ensure wide industry participation, a Directory Enabled Network Ad Hoc Working Group has been created. The DEN AHWG drives the efforts of industry participants in their contribution to the DEN specification.

The initiative has gained momentum through wide industry and customer support. At the last DEN AHWG meeting, 67 companies where represented, among them: 3COM, Berkeley Networks, Cabletron Systems, Cisco Systems, CompuServe Network Services, Cylink Corp, Hewlett-Packard Co., IBM, Lucent Technologies, Microsoft, Netscape Communications, Novell, Tivoli Systems, Quadritek Systems, Texaco, TIBCO Software, Siemens-Nixdorf Information Systems.

The DEN Customer Advisory Group, which has been formed to guide the development of the DEN specification into an industry standard has submitted the DEN specification to the Desktop Management task Force (DMTF) for its integration under the Common Information Model (CIM) currently developed by DMTF.

Further information on the DEN specification and the status of DEN developments are available on DEN Specs & Info: http://www.universe.digex.net/~murchiso/den/

Cisco and Microsoft will focus their efforts on Microsoftís Active Directory, which Cisco has adopted for its network integrated directory services. Other products are likely to follow in their integration of DEN specifications, namely Netscapeís Directory Server, Novellís NDS, and IBM/Lotusí Notes.

Although the specification has not yet reached industry standard status, several large enterprises and software houses ó J.D. Edwards & Co, The Baan Co, SAP AG and PeopleSoft ó have already been working on the implementation of DEN based products, using mainly Microsoftís Active Directory.

VII. REFERENCES

To compile this document, these references and sources of information have been used:

DEN Specs, dir-nets@andrew.cmu.edu

DEN Specs & Info: http://www.universe.digex.net/~murchiso/den/

Lowering the TCO with Active Directory-Enabled applications, Microsoft Corporation, www.microsoft.com/ntserver/

Cisco Network Services/Active Directory, Cisco Systems, www.cisco.com

Network Aware Business Solutions: The Virtual On-line Financial Services Practice White Paper, Cisco Systems/KPMG, www.kpmg.com

Cisco internal research documents and papers (company confidential)

For further information on DEN and Ciscoís DEN based solution please contact Alain Mignot mignot@cisco.com or your nearest Cisco Systems, Inc. office. (list of offices available on www.cisco.com)

Return to Top View Full-screen

The Demise Of Local Loop Power in Australia

Jane Forster and Caroline Lovell

Senior Solicitor, Australia

ABSTRACT

In Australia, round two in the battle against Telstra's local loop power is in progress. The Australian regulator of competition issues in the telecommunications industry, the Australian Competition and Consumer Commission ("the ACCC") is currently conducting an inquiry into whether it should declare local call resale and local interconnection services. Declaration by the ACCC could compel Telstra to provide access to its Customer Access Network ("CAN") to other carriers and service providers in Australia.

View Full Text

The Demise Of Local Loop Power In Australia

I. INTRODUCTION

In Australia, round two in the battle against Telstra's local loop power is in progress.

The Australian regulator of competition issues in the telecommunications industry, the Australian Competition and Consumer Commission ("the ACCC") is currently conducting an inquiry into whether it should declare local call resale and local interconnection services. Declaration by the ACCC could compel Telstra, the operator and owner of the Australian local loop, to provide access to its Customer Access Network ("CAN") to other carriers and service providers in Australia.

The first attack, which involved giving the second fixed line entrant - Optus Networks - some 5 years to establish a second network, was not a success - at least not if measured in terms of local access.

A valuable opportunity to deal with the effects of local loop power was lost when, in 1997, one third of Telstra was floated on the Australian Stock Exchange in the absence of any restructuring of its assets. This was contrary to the recommendations contained in the *Report of the Independent Committee of Inquiry into National Competition Policy* chaired by Professor Fred Hilmer (*"the Hilmer Report"*) which had concluded, in relation to the privatisation of public monopolies:

> *"...there is a risk that privatisation without appropriate restructuring may entrench the anti-competitive structure of the former public monopolies, making structural reform even more important."*

The *Hilmer Report* recommended two alternatives to address the bottleneck power of public monopolies. First, the natural monopoly element could be structurally separated from the competitive elements, for example in a separate company. In Telstra's case, this would involve separation or divestiture into two separate organisations: one which owns and manages the infrastructure and another which conducts retail operations.

Second, the integrated structure could be left intact and reliance placed on more intrusive regulatory controls, such as the separation between network and retail operations of accounting functions, staff and general information and systems, to guard against cross-subsidisation and the potential misuse of control over access to the natural monopoly element.

The *Hilmer Report* concluded that where a natural monopoly element is present, regulatory controls such as accounting separation are insufficient to remove potential incentives to misuse control over access to a vertically integrated element and that full separation at the level of ownership or control is required.

Despite the *Hilmer Report* recommendations, no steps were taken to separate Telstra's vertically integrated operations when the first third of the company was privatised. Nor were any steps taken to impose increased regulatory controls on Telstra, such as accounting separation between its network and retail operations.

This paper examines the local loop in Australia, compares it to the situations in the United Kingdom and the United States and asks the questions:

- Is Telstra's local loop power a hindrance to the development of competition in Australia?
- Can any anti-competitive or potentially anti-competitive effects of Telstra's local loop power be corrected through ACCC declarations of local call and local interconnection services?

II. WHAT IS LOCAL LOOP POWER?

Local loop power is used in this paper to refer to the benefits which accrue to a carrier who owns or controls the means of access to end-users.

The benefits which accrue to such a carrier are not limited to monopoly returns in the provision of local call services. The benefits also include:

- The ease with which the owner of the local loop can introduce new services over the loop and exercise a measure of control over what new services are introduced and when;
- The compatibility between the local loop and the owner's other infrastructure;
- Access to information concerning call usage over customer access lines which can be used by the owner in planning system upgrades, the provision of new services and so on;

- The greater likelihood of being first port of call by persons wishing to supply new services, particularly content related services, to end-users;

- The power which can be exercised in markets for services supplied by the owner (subject, of course, to any regulatory restrictions which might apply) including by way of the setting of access charges and by the use of cross-subsidies in relation to the provision of services by the owner.

The apparent benefits of local loop power were identified in a 1996 OECD paper *"Local Telecommunication Competition: Developments and Policy Issues"*. The paper made a number of interesting points, but two which seem to be particularly telling are:

- First, that the evidence indicates that new carriers gain market share in national markets for long distance services at a slower rate when faced with an incumbent that controls the local loop. In reaching this conclusion, the paper compared the growth in market share of new long distance carriers in Japan and the UK to new long distance carriers in the US. Growth was much faster in the US, the only country to have a separation between local access and long distance service provision.

- Second, that the experience in Finland with Finnet - the consortium of local telephone companies with 73% of the local access lines which when allowed to enter the long distance market, captured a market share of 56% in just 12 months - demonstrates, from a different viewpoint, the importance of owning and managing local access.

III. LOCAL LOOP POWER IN AUSTRALIA

In Australia, Telstra has a degree of local loop power which the duopoly policy of the previous legislative regime did not diminish and which the deregulated market of the new post 1 July 1997 regime has done little to alter.

At the beginning of the 1990s, Australia's telecommunications needs were serviced by Government owned monopolies. The Telecommunications Act 1991 permitted limited competition and, in combination with policy, the permitted competition consisted of a second fixed line carrier, two additional public mobile service carriers and resellers.

Under this regime, competition with the incumbent carrier Telstra in both the long distance and mobile services markets developed reasonably well. Competition in the local call services market remains negligible - there being a handful of resellers of Telstra's services who compete by buying in bulk and in adding value where they can.

Nevertheless, it is clear that there is considerable potential for competition at the local level in Australia. This is demonstrated by the advanced plans and strategies disclosed in the submissions to the ACCC's inquiry made by some of Telstra's competitors. Less obvious, are a number of players who are investigating the wireless access market and a number of content service providers who are anxious to have greater access to end-users.

Although not reflected in the publicly available submissions to the ACCC's inquiry, internet and other content service providers will have an interest in the outcome of the ACCC's inquiry. The ACCC itself recognises this and in its Discussion Paper suggested that consideration might be given to the impact of declaration of local interconnection services on competition in the markets in which data services are supplied to end-users.

It is difficult to verify, let alone measure, the advantages which attach to local access power when the carrier who owns or operates the local loop also controls relevant information about its costs and usage of the local loop. Telstra claims:

> *"To begin with, rentals, both to residential and to business consumers, are kept by regulation at levels which could not be sustained by a stand-alone business..."*
>
> *"Local call charges are equally constrained, notably in terms of the requirement to provide residential customers with an untimed local call at a charge no greater than 25 cents...."*
>
> *"In essence, the current price controls means that Telstra cannot exercise market power over the services at issue. Market power is the power to increase price or reduce quality relative to the levels that would prevail in a competitive market. Telstra submits that it lacks that power, as can be seen from the low rate of return it obtains from the assets [the customer access network] at issue."*

Optus, on the other hand, claims:

> *"Although Optus does not have visibility of Telstra's costs, Optus*

believes that recent media briefings given by Telstra demonstrate that Telstra more than fully recovers the cost of the CAN via line rental charges. Telstra has stated in its media briefings that the costs to Telstra in maintaining and upgrading the CAN over the last three financial years are approximately $666 million in 1994-95, $920 million in 1995-96 and $848 million 1996-97. Telstra's monthly line rental charges are $11.60 for residential customers and $20.00 for business customers. Optus estimates that the line rental revenue obtained by Telstra in the 1995-96 financial year was approximately $1.8 billion."

IV. REGULATION IN AUSTRALIA - - AN INDUSTRY SPECIFIC ACCESS REGIME

A telecommunications specific access regime applies in Australia and is governed by Part XIC of the ***Trade Practices Act 1974 (Cth)*** ("the ***TPA***") which commenced operation on 30 April 1997.

The ACCC may only declare a service on the recommendation of the Telecommunications Access Forum or after holding a public inquiry into whether to declare the service and preparing a public report on the inquiry. The ACCC may initiate an inquiry itself or it may be requested to do so by any person.

Once the ACCC has declared a service, an "access provider" must supply the service to an access seeker upon request, to enable the access seeker to provide carriage and/or content services. The terms and conditions of supply are to be agreed between the access provider and the access seeker. Failing a commercially negotiated agreement, supply must be in accordance with any approved access undertaking. If there is no undertaking, terms and conditions will be determined by the ACCC after arbitration.

The ACCC was required, by legislative provisions applying to the transition from the ***Telecommunications Act 1991 (Cth)*** to the ***Telecoms Act***, to issue a statement setting out services which were either covered by access agreements registered under the previous regime, or services which were needed for the supply of broadcasting services. These services were deemed to be declared for the purposes of Part XIC.

On 30 June 1997 the ACCC deemed the following services relating to the use of the CAN to be declared:

- Domestic PSTN originating and terminating access; and
- Conditioned local loop access.

Domestic PSTN originating and terminating access provides access to the carriage of calls from calling parties and to called parties directly connected to the access provider's network to and from points of interconnection with the access seeker's network. The deemed declaration of a 'conditioned local loop' access service is for unswitched transmission between the access seeker's customer's premises and the access seeker's frame or like equipment. The service is a conditioned two wire service and includes the customer's access line, jumpering at the local exchange and connection to the access seeker's equipment.

These deemed declared services are used by switched service providers who do not have direct access to end users. For such service providers, the costs of transmission from and to its point of presence is a significant part of their costs. Deemed declaration of these services has not promoted competition at the local level, first because the conditioned nature of the service limits its uses and, secondly, because they do not include interconnection at the local exchange.

V. THE ACCC'S CURRENT INQUIRY

The ACCC's decision to hold a public inquiry into whether to declare local call and local interconnection services was announced on 19 March 1989. Originally, the ACCC had expected to publish its draft report by early July 1989 but the draft report is now not expected to be published until sometime in November.

The ACCC has drawn a distinction, not only generally for the purposes of Part XIC, but for its purposes in deciding whether to declare local call and local interconnection services, between facilities based competition and services based competition'.

Facilities based competition involves competitors installing their own facilities to contest the market for particular services. Services based competition operates when competitors provide new or improved services using existing facilities and/or they compete, for example, to provide cheaper or more convenient services using the same network. Essentially, the ACCC is of the view that facilities based competition is more in the long term interests of end-users than service based competition.

In its Discussion Paper on the Declaration of Local Telecommunications Services, the ACCC has expressed the view that access to local interconnection services would promote a greater level of facilities based competition than access to local call services and that it would, therefore, provide more scope for introducing new and innovative services. The former, in the ACCC's opinion, would result in partial facilities based competition whereby the access seeker will seek access to some of the infrastructure of the access provider but will also need to install its own facilities. With local services, there is no need for the entrant to invest in infrastructure.

The ACCC has expressed the view that access to local call services would, nevertheless, promote service based competition which is an important element of the competitive process and could provide a stepping stone to a greater level of facilities based competition.

Not unexpectedly, Optus and AAPT Telecommunications (regarded as being the number 2 and number 3 carriers respectively in Australia) agree with the ACCC that declaration of local interconnect services will result in partial facilities based competition.

In its submission, Optus says that although full duplication of an incumbent's local network would achieve the most efficient outcome and therefore be the most beneficial to the long term interests of end-users, it would be impracticable or wasteful to fully duplicate the Telstra local network. If full duplication is ever to be achieved, Optus says that local call service resale and partial local network duplication are necessary stepping stones to full duplication of the existing local network.

In its submission, AAPT makes the significant point that new market entrants under the 1997 regulatory regime do not have the same means as the carriers under the 1991 regime to deploy significant networks - this is because the carrier powers and immunities which existed under the 1991 Act have been significantly reduced under the 1997 Act. In these circumstances, says AAPT, full facilities based competition is unlikely - at least in the short term. AAPT is of the view that there is little realistic likelihood that Telstra's PSTN will ever be fully duplicated.

AAPT says that facilities based competition must be allowed to develop incrementally and that a new entrant must be able to acquire the particular combination of bottleneck network components that it needs at any one time and be able to change that combination over time.

In its submission, Telstra expresses the view that the deployment and activation of alternatives to Telstra's network will not occur if entrants face regulatory signals which encourage them to rely primarily on facilities provided by Telstra. Curiously, Telstra notes that Optus and others have emphasised the benefits of "one-bill". This, says Telstra, makes deployment of competing access networks commercially attractive to other players because it allows them to match Telstra's one-bill advantage. The declarations of local call and local interconnect services, says Telstra, would give other players this advantage without resulting in the deployment or activation of alternative local networks.

Telstra also claims that alternative means of providing local interconnection services are widely available and have already been extensively deployed in Australia, including hybrid optical fibre and coaxial cable distribution, radio access and optical fibre rings. Telstra also says that international evidence suggests that take-up of local interconnect services is extremely low, this reflecting the availability of ready, often superior, alternatives.

In its submission, Telstra relies heavily on the UK experience to argue against declaration.

In their submissions, Optus and AAPT support the US approach as a better model for Australia.

VI. THE UK APPROACH -- FACILITIES BASED COMPETITION

Competition in relation to local services in the UK is reportedly more advanced than in any other OECD country. Since the early 1980s the UK government's policy has been to encourage facilities based competition, or competition based on the establishment of competing infrastructure at all levels of the market. This policy has focussed particularly on the "access market", or the development of alternative infrastructure between the end-user and the local exchange to the fixed line network of the incumbent British Telecom ("BT"). The UK government believed this policy would provide end-users with a greater choice of services, facilitate the most efficient development of the telecommunications market and lead to a gradually diminishing level of regulation as market forces prevailed.

The UK regulator, Oftel, recognises that direct connection to BT's CAN or local loop is feasible and that the most convenient point to connect to the local loop would be at BT's local exchanges with calls being diverted at the Main Distribution Frame ("MDF") to the other network operator's (or carrier's) switch which could be located in a nearby building. However, Oftel believes that direct connection would adversely affect the development of competition and would not be in the interests of UK end-users. Oftel's aim is for all end-users to have the choice of at least three network operators, potentially using a variety of technology.

Interconnection or "indirect access" to BT's network at points further from the customer's premises than the local exchange has, since early 1996, been permitted for network operators with RCS status ("Relevant Connectable System Status") at a cost-based charge. RCS status is currently only available to operators making a significant contribution to infrastructure competition. Other operators, for example, creating networks from leased lines or capacity and switches, are not eligible for interconnection.

Since 1 March 1995, BT has been subject to licence conditions which impose accounting separation of its network, access and retail activities, making it easier for its competitors to negotiate interconnection.

Alternative cable and radio (wireless) local loops have been developed, albeit at enormous cost. Oftel estimates that by the end of 1996, ,72 billion had been spent building alternative local loops. British cable companies expect to be able to provide local services via alternative cable local loops to 70% of existing households by 2001 and to an even higher percentage of businesses. The fixed wireless operator, Iconica, anticipates it will be able to provide local services to around 75% of the UK population by 2001. In 1997 more than 750,000 UK households obtained a telephone line from a company other than BT.

In March 1998, Oftel announced that it proposed to implement the EU Interconnection Directive (ICD 97/33/EC) as a replacement for the existing interconnection arrangements. This proposal would remove the requirement for an operator seeking interconnection to be making a significant contribution to infrastructure competition. Oftel expects implementation to take place during 1998. Oftel believes the new proposal will continue to encourage facilities based competition, presumably because the development of alternative local loops is well advanced and because, at this stage, there does not appear to be any proposal to bring the point of interconnection closer to the end-user's premises so that interconnection will remain indirect.

VII. THE US APPROACH -- A CHOICE OF ENTRY PATHS

The United States has had a quite different journey towards competition. The Modification of Final Judgment ("MFJ") in 1982 resulted in the separation of the providers of local exchange services - the Bell Operating Companies - from the provider of long distance services and the parent of the Bell Operating Companies, AT&T.

The MFJ was followed by a period of dramatic increase in competition in long distance services. However, the market for local call services remained characterised by regional monopolies.

The Telecommunications Act of 1996 has as one of its objectives, the fostering of local competition. Thus, section 251 of the Act requires all carriers to allow other carriers to interconnect with their network, requires all local exchange carriers to resell their services at wholesale rates and requires the provision of number portability and dialling parity.

In addition, the former prohibition on the local exchange carriers in providing long distance services is, subject to the local exchange carriers meeting certain criteria, removed. The criteria which must be met include that the local exchange carrier has made available unbundled access to the local loop.

Thus, the US approach has been to provide for competition in all available forms and at all levels ranging from local call resale to access to the loop at the exchange level together with or separately from switching and other elements which are involved in a local call.

VIII. WHAT DISTINGUISHES AUSTRALIA?

Both the US and the UK contexts are very different to Australia.

The UK is a much smaller country with a much higher population density. These factors have enabled BT's competitors to install alternative networks which reach or pass large masses of population much more quickly and for lower costs than would be possible in Australia. Arguably, the regulatory approach taken in the UK is inappropriate for the Australian context, at least at this early stage of deregulation.

Telstra has argued that the adoption by the ACCC of the UK approach would promote facilities based competition while Optus has argued that it would be unsuitable for the Australian context without regulatory safeguards and restrictions. Such safeguards and restrictions would be incompatible with the new deregulated regime of the ***Telecoms Act***.

As already noted, however, the ACCC appears to have accepted that anything like full facilities based competition in relation to the local loop is unlikely in the short term and that this is not an appropriate approach for Australia. Unlike Oftel, the ACCC has no policy favouring facilities based competition over services based competition.

The Australian situation is also different to that in the US. In the US, the long distance and international markets do not include a carrier who, in addition to having a substantial degree of power in the long distance markets, also owns and controls 98% of the local loop.

However, for the reasons that the US has gone down the road of all forms of competition, Australia even more so should follow. In the US, at least, the monopolies were regional. In Australia, the monopoly is national and it covers a geographical area nearly the same size as the US but with only a small fraction of the population.

IX. IS TELSTRA'S LOCAL LOOP POWER A HINDRANCE TO THE DEVELOPMENT OF COMPETITION?

For a carrier with local access power of monopoly proportions, the opportunities to engage in anti-competitive conduct are many. Does Telstra? Recognising that the fineness of the distinction between acting competitively and acting anti-competitively is well recognised and difficult to draw, it is noted:

- In the local call services market, Telstra's competitors have to date been largely restricted to reselling local call services provided by Telstra. It is believed that the wholesale prices offered by Telstra have been very close to the price Telstra charges its own end-users or customers. Non-price barriers to competition, such as Telstra's complicated churn procedures, have also had an impact.

- Competitors, or potential competitors of Telstra, have been attempting to gain access to Telstra's CAN by commercial negotiations for years. These competitors have welcomed the ACCC's inquiry as a means of breaking the impasse in these negotiations.

- Only two competition notices have been issued by the ACCC, both against Telstra. The first, issued in May 1998, alleged that Telstra was engaging in anti-competitive conduct by charging its internet service provider competitors 19c per megabyte for carrying traffic across Telstra's network but refusing to pay them for their carriage of Telstra's traffic across their networks. It is fairly clear that Telstra's local loop power contributed to its ability to engage in this type of conduct. The second competition notice, issued in August 1998, alleged that Telstra had engaged in anti-competitive conduct in its local call churn process by, for example, the transfer fees charged by Telstra and the conditions regarding pre-transfer debt (depending on the fee paid by the gaining service provider, the customer debt is inherited).

The ACCC is unlikely to be persuaded against declaration by Telstra's arguments. The views expressed by Optus and AAPT to the effect that Telstra's local access network is unlikely to be duplicated either in the short or long term are more likely to be accepted - given that they reflect the reality to date. Given this, Telstra's "one-bill" argument is turned into a further argument in support of declaration, particularly of local call resale. Telstra's arguments about alternatives also seem to be belied by the following points:

- Telstra owns 98% of the fixed line local access network;
- Telstra supplies close to 100% of local call services;
- Optus was unable to duplicate - to any significant degree - Telstra's local network in circumstances where it was the only competitor and had significant powers and immunities;
- No new entrant emerged from the recent 1.8 GHz and 800 MHZ spectrum auctions with sufficient spectrum to deploy any significant wireless local loop infrastructure.

X. WILL ACCC DECLARATION SOLVE THE PROBLEM?

Whether or not ACCC declarations will solve the problem is a rather large unknown.

Declaration is one thing, taking advantage of a legislative right to access to declared services is another. In the case of local call services, a declaration will not immediately solve the billing problems and churn processing problems that exist in relation to resale of this service. Nor will a declaration of itself determine the most important aspect of access to such a service, namely, price. Under the legislative provisions, the parties - the access provider and the access seeker - have to agree on the terms and conditions on which access to a declared service will be given. Not surprisingly, price is the one term on which access providers and access seekers are unable to agree. However, there is a mechanism to determine any dispute about terms and conditions including price. If the parties cannot agree, either party can notify the ACCC that a dispute exists and the ACCC will determine that dispute by holding an arbitration.

With local call resale, the price at which that service is supplied will be critical to a reduction of Telstra's local loop power.

In relation to local interconnect, although this has a far greater potential to reduce Telstra's local loop power, the costs involved in taking advantage of the service are very significant. Access seekers must build infrastructure which extends from present points of interconnect to Telstra's local exchanges. Given that the powers and immunities which Telstra used to enjoy are no longer available, this involves negotiation with land owners and occupiers and the entering into of commercial arrangements with such owners and occupiers. As with local call resale, the access seekers will have to agree on terms and conditions of access with Telstra and depending on what price is agreed or is determined by arbitration, this is an added cost.

The above difficulties noted, perhaps the most important point to note is that at this stage of the game - or the war - there is no alternative solution to dealing with Telstra's local loop power apart from requiring it to give access both to both local call services and to the loop itself. The opportunity which existed to structurally separate the local loop from Telstra's other services and infrastructure was lost forever when Telstra was partly privatised. With the Australian public holding a third of the shares in Telstra, any legislative action to combat Telstra's power must now take account of this fact and tread the fine line between promoting competition and not causing harm to the shareholders.

Return to Top View Full-screen

Convergence of Telecommunications Technologies and Its Impacts on Universal Service Policy in Taiwan

Chung-Chuan Yang

National Kaohsiung First University of Science and Technology, Taiwan

ABSTRACT

The trends of convergence in telecommunications technologies, industries, and regulatory regimes have created tremendous impacts on telecommunication policies in Taiwan. The case is especially remarkable in the provision of universal service in Taiwan. In many developed nations, there have been heated academic and public debates about whether services provided on the National Information Infrastructure (NII), or future GII, should be included in the universal service package, how regulatory regimes based on structural separation thesis should be revised to cope with new challenges, and what new universal service policies should be devised to meet the social goals and promote new technological initiatives. Taiwan's government, like many other governments in the world, has faced these issues that can be mainly attributed to the technological trend of convergence.

The purposes of this paper are aimed to investigate 1) the developments of the NII plans and policies in Taiwan; 2) the roles and visions of various stake-holders in the NII policy-making process in Taiwan; 3) the impacts of telecommunication market liberalization and technological convergence on universal service provision; 4) appropriate mechanisms to ensure the provision of universal service in the future.

View Full Text

Convergence of Telecommunications Technologies and Its Impacts on Universal Service Policy in Taiwan

I. INTRODUCTION

Recent advances in the information-communication technologies have brought about a brand-new environment for telecommunication policy-makers and telecommunications scholars in Taiwan. Convergence, as one of the most taunted technological trend in the late 20th century by many communication professionals, not only depicts many recent advancements in the telecommunications field, but also predicts what the future of telecommunications media will look like in the next century (Baldwin, McVoy, & Steinfield, 1996).

The convergence of information, communications, and media technologies has emerged in Taiwan since early 1990s. For example, applications related to telecommunications networks (such as electronic newspapers, web broadcasting, Internet telephony, cable telephony, etc.) have all gained wide popularity. Furthermore, the competition in the telecommunication marketplace has emerged in many fronts. Network infrastructure competition such as the emergence of wireless and computer telephony networks begins to gather momentum in Taiwan where telecommunications market is undergoing gradual liberalization. As different telecommunications networks converge and compete with each other, new telecommunications services and providers are allowed to enter the telecommunications market once-monopolized by the Directorate General of Telecommunications (DGT). As the market shakeout unfolds, consequently, new regulatory mechanisms need to be proposed to cope with this new development.

Among many important regulatory issues, what has been attracting a lot of attention is the provision of universal service. The issue of universal service provision has reemerged due to the increasing deregulation and convergence trend in Taiwan, as well as other nations in the world. In the past, the problem of formulating appropriate universal service policies was relatively simple when traditional telephone networks provided no more than voice communication services. The challenge at that time was to extend the network in such a manner that the entire population was served at a reasonable and affordable price. The solution was found in an elaborate set of internal subsidy mechanisms between long-distance and local rates that enabled the extension of telephone service to almost entire population. However, the recent proliferation of telecommunications-based advanced services has made the issue of universal service very complicated (Sawhney, 1995). The problem of universal service provision in advanced telecommunications networks such as the NII is in particular acute with the increasing importance of network-based information services in an information-based economy.

The purposes of this study are aimed to investigate 1) the developments of the NII plans and policies in Taiwan; 2) the roles and visions of various stake-holders in the NII policy-making process in Taiwan; 3) the impacts of telecommunication market liberalization and technological convergence on universal service provision; 4) appropriate mechanisms to ensure the provision of universal service in the future.

II. THE NII INITIATIVE IN TAIWAN

The term, "National Information Infrastructure," was first created in the United States. It refers to "the hardware, software, standards, personnel, and training facilities that will one day form an information infrastructure that will place vast quantities of voice, video, and data at users' fingertips" (General Accounting Office, 1994, p. 12). The conceptualized NII in the United States includes the following components: 1) interconnected and inter-operable fibre-cable telecommunications networks; 2) many information appliances such as computers, televisions, fax machines, telephones, etc.; 3) inter-linked databases, software, and information services; and 4) end users with knowledge to use or operate these systems (Information Infrastructure Task Force, 1994 a, b; Liu, 1994). In Taiwan, the NII is conceptualized as the inclusion of superb telecommunication network, network services and the techniques, standards and regulations in various applications (ISOC Taiwan, 1998a).

Historically, the term "infrastructure" was often applied to public-sector investments in highways, airways, schools, and libraries. As for a national information infrastructure, it is intended to serve a broad public interest and is an important economic factor contributing to commercial and industrial interests. The national information infrastructure includes the following elements: lines linking local subscribers to switching systems, overseas lines providing two-way access to subscribers in foreign countries, and customer premise equipment (CPE) providing the interface linking the user and the system.

The NII Initiative in Taiwan was first proposed by the then Premier Lien Tsang in 1994, following a similar plan in the United States. The NII is planned and operated by a special committee, NII Steering Committee that is responsible for the planning and implementation of various NII projects in Taiwan. It was organized among all the ministries, commissions and councils under the Executive Yuan. The NII Steering Committee was installed in August 1994. Within the Committee, a Civil Advisory Board has also been established with board members invited from the leaders of the industries, academia and professional societies. This is to ensure active joint planning and promoting vigorous participation from the private sectors (NII Steering Committee, 1997).

NII is composed of networks for various kinds of applications and software (NII Steering Committee, 1995a, b). Hsia (1995) pointed out that Taiwan's NII is composed of three elements: conduit, compute, and content. More specifically, Taiwan's NII will include the following components:1) hardware facilities; 2) information; 3) applications; 4) network standard and transmission protocol; 5) cooperation between government (NII Steering Committee, 1995c).

The major directions of the Taiwan's NII Initiative include the following (NII Steering Committee, 1997):

- Network construction
- Education and training
- Electronic government and government on-net
- Electronic commerce
- Social welfare
- Life-long learning
- Chinese cultural relics on-net
- Study and revision of the related laws and regulation
- Doothing the impact on the society and humanity
- Internationalization of Chinese networks.

At the present stage, Taiwan's NII development has established the following five goals (NII Steering Committee, 1997):

- Promoting the use of Internet: to reach three million Internet users by the year of 2000 in order to promote pervasive use of network applications

- Putting every middle school and every primary school on Internet to ensure that, by the year of 2000, 20% of overall students will have access to one networking-multimedia computer at the minimum

- Developing Taiwan an Internet hub in the Asia Pacific area by fully liberalizing fully liberalizing its telecommunications market from monopoly, and by expediting its network connection to all other Asia-Pacific countries as well as all continents

- Establishing a "Global Chinese Network Information Center" by sharing various historical and cultural information it maintains

- Developing a new industry of network multimedia and establishing an Information Society in Taiwan

As discussed in the above paragraphs, the goals of Taiwan's NII are to ensure that Taiwan will play a major role in global communications for the next century. In addition to the educational, commercial and entertainment benefits that NII will bring to the country, Taiwan expects the completion of the NII will help drive its domestic hardware and software industries. Furthermore, a top-notch information infrastructure is also necessary to maintain Taiwan's competitiveness in its efforts to become a regional telecommunications operating hub. Under this plan, by 2005 the country is planned to build a broadband information superhighway that provides interactive voice, data and video service nationwide and is linked with international networks and transmitted over optical fiber, coaxial cable, and satellite. An estimated $10 billion U.S. dollars will be invested for NII development through 2005 (Zarit, 1995).

The importance of NII to the future of Taiwan is to "promote the use of NII," "to keep up with the most developed nations, and "to enhance Taiwan's competitive advantage in a global economy" (NII Steering Committee, 1995b). More specifically, the purposes of Taiwan's NII Initiative are as follows:

1) To build Taiwan as the most informationalized country.

2) To build Taiwan as the Asia Regional Operating Center.

3) To develop new technologies that can be used for multimedia and communication technologies.

4) To enhance the welfare of Taiwanese people.

5) To create a better environment that allows exchange of cultural and knowledge information (NII Steering Committee, 1995b).

III. NII, PUBLIC INTERESTS, AND UNIVERSAL SERVICE

Similar to many advanced and developed nations, the NII Initiative in Taiwan has been treated as an instrument that will bring tremendous economic benefits. It is also deemed vital to ensure economic gains from the implementation of the NII and from the manufacturing of network-related hardware and software. Cultural and social dimensions of the information infrastructure have not been paid much attention until recently.

The NII is viewed as a job-creating, cost-reducing, life-quality enhancing magic wand of the 21 century by most governments initiating such plans. After its completion, the NII will be capable of transmitting large amount of data, video, graphics, and images at a high speed. It will also connect businesses, schools, hospitals, residences, and other public facilities by a broadband, interactive telecommunications network (Information Infrastructure Task Force, 1994). Many advanced information services will become available to their citizens. Among these applications are telemedicine, distance education, video-on-demand (VOD), and tele-shopping.

However, because of a strong need to upgrade its telecommunications infrastructures to compete in a global information economy, the NII plans in Taiwan, as in other Asian Tigers, are often treated as the construction of physical facilities (NII Steering Committee, 1997). A world-class information infrastructure is also necessary to keep Taiwan competitiveness in its efforts to become a regional telecommunications operating hub. In Taiwan, over USD$10 billion will be used for NII development through 2005 (Zarit, 1995). State-owned Chung-Hwa Telecom has drafted an aggressive plan to invest NT$16 billion during FY97 ~ FY99 for information network construction so as to provide quality services to the three million Internet users. With 68% penetration rate of CATV subscription in domestic homes, the government will soon lift the restriction and permitting the CATV operators to offer broadband Internet services available for video transmission. Wireless communication and satellite telecom services will also be liberalized soon. All these different transmission media will participate in Internet services in the future to form a seamless NII network (NII Steering Committee, 1997).

Swahney (1995) pointed out the discourse about universal service takes place at three levels: individual, social system, and humanity. At the individual level, the discussion is on the welfare and rights of each individual human being. The discourse on the social system level deals with the benefits to the society as a whole. The relationship between universal service and humanity is complicated and therefore the discourse is not well articulated. The discussions range from the religious to secular hopes for human unity.

Similarly, these themes are reflected in various discussions about the NII Initiative in Taiwan. Although the enhancement of people's welfare is included as one of the five major objectives that Taiwan's National Infrastructure Initiative (NII) aims to accomplish, many disadvantaged groups seem to be left out by government's aggressive promotion of information and network literacy programs in recent years. Historically, Taiwanese government had ignored the welfare of the disabilities and minorities in the name of pursuing rapid economic developments and ensuring national security. Therefore, with more and more information is distributed through the Internet and accessed solely via computer, there is an urgent need to consider how NII Initiative can be re-designed to meet the special needs of the information-poor and how they can benefit from the NII, as a result.

A fundamental policy question is what types of universal service should be made available in Taiwan's NII Initiative. Failure to address this question will hinder any further discussions and policy-making processes. Swahney (1995) argued that, from a policy-making perspective, the most serious problem in the universal service will be the lack of consensus on what constitutes basic services that should be made universally available to all citizens.

Swahney (1994) pointed out that there is a consensus among policy scholars and practitioners in the United States that the definition of universal service should be expanded beyond plain old telephone service (POTS). However, such consensus has not been achieved in Taiwan, mainly due to the innovative nature of this topic and the lack of relevant studies from local scholars. As Hadden (1994) indicated the redefinition of universal service should be approached from both policy-makers' and users' perspectives to ensure that such policy revision can benefit the society in the end. If redefining universal service will be the first step, an important policy question is whether the universal service package should be extended gradually and incrementally, or whether futuristic services should be included.

For consumers, what services should be deemed as universal or basic and included is their major concerns. As Hadden (1994) pointed out, "[h]ow can we ensure that the information and services available on the NII are important and useful enough that people will want access to be basic or universal'?" For example, in the past, universal service may just mean access to a party line and use traditional POT services. However, most people nowadays expect access to private lines. Moreover, advanced telecommunications services such as caller identification, call forwarding, voice mail, call blocking, video services, high-speed digital transmission, many Internet-based applications can, one day, become necessity of life.

However, the process of redefining new universal service package can be long and pain taking. Any mistake can also result in long-term and negative effect on society. Hudson Institute's research argues for a delay in expanding universal service concept before policy-makers understand the demand and cost of the new digital interactive services available on the NII (Pitsch & Teolis, 1994). As Pitsch and Teolis (1994) put it, "[b]uilding the infrastructure and providing services for use on it are inherently risky actions, and prematurely expanding universal service could increase these risks and thereby delay or kill innovative efforts" (p. 10).

IV. IMPACTS ON REGULATORY REGIMES

The provision of universal service in the NII age has attracted the attention from government regulators, public-policy scholars, advocate (non-commercial) groups, and commercial stakeholders.

For government regulator, the functions of a regulatory regime, unfortunately, have been hindered by recent trend of telecommunications deregulation in Taiwan. In some cases, deregulation has required the regulatory agencies to adjust its organizational structure to deal with newly privatized telecommunications businesses. As Taiwan's telecommunications deregulation process was partially pushed by the pressure to join the WTO, the deregulatory process is less thoughtful and, thus, has created negative impacts on the regulatory process of universal service provision.

Taiwan's regulatory authority, the Directorate General of Telecommunications (DGT), has quickened its steps towards the liberalization of its telecommunications industry in this island-state. On January 29, 1997, the DGT decided to accelerate the liberalization of basic telephony services to the year of 1999, two years earlier than originally planned. The acceleration of basic telephony services deregulation followed the passage of Taiwan's Telecom Acts in January 1996, which resulted in the separation of the DGT into two independent entities—the regulator DGT and the service provider Chung-Hwa Telecom.

Under this new schedule, state-owned Chung-Hwa Telecom retains its monopoly on basic telephony services, including local fixed-line, inter-city, domestic long distance and international service, until 1999. However, the government is planning to privatize Chung-Hwa Telecom within the next five years and is considering a proposal by local business leaders to release 30% of the company's shares to the public and auction of another 20%-30% to a strategic investor.

The trend of technological convergence has rendered many of the past regulatory regimes inoperable. In the past, telecommunications, media, and computer industries are regulated by separate government entities in various ministries. The Government Information Office regulates the contents and licenses of media businesses. The DGT regulated communication hardware and spectrum allocation. The Department of National Defense controls some of the spectrum for military uses. As a result, organizational conflicts and turf fighting have deterred the liberalization of telecommunications industry in Taiwan. However, with the convergence of telecommunication technologies, the lines between media, telecommunications, and information technologies are blurring. As a result, the recent reengineering attempt of the government has begun to consider the establishment of an encompassing regulatory commission, similar to the FCC in the United States, to regulate the emerging information-communication industries. This new development can benefits the provision of universal service in the long run.

V. ROLE OF NON-COMMERCIAL STAKEHOLDERS

Because of the enforcement of Martial Law in the past four decades, the involvement of advocate groups in the policy-formation process has been minimal. However, in order to ensure the social goals of the NII can be accomplished successful, non-commercial stakeholders should play an active role of advocating social benefits and public interest of the NII during the policy-formation process. To understand the role of non-commercial stakeholders in affecting the policy-making of NII, a questionnaire survey of 184 organizations was conducted.

A list of non-commercial organizations located in Taipei was obtained from the Non-Profit Organizations Association Division, Department of Interior Affairs in Taiwan. The total number of non-commercial organizations registered with the Division amounts to 322 in 1995. However, only organizations (n=184) that represent the following groups were surveyed in this study: children and youth welfare (n=35), the visually- and hearing-impaired (n=9), the mentally retarded (n=9), the physically disabled (n=54), environmentally oriented (n=22), the minorities, and other public interest groups in general (n=41). This research used a census method, in which all organizations in the population were surveyed (Yang, 1996).

1. *Knowledge of the NII Initiative in Taiwan*

Twenty-one (36%) respondents have heard of the NII while thirty-seven (64%) of them have not. Most of visually-, hearing-, and physically disabled groups that tend to be low in education, socioeconomic, and occupational status have not heard about the NII. Only four respondents (33%) in the physically disabled groups have heard of the NII, while eight respondents (67%) have not. All eight respondents in the hearing- and visually impaired groups have not heard of the NII.

Most of the respondents cannot provide a thorough description of the contents and purposes of the NII Initiative. For some respondents, the answers to this question are very general such as "Network is good for our organizations," "NII can increase economic benefits," etc.

2. *Attitude towards the NII Initiative in Taiwan*

Because of the lack of understanding of the NII, over 80% of the respondents do not have a clear attitude toward the NII. Several respondents did not see the relevance of the NII to their organizations, while many respondents said that the NII has nothing to do with their organizations. Only a few respondents pointed out that NII can help "the fast moving of information," "help the promotion of their organizations," etc.

3. *Perceived Goals of the NII Initiative in Taiwan*

As to the goals and purposes of the NII, "to enhance citizen's welfare" is most often selected by respondents (n=38). However, "to increase national competitiveness" is the second highest answer (n=35) selected by the respondents. "To solve social problems" was the third highest answer (n=29) selected by the respondents.

4. *Policy Directions of the NII Initiative in Taiwan*

Respondents pointed out the overemphasis on the construction of facilities (n=23), economic problems (n=18), and the ignorance of the negative effects of technologies (n=10) are the top three problems in the formation of the NII policy in Taiwan.

As to how government should encourage the use of the NII, over 28% of the respondents (n=56) have proposed a dedicated networks for individual groups (such as LatinoNet in the U.S.), while 24% (n=49) of the respondents said that educational programs are important. Subsidization of equipment and network access charge is also listed as an important factor. Twenty-one percent of the respondents (n=43) selected this item.

In terms of how government should assist non-commercial stakeholders to make the best use of the NII, the majority of respondent's wants subsidize of hardware and facilities that allow the access of the NII. A few of the respondents said there is no need for using the NII.

5. *Involvement in the NII Policy-Making Process*

Over 97% of the respondents (n=57) have not expressed their concerns over the NII to the government or policy-maker. Only two respondents (3%) have done so. For those organizations that have not expressed their opinions, "have not thought about it" is the only reason they selected.

6. *Channels of Influence over the Policy-formation Process*

The majority of respondents use traditional mass media (e.g., newspaper and television) and people who work for these media organizations to express their concerns over public interest issues. Over 50% of the respondents selected these two channels to exercise their influence.

IV. CONCLUSION

The implications of "digital convergence" can be profound. Garnham (1996) pointed out that "the use of all-embracing terms like 'multimedia' and 'convergence' disguises important distinctions that should still be drawn between a number of separate but interrelated processes which affect the potential impact of digitalization." (p. 106) The way the communications sectors actually develops in response to the technological potential of convergence will in part depend on the regulatory responses to strong opposing arguments (Garnham, 1996). In other words, regulatory mechanisms, if designed appropriately and enforced effectively, can have a positive effect on the shaping of future communication landscape. As a result, government in Taiwan, as well as many others around the world, needs to contemplate the issue of universal service provision in a converging environment.

The National Information Infrastructure (NII) will change how people work, learn, live, play and communicate with each other. Although private sectors will play an important role in the building of the NII, government policy should lead the reforming of telecommunications policy, promotion of the NII applications, resolution of information policy issues such as privacy, security and intellectual property and investing in long-term R&D (Kalil, 1995).

The emergence of the National Information Infrastructure will pose new challenges to existing regulatory frameworks. As Faulhaber (1995) pointed out, "[t]he policy problems of the information superhighway are substantially different from the old telephone system, and the public institutions required to solve these problems will be substantially different from those adapted to the previous regimes" (p. 271).

The issue of access to information especially among the disadvantaged groups in society can only be alleviated to a limited degree by the distribution of new access-enabled technology such as free computer equipment, e-mail account, or local access points. In order to sensitize the public as well as government officials about the importance of universal service, several policy directions should be taken into consideration.

1. *Building Consensus on the Provision of Universal Service*

Government monopoly on telephone service in the past decades has made cross-subsidization and universal service provision an issue that did not interest most policy researchers in Taiwan. Universal service is often treated as an internal cost allocation problem inside the Directorate General of Telecommunications (DGT). However, future privatization of DGT and the introduction of new communication-information technologies (such as NII or the Internet) can endanger the status quo of universal service provision in Taiwan. This issue will especially emerge as the rate-of-return plan is now shifting to price-cap in Taiwan. Under this circumstance, the provision of universal service will be viewed as a cost-incurring obligation that monopoly Chung-Hwa Telecom and private telecommunications operators all want to avoid if they can.

Apparently, the lack of discussions on the universal service in telephone service has shown a society-wide ignorance of potential side-effects of informationalization of the society. The public and policy-makers are likely to transfer the same ignorance toward the information needs of the information have-nots. After the examining government publications (NII Steering Committee, 1994a, b, c) and many newspaper and magazine articles on the NII topic, only a few public interest statements can be found (Tseng, 1995; Wu, 1995; Yang, 1996). Most discourses on the NII center on the economic benefits (Chen, 1994; Wu, 1994). Until recently, the social implications of the NII are rarely mentioned (NII Steering Committee, 1997, ISOC, 1998). However, the lack of awareness about NII's social impacts can lead to an initiative that widens the gap between social classes, bringing more social unrest rather than the bright new future as depicted by most NII proponents in Taiwan.

Fortunately, this situation has changed in recent years. The NII Steering Committee and the Ministry of Education will promote a plan to invest US 200 million on information literacy program in Taiwan (Li, 1996). The NII steering Committee also calls for the private sectors and industries to cooperate in the development of a sound networking environment to support the networking of primary and secondary education institutes in Taiwan. Through mutual cooperation between the government and private sectors, the target is to attain the ratio of 20 students to one networking-multimedia computer at a minimum and to make abundant learning resources and contents available for access. These will make Internet a vital part in primary and junior schools' curriculum (NII Steering Committee, 1997).

2. *Selecting Appropriate Regulator Mechanisms*

It seems that Taiwanese government centers on its promotion of the NII on facilities-based mechanisms. For example, a major NII component is heavy investments by private and public sector on the NII network. As precursors to the futuristic NII, several computer networks are introduced to connect to the Internet. The most popular networks are TANet, Seednet, and Hinet. However, will the completion of the NII network guarantee that everyone is able to access the network and enjoy cornucopia information resources available on the network? The answer is apparently negative. Not to mention the state-of-the-art information appliances, the Internet users only make up tenth of the island population (about 2.30 million as of early 1998). Surveys have constantly identified that the demographics of the Internet users are likely to be high-income and high-education segments of the society (Wang, 1997; Wang, Fang, Li, and Wang, 1998). The less favored groups are not likely to use the Internet due to their limited financial resources, not to mention that the heavy reliance on visual abilities seem to exclude them. Therefore, it is evident that a few selected groups who have the luxury to own a "car" will only drive the Information Highway.

As Taiwan's government plans most national developments (e.g., the defunct Six-Year National Construction Plan or the current Asia-Pacific Operating Centers), government is going to play a vital role in promoting universal service goals. Although Taiwan's government will allow private sectors to participate in the building of the NII, it will also have a lot of influences on the direction of the NII, given the amount of investment planned and current monopoly on telecommunications.

However, it should be kept in mind that the success of the NII plan may depend on more than investment on hardware and network, the non-technological aspects of the infrastructure are also critical. McClure (1993) identified these non-technological factors as human resources, political, social processes, organizational support, and end-users' attitude. He concluded that "[d]iscussions about how the network should evolve, how people should be able to use the network, and how individuals will be empowered by using the network ... are essential" (p., 172). Without a debate on how social goals can be reached in an electronic age, there will be an increasing gap between the "network literate" and "network illiterate" (McClure, 1993, p. 172). Even worse, this gap can be widened because the introduction of the NII (Doctor, 1993).

V. FUTURE POLICY IMPLICATIONS

The introduction of the access-enabling system, as well as other technologies to ensure the access to the NII by the information-have-nots, is bound to positively affect the provision of universal service in Taiwan. However, more measures should be done to better take care of disadvantaged groups. The following section will divide these mechanisms into the following categories: regulation-, facilities-, and knowledge-based mechanisms.

1. *Regulation-Based Mechanisms*

Solutions based on regulations should be set up by the government to ensure the universal service for the disabilities. Many models are now available to adopt or adjust. For example, Eli Noam's Financial Support System which is based on symmetry, neutrality, and user-friendliness to ensure universal service in a competitive marketplace. Taxation is also a good viable mechanism. Stahlman (1994) proposed public broadcasting taxes (as used in Britain where $120 will be paid for owning a television) or taxes from cable fees. Eli Noam (1994) noted other sources to pay for universal service may include network taxes, telecommunications sales taxes, value-added service surcharges, net transmission account system, and a property tax on carriers.

2. *Facilities-Based Mechanisms*

These include the building of the NII, availability of public electronic access points, voucher and customer premise equipment to access information resources available on the NII. For the visually impaired, the Golden Point Computer System is still limited to college-educated students. As one of its developers, Mr. Yang, (Shu, 1996) pointed out, among 20 thousand visually impaired individuals in Taiwan, only 100 computer specifically designed are available. Government may need to include the computer as well as some advanced enabling technologies in the assistance programs which allow the visually-impaired to purchase fax machine in the past (Liu & Yang, 1997).

In addition, ever increasing cost of getting online will also prohibit the disadvantaged groups to access the immense pool of the information on the Internet. For example, the visually impaired will need to spend more time on viewing a web page because the conversion and reading from Braille take time. Therefore, it should be considered if subsidy for online subscription will also be included in these programs. If not, networks built specifically for this group and other disabilities should be an alternative.

3. *Knowledge-Based Mechanisms*

Williams and Pavlik (1994) noted that the problem in information access "is not always just one of availability, but the capability to take advantage of availability, and even the knowledge and attitudes of what information is important to a given situation" (p. 217). McClure (1993) pointed out that there emerges "an education disconnect between the rapidly developing communications technologies and information resources available to the public, and the public's ability to use these resources (p. 137). Therefore, to ensure universal service, knowledge-based measures will need to be included.

In the Article 19 of the Universal Service Declaration of Human Rights, it is claimed that "[e]veryone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive, and impart information and ideas through any media and regardless of frontiers." (cited in Yang, 1996) The introduction of the NII and similarly advanced telecommunications technologies does not preclude the applicability of this axiom. On the contrary, it is timely to bring the importance of universal service provision into the current NII Initiative discourses to enhance its benefits to all human races.

VI. REFERENCES

1. Baldwin, T. F., McVoy, D. S., & Steinfield, C. (1996). *Convergence: Integrating media, information, and communication.* Newsbury, CA: Sage

Publications, Inc.

2. Doctor, R. D. (1993, April 13). *The National Information Infrastructure: Social equity considerations.* Paper presented at the Center for Civic Networking Conference: From Town Halls to Civic Networks, Washington, D. C.

3. Faulhaber, G. R. (1995). Public policy in telecommunications: The third revolution. *Information Economics and Policy,* 7(3), 251-282.

4. Garnham, N. (1996). Constraints on multimedia convergence. In Dutton, W. H. (Ed.), *Information and communication technologies: Visions and realities* (pp. 103-119). Cambridge: Oxford University Press.

5. General Accounting Office. (1994). *Information superhighway: Issues affecting development (Report GAO/RCED 94-285).* Washington, D. C.: General Accounting Office.

6. Hadden, S. (1994). Universal service and open access. NTIA Virtual Conference.

7. Hsia, H. M. (1995, June 16). *Developments and current state of the NII in Taiwan.* Presented at the Conference of NII Developments in Taiwan, Taipei, Taiwan.

8. Information Infrastructure Task Force. (1994a, March 28). *The National Information Infrastructure: Agenda for Action.* Washington, D.C.: [no publisher information]

9. Information Infrastructure Task Force. (1994b). *The National Information Infrastructure: Frequently asked questions.* Washington, D.C.: [no publisher information]

10. ISOC Taiwan. (1998a). NII in Taiwan [Online]. Available: http://www.isoc.org.tw/nii.htm

11. Kalil, T. (1995, October). Public policy and the national information infrastructure. *Business Economics*, 30(4), 15-20.

12. Li, R. S. (1996, December 18). Six billion to promote universal access. *United Daily News*, p. 43.

13. Liu, P. (1994, July 4). Taiwan information highway-Taiwan's path to the 21st century. *Business Taiwan.*

14. Liu, Y. L. & Yang, C. C. (1997, July). Close-captioning Service in Taiwan and its policy implications. *Journal of Broadcasting and Television*, 3(2), 109-140?

15. McClure, C. R. (1993). Network literacy in an electronic society: An educational disconnect. In *The knowledge economy: The nature of information in the 21st century* (pp. 137-178). [np]: Institute for Information Studies.

16. Noam, E. (1994). *How to pay for universal service in telecommunications under competition: Reforming the financial support system for universal service in telecommunications.* NTIA Virtual Conference.

17. NII Steering Committee. (1995a, April 26). Eighth Meeting of NII Steering Committee. *NII Bulletin*, 9. Taipei, Taiwan.

18. NII Steering Committee. (1995b). Introduction to NII [Online]. Available: http://www.nii.gov.tw/status/index.htm

19. NII Steering Committee. (1995c). NII Q&A. [Online]. Available: http://www.nii.gov.tw/qa/index.htm

20. NII Steering Committee. (1997, August). The National Information Infrastructure (NII) of R.O.C. Abstract [Online]. Available: http://www.nii.gov.tw/niieng/nii.htm

21. Pitsch, P. K., & Teolis, D. P. (1994, August). *Updating universal telephone service.* Indianapolis, IN: Hudson Institute.

22. Sawhney, H. (1995). Universal service: Prosaic motives and great ideals. In Brock. G. W. (Ed.), *Toward competitive telecommunication industry: Selected papers from the 1994 Telecommunications Policy Research Conference* (pp. 205-224). Mahwah, New Jersey: LEA.

23. Shu, F. Y. (1996, December 18). Mr. Yang S. H dedicated to promoting information illiteracy for the visually-impaired. *Freedom Times*, p. 38.

24. Stahlman, M. (1994, May 30). Over the horizon; read my lips; here comes

the info-tax. *Computer Reseller News*, p. 194.

25. Swahney, H. (1994, Fall). Universal service: Prosaic motives and great ideals. *Journal of Broadcasting & Electronic Media*, 375-395.

26. Tseng, C. C. (1995, February 27). Statement in the "How to Build Our NII." Conference sponsored by the Commercial Times, Taipei.

27. Wang, Tse-Ren. (1997, November). White-collared workers make up of the majority of Internet users in Taiwan. *Commonwealth Magazine,* p. 124-145.

28. Wang, Hong-Rong, Fang, Wen-Chang, Li, Yi-Chia, and Wang, Tse,Jien. (1998). *A survey of Internet population in Taiwan.* Paper submitted for possible presentation at the TANET98 Conference, Haulien, Taiwan.

29. Williams, F., & Pavlik, J. V. (1994). *The people's right to know: Media, democracy, and the Information Highway. Hillsdale, NJ: LEA.*

30. Wu, S. M. (1994). Potential of the NII. *Communications Magazine,* pp. 54-59.

31. Wu, T. L. (1995, February 27). Statement in the "How to Build Our NII" Conference. Sponsored by the *Commercial Times*, Taipei.

32. Yang, C. C. (1996, June). Ensuring universal service in the National Information Infrastructure (NII) Initiative in Taiwan. *Journal of Communication and Culture, 4,* 33-66.

33. You, M. B. (1990). *A policy-making as argument perspective on alternatives to rate of return regulation.* Occasional paper. Columbus, OH: National Regulatory Research Institute.

34. Zarit, W. (1995, January 15). Taiwan mapping out plans to build the superhighway to its information future. *East Asian Executive Reports*, 17(1), p. 8, 15+.

VII. **ENDNOTES**

1. The author would like to thank the National Science Council in

Taiwan for its financial support [NSC 86-2412-H-327-001] of this study.

Foreign Ownership Regulations in Korean Telecom Market

Jae-Ho Byun and Pang-Ryong Kim

ERTI, Republic of Korea

ABSTRACT

The Korean telecom market has been seeing rapid growth since 1991, marking an annual average growth of 21.6%. The size of the market amounted to 4.532 trillion won in 1991, but it rose to 14.745 trillion won in 1997. Despite the strong growth potential of the market, foreign access to the Korea's telecom market has been rigidly restricted. However, in the wake of the WTO Telecom Accord, Korean government has been mitigating, or lifting, foreign ownership regulations after reviewing its overall policies regarding foreign ownerships. After the advent of economic crisis in particular, Korean government has actively invited foreign capital by easing foreign ownership regulations earlier than the schedule it proposed at WTO negotiations table. This study will first explain the overall conditions of the Korean telecom market and then review regulations and policies pertaining to foreign ownership. Finally, this study will examine foreign companies' investment in Korean telecom market.

View Full Text

Foreign Ownership Regulations in Korean Telecom Market

1. Current Conditions of Korea's Telecom Market

1.1 Deregulation Policy

Korea's telecom market had been under direct control of the Ministry of Information and Telecommunications (MIC), which is in charge of communications policies, until early 1980s. With the establishment of Korea Telecom (KT) in 1981, the operation of telecom services became independent from the MIC. Between 1982 and 1984, DACOM and KMT (renamed as SK Telecom in 1997) were founded and monopolized the markets of data communication services and mobile telephone services, respectively. The MIC allowed their monopoly in the telecoms industry to clear the chronic telephone backlog in the earliest time possible. With the satisfactory disappearance of the backlog in the late 1980s, however, the MIC decided to gradually introduce competition to the industry for qualitative advancement of the telecoms industry.

In an effort to implement this policy, the MIC had converted the monopolistic operation of all major telecom services other than local telephone services into duopolistic system from 1991 to 1995. In 1991, DACOM was allowed to step into international telephone services market, and 10 paging companies were selected as the second paging service providers for regional paging services in 1992. Shinsegi Telecom was selected in 1994 as the second mobile telephone service provider, and DACOM was permitted to enter into long-distance telephone services market in 1995.

However, the MIC again expanded this duopolistic system to full-fledged competition system in preparation for the opening of the domestic market after 1998 in accordance with the WTO Telecom Accord. The MIC turned to the full-blown competition system between 1996 and 1997 by allowing new service providers into almost all sectors of telecom services which had been under the duopolistic system. All sectors of telecom services were at last thrown into competition as the MIC permitted Hanaro Telecom into local telephone services market, which had remained monopolized by KT (See Table 1).

Table 1. Common Carriers in Korea, December 1997

Classification		Incumbents	Entrants Licensed between 1996 and 1997
Telephone	Local	KT	Hanaro Telecom
	Long- distance	KT, Dacom	Onse Telecom
	International	KT, Dacom	Onse Telecom
Leased Line		KT Dacom	Thurunet G&G Telecom Dream Line Onse Telecom
Cellular Telephone		SK Telecom Shinsegi	
PCS			KT Freetel LG Telecom Hansol PCS
TRS		(National) Hangook TRS	(National) Anam Telecom (Regional) 9 operators
CT-2			(National) KT (Regional) 9 perators
Paging		(National) SK Telecom (Regional) 10 operators	(Regional) 2 operators
Wireless Data Transmission			Air Media Intech Telecom Hanse Telecom

1.2 Classification of Telecom Services and Providers

According to the Public Telecommunications Business Law, telecom services in Korea are classified into basic telecom services, specific telecom services and value-added services and telecom service providers are classified into common carrier, specific telecom service providers and value-added service providers. Basic telecom services include wired and wireless services provided through telecom facilities installed by common carriers. Specific telecom services refer to the wired and wireless telecom services provided by specific telecom service providers using facilities of common carriers. Leased line resale, Internet phone and callback services are included in specific telecom services. Value-added services refer to services other than basic telecom services, provided by value-added service providers using facilities leased from common carriers (See Table 2).

Table 2. Classification of Telecom Service Providers

	Common Carriers	Value-Added Service Providers	Specific Telecom Service Providers
Possession of Telecom Facilities	Possesses Network facilities.	Leases Network facilities.	Possesses switching facilities or uses facilities of common carriers.
Services provided	Wired and wireless services (local/long-distance/international telephone services)	Value-added services	Voice line resale/Internet phone/callback services
Licensing Methodology	License to be issued by MIC	Notification to MIC.	Registration to be made with MIC

1.3 Market Sizes of Individual Services

Thanks to MIC's introduction of competition, Korea's telecom market has shown a sharp growth since 1991, marking an annual average growth of 21.6%. The market size was 4.532 trillion won in 1991 and it grew to 14.275 trillion won in 1997 (See Table 3.).

Table 3. Market Sizes of Telecom Services (Unit: 1 billion won)

	1991	1992	1993	1994	1995	1996	1997
Basic Telecom Services	4,464	5,279	5,885	6,621	8,193	12,002	13,437

Value-Added Services	69	120	195	236	361	507	838
Total	4,533	5,399	6,080	6,857	8,554	12,509	14,275
Growth from the Previous Year		19.1	12.6	12.7	24.7	46.2	14.1

As shown in Table 3, Korea's telecom market has been steadily expanded, but with big differences among services. First, wired services market was diminished in size in 1997 compared to 1996 in spite of an increase in the number of subscribers. The reduction is attributed to reduced service use due to economic recession and price competition among service providers in long-distance and international telephone services markets.

Meanwhile, wireless services market has kept a rapid growth at annual average of 81.9% since 1991. This market has sharply expanded in size, since 1996 in particular, thanks to full-blown competition in the mobile telephone market with drastic increase in the number of new service providers, including Shinsegi Telecom, the second cellular mobile telephone service provider, and PCS service providers. Fierce competition among service providers in their effort to secure users resulted in sharp decrease in terminal prices and service charges. Potential customers who had postponed subscriptions because of high costs of terminals and services were greatly attracted, resulting in drastic increase in the numbers of subscribers.

Table 4. Market Sizes and Numbers of Subscribers of Basic Telecom Services

		1991	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**
Wired Services	Sales (in billion won)	4,314	5,019	5,447	5,670	6,483	8,563	8,248
	No. of Subscribers (in 1,000)	14,849	15,920	17,024	18,102	19,197	20,204	21,508
Wireless Services	Sales (in billion won)	149	260	439	950	1,710	3,438	5,188

	No. of Subscribers (in 1,000)	1,023	1,730	3,127	7,330	11,276	15,858	22,955

Of wireless services, the growth of cellular mobile telephone services and PCS services leads expansion of the entire wireless services market. The cellular mobile telephone service sector has marked a steady growth despite the advent of new services, such as PCS and CT-2. The market recorded 80% growth in 1997 over the previous year, greatly exceeding the 50% growth of the entire mobile communications market.

Table 5. Numbers of Cellular Mobile Telephone Subscribers (Unit: 1,000)

	SK Telecom	Shissegi Telecom	Total
End of Dec. 1996	2,891(91%)	290(9%)	3,181
End of Dec. 1997	4,571(81%)	1,125(19%)	5,696
End of June 1998	5,140(77%)	1,537(23%)	6,677

* Figures in ( ) refer to market shares.

Table 6. Numbers of PCS Subscribers (Unit: 1,000)

	KT Freetel	LG Telecom	Hansol PCS	Total
End of Dec. 1997	350(31%)	366(32%)	416(37%)	1,132
End of June 1998	1,374(39%)	1,248(36%)	880(25%)	3,502
End of Sept. 1998	1,927(41%)	1,703(37%)	1,045(22%)	4,675

* Figures in ( ) refer to the market shares.

As shown in Tables above, the numbers of cellular mobile telephone and PCS subscribers increased sharply, while other wireless services such as paging and CT-2 services staggered as a result of failed competition with cellular mobile telephone and PCS services.

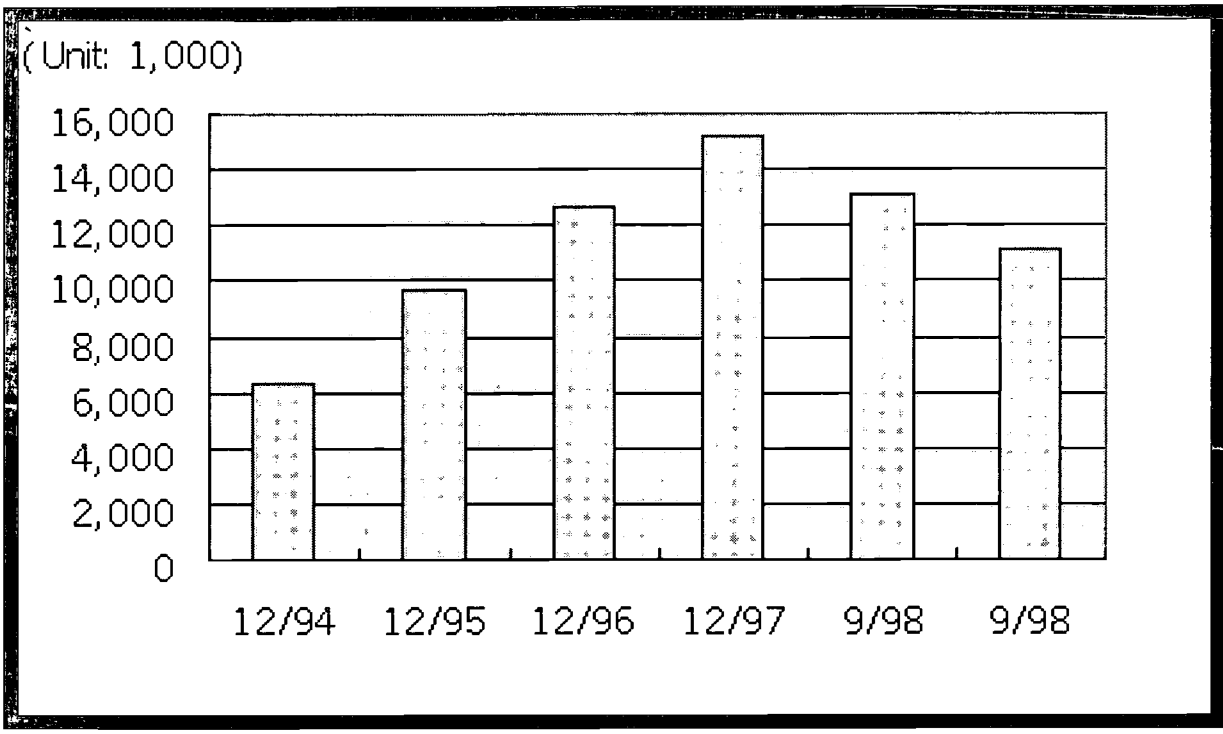
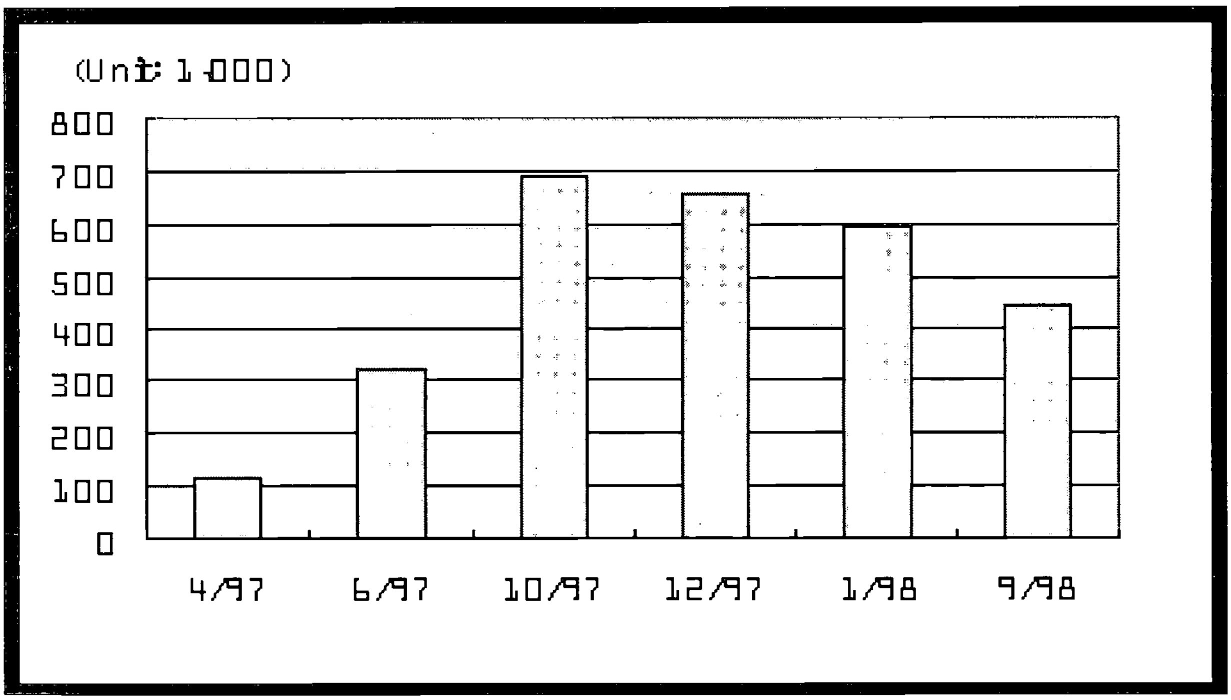


Table 7. Numbers of Paging Subscribers

Table 8. Numbers of CT-2 Subscribers



As shown in tables above, Korea's telecom market has kept high growth at annual average of 21% thanks to the rapid progress of cellular mobile telephone and PCS services. However, the government's introduction of competition to the market pushed all telecom service sectors into severe competition. Except those incumbents holding firm positions in the market, like KT and

SK Telecom, most new service providers have been suffering shortages in funds in the wake of the financial crisis which struck Korea at the end of 1997. Currently, many service providers are attempting strategic alliance with foreign companies and inducement of foreign capital.

2. Foreign Ownership Regulations

The MIC has continued easing foreign ownership regulations since 1990 with the aim of vitalizing domestic telecom market and fortifying competitiveness of domestic service providers. Especially, WTO Telecom Accord allowed foreign investors easier access to Korea's telecom market. Foreign ownership regulations for each telecom service sector is as follows:

2.1 Value-Added Services

The MIC already permitted foreign ownership of up to 50% of the total equity for value-added service sector in 1990. Since it further allowed 100% foreign ownership in 1994, foreign investors are not restricted at all in doing business in the value-added service market.

2.2 Basic Telecom Services

Foreign ownership in basic telecom services had been banned until 1990, but allowed for up to 33% of the total equity in 1991 for wireless services. Despite this partial deregulation, foreigners could not become the largest stockholder in the basic telecom service sector, and the equity ceiling for single entity, for both locals and foreigners, was limited to 10% for wired services and 33% for wireless services. For these limitations, it was hard to induce active foreign investments.

The partial opening of the market could not be sustained any longer as WTO Telecom Accord was reached in 1997. The MIC revised the Public Telecommunications Business Law in 1997 and eased foreign ownership regulations in large scale reflecting WTO Telecom Accord. With the revision, foreign investment in the wired service sector which foreigners had not been allowed to access was allowed for an equity holding of up to 33% (20% for KT) from January 1998. The allowed foreign equity holding is scheduled to be expanded to 49% (33% for KT) for both wired and wireless services from January 2001. In addition, foreign investors can become the largest stockholders of all common carriers except KT from 1999, and the restrictions on foreign representative and the number of foreign executives were lifted in January 1998.

However, a voice was raised that all these deregulation efforts were not yet enough to attract foreign investors to Korea's telecom market. In addition, the government realized an urgent need to induce foreign capital in escaping the financial crisis which began at the end of 1997. With this awareness, the MIC again revised part of the Public Telecommunication Business Law in September 1998, a year after the previous revision. With the revision, the single entity equity limit of up to 10% for wired services and 33% for wireless services was abolished.

Furthermore, the expansion of foreign equity ceiling for KT, from 20% to 33%, went into effect earlier than scheduled.

Table 9. Foreign Ownership Regulations

		~1997	1998	1999	2001
Foreign Ownership Limit	Wired services	0%	33%	33%	49%
	Wireless services	33%	33%	33%	49%
	Lease line resale	0%	49%	49%	100%
Single Entity Equity Holding Limit	Wired services	10%	10%	Limitless	Limitless
	Wireless services	33%	33%	Limitless	Limitless
Largest Foreign Stockholder		Not permitted	Not permitted	Permitted	Permitted

2.3 Specific Telecom Services

The MIC banned foreign access to specific telecom services (e.g., voice resale service, Internet phone service and Callback service). With the revision of the Public Telecommunications Business Law in 1997, however, the MIC permitted foreign ownership of up to 49% of the total equity for specific telecom services from January 1999. This permission schedule was readjusted to September 17, 1998 at the time of revising the Law in September 1998.

2.4 Mitigation of M&A Regulations

According to the Public Telecommunications Business Law, common carriers were not allowed to hold an equity in other common carriers, and a non-common carrier's M&A with a common carrier was banned. However, with the revision of the Law in September 1998, a common carrier can hold an equity in other common carrier and can be merged or acquired by a non-common carrier. With this permission, M&As between common and non-common carriers will be activated, and M&As between foreign companies and domestic common carriers are likely to be pursued.

2.5 Prospect of Foreign Ownership Regulations

The MIC is preparing for the revision of the Public Telecommunications Business Law to expand foreign ownership limit to 49% from January 1999, moved up from originally scheduled 2001. If this early expansion of foreign ownership passes through the National Assembly, foreign investors will be able to make more investment from January 1999, two years earlier than the schedule which Korea presented at WTO negotiation table. Moreover, the Minister of the MIC revealed that the government would review expansion of foreign ownership limit to 51% if the early expansion plan brings about positive outcomes.

3. Current status of Foreign Investment

Until 1997, Korea's telecom market climate for foreign investment was so unfriendly that active foreign investment could not be anticipated. The foreign ownership regulations limited foreign investment to value-added services and wireless services. For these reasons, foreign investment in the domestic market amounted just to US$210 million in July 1997. However, foreign investment in domestic market has become active after the foreign investment limit was expanded through the revision of the Public Telecommunications Business Law in 1997.

3.1 Basic Telecom Services

Foreign investment in basic telecom services amounted to US$192 million as of the end of July 1997. With new foreign investment worth US$660 million induced from January to October 1998, the total foreign investment as of October 1998 amounted to US$852 million. Most of the investment was made in wireless services, none in wired services(See Table 10). There are three reasons for the concentration of foreign investment in wireless services. First, from 1991, foreign investment was allowed for up to 33% of the total equity in the wireless service sector, while it was not allowed in the wired service sector until the end of 1997. Second, as shown in Table 4, the wireless service market is showing an explosive growth rate, while the growth of the wired service market is very sluggish. This naturally makes the wireless service sector more attractive to foreign investors. Third, fierce competition was brought about in the wireless service market due to the entry of three new PCS service providers into the market. Faced with shortages in funds as a result, these service providers actively attempted to invite foreign investments.

3.2 Value-Added Services

As of July 1997, 14 value-added service providers had foreign investors in them. Of these service providers, 7 providers were 100% foreign-invested companies and the remaining 7 were joint-ventured companies with less than 50% foreign investment in the total equity. The total investment amount as of July 1997 amounted to US$20 million, and this amount climbed to US$54 million, with new foreign investment worth US$34 million between January and October 1998.

3.3 Prospect of Foreign Investment

Both local and foreign investors can step into all telecom service markets thanks to the government's deregulation. From the perspective of current market conditions, however, there will be no direct applications from foreign investors for licenses of new services, excepting those for specific telecom and value-added services, for some time ahead. Nevertheless, acquisition of equities by foreign investors in existing wired and wireless services will be active thanks to the government's efforts to invite foreign capital and telecom service providers' active inducement of foreign capital to cope with money shortages resulting from the financial crisis.

As to wired services, in view of the fact that Korean government's 15% share (approximately US$1 billion) of KT's equity will be sold to foreign telecom service providers, and that DACOM, Onse Telecom and Hanaro Telecom also attempt to induce foreign capital, it is expected that foreign investment will be made in the wired service sector before long.

Table 10. Foreign Investment in Korea for Basic Telecom Services

Services	Companies	Capital (billion won)	Foreign Investment Rates (%) in Comparison with total Capital
Cellular	Shinsegi Telecom	350	Air Touch (10.68); SBC (7.84); Qualcomm (2.46)
	SK Telecom	29.2	CITI BANK (7.27); SCUDDER (2.02); Capital Research & Management (1.32); SCHRODER (0.76); Tiger Fund(6.89), Others (14.74)
PCS	KT Freetel	500	Motorola (2.80)
	LG Telecom	250	BT(23.49)
	Hansol PCS	200	BCI(24)
TRS	Anam Telecom	30	Geotek Communications (21.00)

CT-2	Seoul Telecom	20	Bankers Trust International PLC (England) (4.23), Asia Finance and Investment Corp., Ltd. (Singapore) (1.17), Korea Special Opportunities Fund PLC (Ireland) (1.45), Aesthetic Investments Fund Public Ltd. Co. (Ireland) (1.57), Korea OTC Growth Investment (L) Ltd. (Malaysia) (1.17)

* Figures for LG Telecom and Hansol PCS are those as of October 1998, and others as of July 1997.

The wireless service sector shows annual average growth rate of over 50%, which is considered quite high, attracting foreign investors' deep interest. Of wireless service providers, SK Telecom is particularly popular among foreign investors. However, the company cannot attract more foreign investment because its 33% foreign ownership limit has been fulfilled. It can invite additional foreign investment if the foreign equity holding limit is expanded to 49% effective in January 1999 once the Public Telecommunications Business Law is revised as scheduled. Besides SK Telecom, other PCS service providers, including KT Freetel, LG Telecom and Hansol PCS, are also making efforts to induce foreign capital. LG Telecom already agreed to sell 23.49% (approximately US$400 million) of its total shares to BT in October 1998. Hansol PCS also agreed to sell 24% (approximately US$260 million) of its total shares to BCI, a Canadian company. BT and BCI reportedly think highly of the technological capability of these Korean companies and growth potential of PCS services in Korea. Foreign investment in wireless services, therefore, is expected to steadily grow centering on cellular mobile telephone service providers and PCS service providers.

Since foreign equity holding limit will be expanded to 49% from September 1998 for specific telecom services, like leased line resale and Internet phone services, brisk entries of voice resale and Internet phone service providers from advanced telecom countries are expected. They are expected to enter Korean market through joint ventures with Korean companies for a while, but independent entry will be pursued from 2001, when 100% foreign ownership is permitted.

4. Conclusion

Korean government's current efforts to ease foreign ownership regulations are devoted to foreign investors' easier access to Korea's telecom market where an annual average growth of over 20% is being marked. Moreover, Korean government plans to expand foreign ownership limit earlier than the schedule it presented at the time of WTO negotiations, in order to expedite inducement of foreign capital. Foreign investment is expected to be further expedited as a result of it.

With regard to these deregulations, some fear the fall of domestic telecom market with its inferior competitiveness under the control of foreign capital. Unlike such apprehensive voices, many experts as well as the MIC anticipate that market opening will contribute to the expansion and quality improvement of the domestic telecom market. Such optimistic views are based on the experience in value-added service market, whose opening has contributed to significant expansion of the domestic value-added service market.

Return to Top View Full-screen

Taiwan's Telecommunications Liberalization and Its Current Status of Implementation

Poli Liu and Toshio Kosuge

University of Electro-Comms, Japan

ABSTRACT

In response to changes in both domestic and international environments, the movements towards liberalization and privatization of Taiwan's telecommunication services which have been pirated as a state monopoly and the amendment of three telecommunication laws passed by the Legislative Yuan in January 1996 will be explained and analyzed in this paper.

Liberalization of telecommunications in Taiwan is to be implemented in three stages. In the first stage, VAN services are to be further liberalized; in the second stage, liberalization of mobile communications services, such as mobile phones and radio pagers is to take place; and total liberalization of local, long distance and international telephone services by 1999 is the objective of the third stage.

The reason for enacting the above mentioned amendments of three telecommunications laws is to realize the goals of the second and third stages. Taiwan's Telecommunications Act was revised with reference to Japanese Telecommunications Service Law in which telecommunications carriers were classified into two classes, Type I and Type II according to their telecommunications facilities. For Type I Carriers, at this stage, licenses for market entry have already been given to a total of 53 mobile communications system companies such as cellular phones and radio paging systems. For Type II Carriers, there is no particular distinction between General Type II and Special Type II like in Japan, so total liberalization has been realized in principle.

However, if you look at the implementation process of Taiwan's telecommunications liberalization, amendment of the Telecommunications Act, reorganization of the Directorate General of Telecommunications, the creation of Chunghwa Telecom Company and other reforms were carried out simultaneously. As for the Directorate General of Telecommunications which is the government

agency supervising telecommunications in Taiwan, it raises many problems in carrying out liberalization, since there was not enough time to prepare the related measures to be made for implementation of liberalization.

In this paper I take the method of research of adopting on-site inquiry and documents examination, and conducting interviews with relevant government officials. The conditions and environments for implementation of the telecommunications liberalization in Taiwan are examined and their various problems and impacts on industries are analyzed from practical and feasible point of view.

View Full Text

Taiwan's Telecommunications Liberalization

and Its Current Status of Implementation

INTRODUCTION

In response to changes in domestic and international conditions, the ROC government finally begin to privatize Taiwan's telecommunication business, which used to be run as a state monopoly. The amendment to the three telecommunication laws is a clear indication of this movement. In short, the amendment was a proposal for amending both the Telecommunication Act and the Ministry of Transportation and Communication (MTC) Directorate General of Telecommunication (DGT) incorporation law. This Amendment was also an enactment of the Chunghwa Telecom Company (CTC) law.

With the passing of this Amendment, the responsibilities between administrative regulation and business management of the telecommunication sector were finally separated. The DGT and CTC, a newly established public firm, are now charging with these two tasks respectively. This separation redresses the long lasting problem of DGT's being both player and referee. Since the liberalization will take place in several phases and will be completed by 1999, it will likely to have a profound impact on the reorganization of Taiwan's various industries. This reorganization, in turn, will help Taiwan's industries to meet challenges in the 21st century.

Through analysis of various government documents and interviews, the circumstances under the implementation of liberalization will be examined in the following paragraphs. The problems and effects which the liberalization brought about on Taiwan's industries will also be discussed from a practical viewpoint.

Present situation in the telecommunication sector

Before July 1996, the Ministry of Transportation and Communication Directorate General of Telecommunication was in charge for all telecommunication services except for broadcasting. The legal foundation for its monopolistic behavior was based on Article 10 of the former Telecommunication Act and Article 5 of the former Directorate General of Telecommunication incorporation law. Given this legal background, the DGT presided over both the administrative regulation and business management responsibilities in the telecommunication sector.

As of June 1997, local phone subscribers amounted to 10,430,000 and the local phone Tele-density per 100 persons reached 48.3%. In addition, with regard to the equipping of telecommunication network, the ratio of digital toll switches in both long-distance and international exchanges reached 100% and 95% for local exchange.

Although Taiwan is having diplomatic relations with only 30 countries, the CTC has never run into any particular trouble regarding its international call services because the company has carrier-to-carrier business relationships with 163 countries globally. However, it seems to
373 be a matter of regret that Taiwan is still unable to join the ITU.

By the end of 1997, CTC's operating income reached NT$166 billion, 2% share of GNP. Traditional services local, long-distance, and 374
international phone calls--counted for 70% of this income. Mobile communications, pagers, and cellular phones together counted for more

than 20%. As of June 1997, pager subscribers numbered 2.5 million, and cellular phone subscribers amounted to 1.25 million. These figures were the volume of circuits which the CTC could then supply at the most; nevertheless, the supply of circuits in response to demand is now in a backlogged state. Accordingly, Taiwan's mobile communication market has a exceedingly large potentiality.

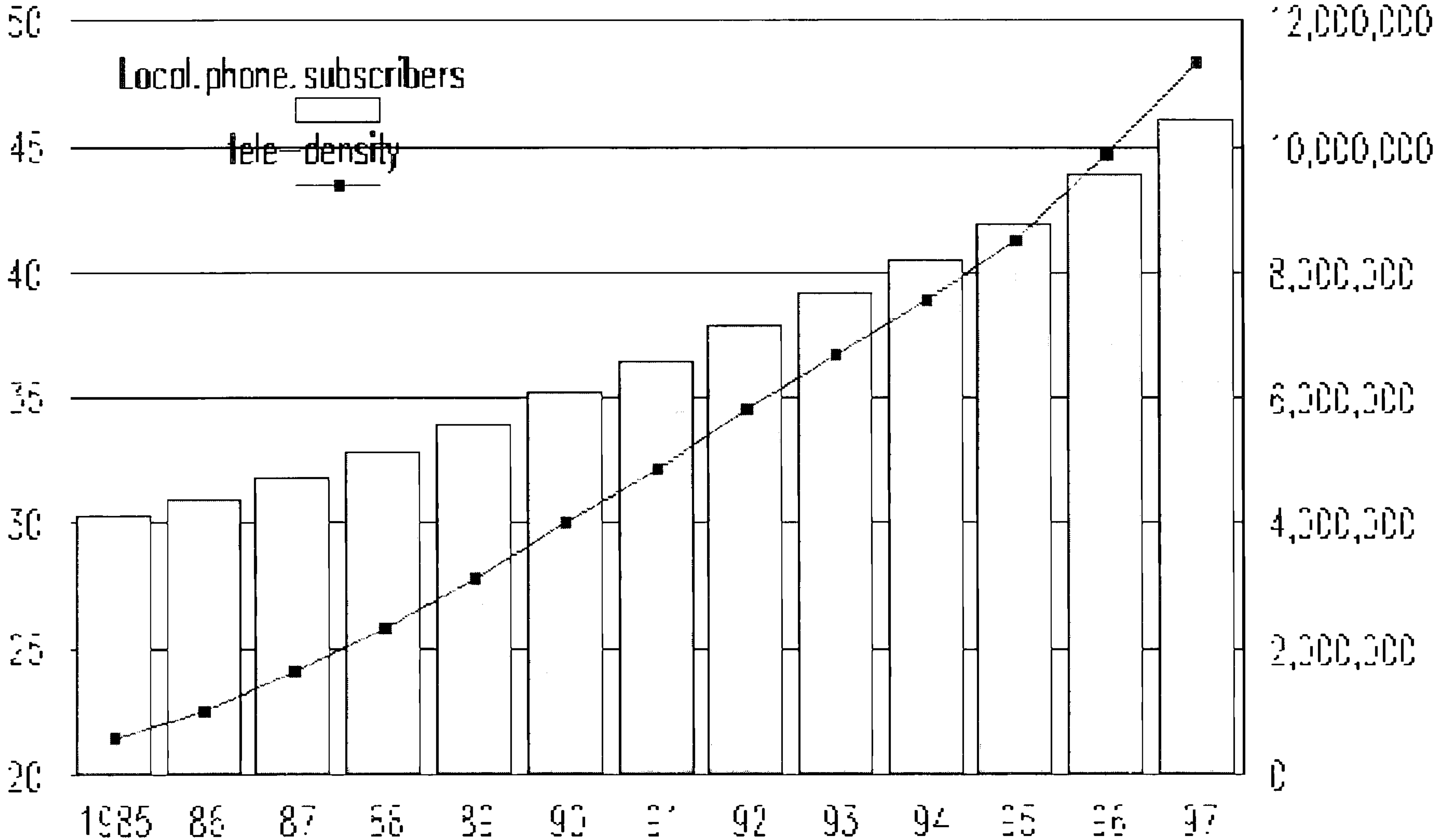


Fig1. Local phone subscribers and Tele-density

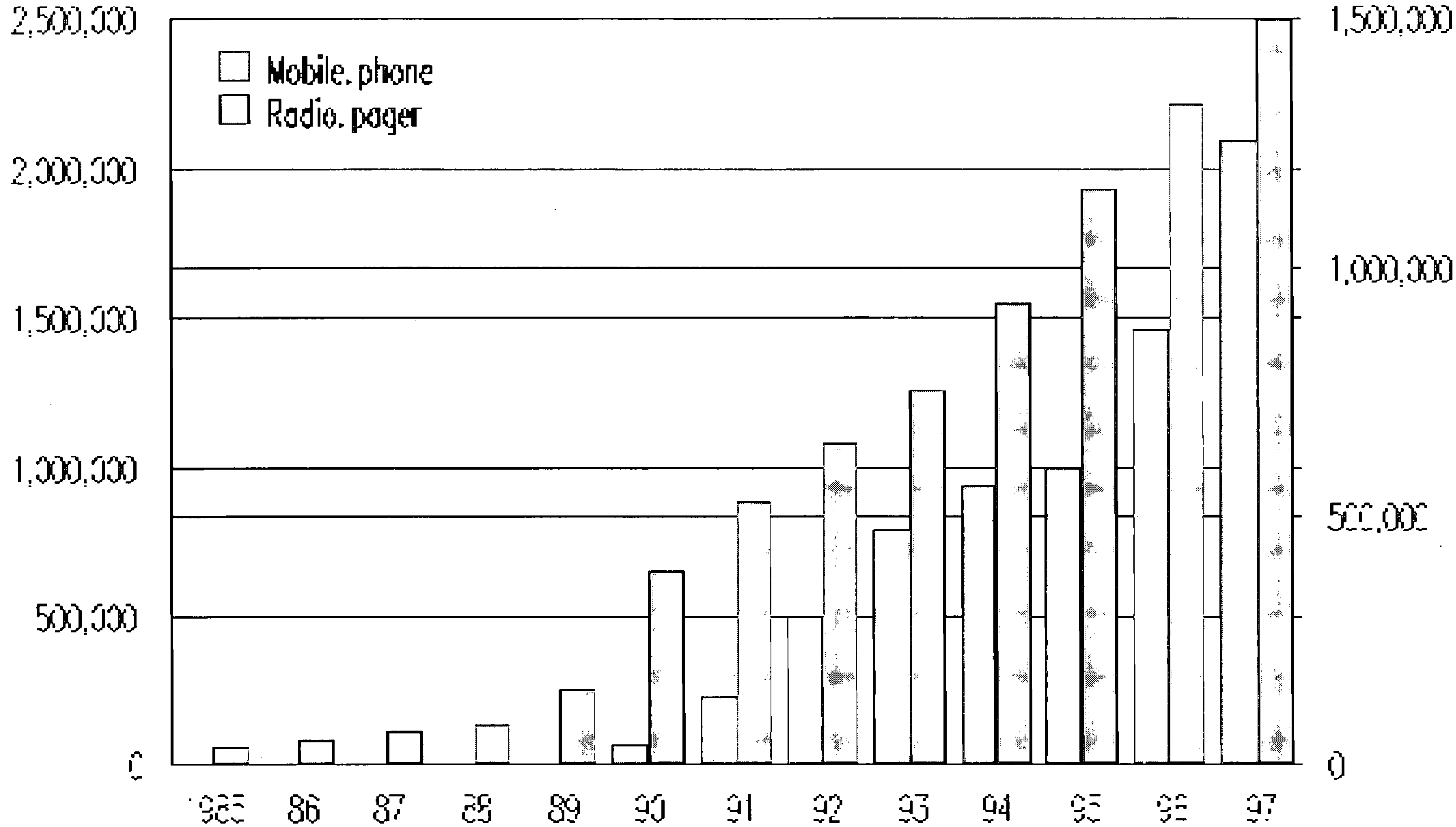


Fig2. Mobile phone and Radio pager

Source: "Chunghwa Telecom Annual Report 1997"

The background of telecommunication liberalization and its analysis

377 With the division of America's AT&T, of England's BT, and of Japan's NTT, a liberalization rich in atmosphere has spread out all over the world since 1980. Under this kind of international environment, the ROC government began to tackle the problems of liberalization with regard to the telecommunication sector in 1988. Then, the government took a further step by passing the amendment to the three telecommunication laws

in January 1996.

The motive for liberalizing Taiwan's telecommunication sector was deeply connected with international relations at the very beginning. This motive was to join the GATT (WTO); hence, the government policies related to the liberalization were constructed according to GATT principles. The optimum goal of GATT principles is aiming at free trade. In order to align with the goal of GATT principles, the Council for Economic Planning and Development (CEPD) passed a resolution to review all aspects of the then Telecommunication Law in May 1988. Next month, the MTC formed a "Telecommunication Policy and Legislation Research Team" based on this resolution. Generally speaking, the ROC government started to tackle on the problems of liberalization with regard to the telecommunication sector for the first time.

However, the government did not actually deal with the problems of liberalization until another resolution which was passed by the Executive Yuan in January 1995. This resolution also put the so-called "Asia-Pacific Regional Operation Center Plan" (APROC) into effect. APROC is a plan which aims at turning Taiwan into an operation center in the Asia-pacific region. There were three factors pushed the government to design such plan at that time: the change in Taiwan's economic structure, the preparation for joining the WTO, and the rapid economic growth in the Asia-Pacific region.

In brief, this plan designs to further liberalize and internationalize Taiwan's economy, given Taiwan has the favorable geographical location in the Asia-Pacific region. The plan also aims at strengthening Taiwan's international competitiveness by establishing Taiwan as an Asia-Pacific regional operation center. Thus, the final goal of this plan is to prepare Taiwan to joint the WTO. In order to achieve these goals, the government gave priority to the planning of six operating centers. Namely, Manufacturing Center, Sea Transportation & Distribution Center, Air Transportation & Distribution Center, Financial Center, Telecommunication Center, and Media Center.

The Telecommunication Center development plan is taking the existing telecommunication facilities as base to provide enterprises improved services with a rational fee system. By making telecommunication enterprises operate more efficiently, enterprises will be able to establish their regional or global information networks and, hence, operating hubs in Taiwan.

Reference: The main functions of a Telecommunication Center are listed in the following:

*To develop Taiwan into a center for information distribution, traffic transferring, and network management in the Asia-Pacific region.

*To provide comprehensive telecommunication services, as envisioned by local and foreign enterprises, for multinational enterprises in selecting Taiwan as an investing nation.

*To provide reasonable-priced, high quality, and convenient telecommunication services so as to attract both local and multinational enterprises to build regional customer service centers in Taiwan.

The following five actual measures are instituted for this development plan:*1

* Liberalizing the telecommunication sector in several phases.

* Rationalization of fee-based telecommunication services

* Reorganizing the DGT with a separation for business regulation and operation in principle.

* Expansion of provision of international telecommunication networks in the Asia- Pacific region

* Provision of NII in accordance with telecommunication liberalization

The progress of the liberalization will be divided into three stages. In the first stage, VAN services are to be further liberalized, and this goal ought to be met by June 1995. In this stage, both the Regulatory Measures of Telecommunication VAN Business and the Operating Regulations of Data Communication should be amended.

The second stage aims to liberalize radio communication services such as VSAT, cellular phones, and pagers. In order to reach the goal of this stage, the Telecommunication Law had to be amended by the Legislative Yuan in December 1995. Finally, the third stage is a complete liberalization of telephone services, and its goal is planned to be accomplished by October 1999 in principle.

The telecommunication center development plan passed the State Affairs Session of the Executive Yuan in October 1995, and the schedule of the amendment to the Three Telecommunication Laws was once again confirmed. Despite fierce opposition activities from DGT employees, the government mobilized members of the governing party through the Three Telecommunication Laws amendment proposal between October 1995 and January 1996.

Accordingly, the liberalization of Taiwan's telecommunication sector is the realization of the concept of telecommunication service center--the "APROC" policy. And it should be clear that in the background to this international factors actually had a big influence because of the preparation for WTO entry.

The Telecommunication Law: Its Major Components and Effects

In response to the domestic and international conditions, the policies regarding the liberalization were implemented as a political choice arising from government deliberation. Through a presidential order in February 5th, 1996, the revised Telecommunication Law came into effect next day.

This Telecommunication Law consists a total of 6 chapters with 72 clauses:

Chapter 1 General Provisions Articles 1 - 10

Chapter 2 Operation of Telecommunications Enterprises Articles 11 - 30

Chapter 3 Telecommunications Development and Management Articles 31 - 45

Chapter 4 Regulation of Telecommunications Articles 46 - 55

Chapter 5 Penal Provisions Articles 56 - 68

Chapter 6 Supplementary Provisions Articles 69 - 72

There are six points with regard to the definitive features of the current Telecommunication Law:

* Separation of governmental regulation and enterprise management (Articles 3 & 30)

* Classification of Telecommunication Enterprises (Article 11)

* Prohibition of cross subsidization (Article 19)

* Introduction of universal service (Article 20

* Introduction of radio wave usage fees (Article 48)

* Strengthening of regulations against law-breakers (Article 58)

As to the first point mentioned in the above, Article 3 of the law states that MTC shall be the competent authority for telecommunication enterprises. MTC shall establish a DGT to regulate the telecommunication sector. The organization of the DGT shall be governed by a separate law. Further, Article 30 states that MTC shall establish a state-owned CTC in order to operate telecommunication enterprises. The establishment and management of this company shall also be determined by a separate law. Therefore, the long lasting problem in terms of the double duties put on the DGT is resolved.

Second, the distinction between Type I and Type II telecommunication companies in Taiwan is a newly established classification system if one compares this system with that of Japan. This classification system depends on whether they have circuit equipment.

According to the law, the Type I group refers to enterprises that install telecommunication machinery and line facilities to provide telecommunication services. These enterprises can begin their operation after receiving special permissions from the MTC. Further, they are required to provide connections to other Type I enterprises if necessary, for which the connection procedures and fee charges are based on standards laid down by the DGT. There is also a limit on foreign ownership: foreigners' shareholdings must not exceed 20% of the total shares. Furthermore, entry will be possible for the first time on government official announcement with regard to the service types and business territories, etc., of these enterprises.

The Type II telecommunication carriers refer to enterprises other than the Type I telecommunication enterprises. The set up of these enterprises are also need approvals from the DGT, though service types and foreign shareholdings are unregulated and free of restriction in principle.

In addition, with regard to the operations of these enterprises, internal cross subsidization is prohibited by Article 19 of the law in the interests of reflecting costs rationally. In other words, in the situation where a Type I enterprise concurrently operates a Type II enterprise, internal cross subsidization of the enterprises is prohibited. Furthermore, in order to ensure the provision of universal telecommunication services, a "Telecommunication Enterprises Universal Service Fund" system which states in Article 20 is introduced. Both Type 1 and Type 2 enterprises invest at a fixed sum ratio when they provide Universal Services, then they will become eligible to receive subsidies from the fund.

Concerning the regulation of air-wave resources, radio frequencies, modes of radio emission, radio station identification codes..etc., duties connected with the regulation of the air-waves are brought together and regulated under the MTC. The principle of paying a toll for air-wave usage is introduced in the Article 48. Furthermore, in order to maintain order in air-wave usage, the Penal Provision of Chapter states that persons who break the administration rules will be fined, sentenced in jail for up to 6 months, and/or confiscated their personal materials & equipments.

The special characteristics of the revised Telecommunication Law are described in the above paragraph. Further, this law provides the legal foundation for liberalizing Taiwan's telecommunication sector.

In order to revise the law and to liberalize the sector, the "DTG organization regulation" and the "CTC regulation" were reformed and enacted together to settle both the administrative regulation and the telecommunication companies' operational problems. Thus, the DGT took exclusive charge of the policies and regulation duties in the telecommunication business; while, the CTC came to operate telecommunication enterprises. These three statutes formed the so-called "the Three Telecommunication Laws". These three statutes became the three pillars supporting the liberalization in Taiwan's telecommunication sector.*2

With the establishment of CTC on July 1st, 1996, the telecommunication business which used to be operated by the DGT is now under the supervision of CTC. Thus, the DGT became administrative regulator while the CTC became the enterprise manager--a new telecommunication regime. In addition, through the liberalization of 5 segments of mobile communication business, the telecommunication sector commenced an era of competition.

From the industry perspective, the effects of present reforms can be discussed from the viewpoints of both software and hardware markets. As shown in Figure 3, competition is introduced by the liberalization. Through the function of the market, consumers can obtain better but cheaper telecommunication services.

Figure 2 shows the pattern of growth for mobile communication subscribers. As of June 1997, the number of pager subscribers reached 2.5 million and 1.25 million for cellular phones. These numbers were the volume of circuits which the CTC could then supply at the most; nevertheless, the supply of circuits in response to actual demand is currently in a backlogged state.

According to the research data collected by Taiwan Institute of Economic Research (TIER), the uncovered mobile communication industry can create over NT$100 billion worth of business opportunities*3. Further, more profitable business opportunities can be expected if both telecommunication and CATV businesses can be combined. Right now, almost all of Taiwan's large corporations are facing strong incentives and are committing themselves to enter these new business areas. Therefore, the liberalization can be expected to contribute significantly to the reorganization of Taiwan's various industries in the future.

Current Issues with the Liberalization in the Telecommunication Sector

As a result of the amendment to the telecommunication law, there are 53 companies have received the New Common Carriers (NCC) establishment permits. Further, Taiwan already opened up to CT2 in November 1994, and the 9 successfully bidding corporations were selected in July 1995. CT2, originated from England, was ended in failure due to a lack of standardization, insufficient base station number, and overpriced administration fee.*4

In Taiwan, problems confronting the CT2 operators are usually the criteria for calculating access charges and the establishment of base stations. These problems have made the CT2 development extremely difficult. By December 1997, only four out of the nine CT2 operators conducted services properly. The rest of the operators were in a state of being almost unable to develop their businesses.

The applications for cellular phones reached 700,000 by September 1997. Sometimes, due to the backlog problem, applicants must wait for the phone for more than a year. By January 1997, eight cellular phone operating companies received approvals for operation. However, an advanced establishment ratio for base stations of over 25% must be achieved in order to commence services because negotiations between the NCC and CTC over access charges did not go well. It was inconceivable that the provision of proper services was likely to be agreed before the end of 1997.*5

The average number of applications for pagers has amounted to 70,000 circuits per month. Due to the inadequate system set up by both CTC and new business entrants, there is an acute backlog problem similar to that of cellular phones. Strategic business alliances and system procurement are cited as the reasons why the newcomer system preparation is behind the schedule. That is, regional operators are forming strategic cooperation ties in order to compete with the other two nationalwide operators. Additionally, through these strategic cooperation ties, the regional operators are making joint system procurement in an attempt to reduce costs.*6

The nature of Mobile Data Communication and Trunked Radio services is different from that of cellular phones and pagers. The business development has been comparatively easier because there never been a problem with the negotiations for access charges with the CTC. It is expected that the respective services will be provided by the former from April 1998, and by the latter at the beginning of 1998.

The following four problems can be cited as the principal issues confronting the liberalization in Taiwan's telecommunication sector.

(1) Internal Cross-Subsidy

An internal cross-subsidy is said to take place when a corporation which is providing goods and/or services for which the business returns are regulated, raises the price of other goods and/or services when supplying additional goods and/or services from amongst the regulated activities, thereby covering the cost of the additional supply*7.

It is obvious that unfair competition will result if internal cross-subsidies are allowed in a competitive market. This is the reason for the provision of Article 19 of the Telecommunications Law: if a telecom company engages in both Type I and Type II operations, that company shall not receive any cross subsidy and shall calculate the profits earned from the two operations separately.

However, the basic telephone services--local, long-distance, and international--calls are still dominated by the CTC. From a legal perspective, it is inevitable that there is an internal cross-subsidy between the basic services and mobile communication services for CTC. The same situation to Type I enterprises because it is not a contravention of Article 19 of the Telecommunication Law. Thus, preserving a competitive advantage by increasing local call charges while reducing mobile phone fees is a serious threat to new entrants in the mobile communication business. In addition, there is a fear that the objective of fundamental liberalization will be ruined if a unfair competition market exists.

Accordingly, internal cross-subsidy should be prohibited not only in the case of Type I enterprises jointly managing Type II enterprises but also between each of the services offered by Type I enterprises.

(2) Reciprocal Connections

In the mobile communication services, the new entrance's networks need local switching to connect with local circuits or subscriber lines when they provide services. And, the local switching is owned by local network operators. On some occasions, the issue of connection will be arisen between the local network operators and new entrants.

Article 16 of the Telecommunication Law indicates a solution for this connection problem. The article states that if a Type I enterprise requests network connection with another enterprise of the same type, that requested party shall not refuse such request. The method of such connection and the calculation of the applicable charges shall be established by the DGT.

However, because the connection methods and calculation of charges are not yet made available to new entrants, the negotiations between CTC and new entrants continue to be deadlocked. This situation is a serious obstacle to the NCC service provision, and the government agency who is responsible for this sector should provide a connection procedure without further delay.

(3) Restrictions on foreign capital

Foreign capital restriction was probably the most disputed issue when the government decided to liberalize the telecommunication sector. Generally speaking, the local enterprises did not have the technology to offer mobile communication services in the beginning; therefore, they needed foreign operators to introduce such technology. However, there was a problem of how to approve the entry of foreign operators into this sector and to what degree should the foreign operators could go.

If there is no limitation of foreign capital on Taiwan's industries, Taiwan will eventually lost its business advantage. Further, there is a worry that the local telecom enterprises will someday be overtaken by foreign operators. Foreign ownership restriction is not merely an economic problem because it involves political issues.

Article 12 of the Telecommunication Law states that foreign operators shall not possess more than one-fifth of the total shares of Type I enterprises. The restriction on foreign ownership called the attention of interested nations, in turn, these nations placed the government under lots of pressures. For example, a US representative negotiated with the government officials for the issue of foreign ownership in July 1996. As a result of this visit from the US representative, the approval of the upper limit of foreign investment was supervised under the MTC.*8

The MTC did not allow indirect foreign investment with regard to the upper limit of foreign ownership, and strictly imposed a 20% restriction on direct foreign ownership. However, due to the reason that the government wanted to joint the WTO, a negotiation with the U.S.A. for this foreign ownership restriction issue again took place in February 1998. Both governments reached an agreement this time. It is now possible for the government to permit foreign ownership deals if both total direct and indirect foreign investment is less than 55.99%.*9 The easing of restrictions on foreign ownership is gradually going with global trends. However, there is a technological gap between countries which possess telecommunication technology and countries which do not, whether principles of competition are introduced through easing restrictions on foreign ownership is a genuinely complex problem and must be examined in an earnest matter.

(4) Toll Formulas

According to the Telecommunication Law, the criteria for calculating the charges of Type I enterprises shall be determined by the DGT, (Article 26). Rate of return on investment is selected as the current system of charges for the telecom enterprises. For CTC, the rate of return is guaranteed between a maximum of 11.5% and a minimum of 8.5%. Further, the minimum rate of return for NCC' is not guaranteed even though its maximum rate of return is controlled at 11.5%. Therefore, it has to run the operation at its own risk.

When the telecommunication sector was behaving like a state monopoly, a system of statutory charges was applied. The situation did not change after the opening up of the sector. An investment rate of return method is still applied by Type I enterprises. However, the computation for the rate of return is based on the financial costs incurred by the DGT at the time rather than based on the costs of all services. Consequently, there is a doubt that whether this computation for rate of return reflects the general costs of enterprises.

From the institutional aspect, however, the investment rate of return system will have impacts on several matters. It will be an obstacle to the liberalization due to a lack of incentives. Further, it will incur excessive investment and high administrative costs. The system will also retain the internal cross-subsidy 10

The DGT has already began to tackle these issues, and is in the process of working out a "Price Cap Regulation" proposal. A particular feature of this proposal is to set an upper limit on the increasing price rates for an item.*11 Further, this regulation has several advantages. First, it enhances the production efficiency. Second, it may help to construct an appropriate charging formula. Third, it charges policies in line with competition. Finally, it reduces the burden of administration costs. On the other hand, this regulation has several disadvantages. The action to bring up internal efficiency will not take place. The regulation will not reflect an efficient price level. Further, there is a danger that prices will adhere to the upper price limit. Finally, it will lower the service quality.*12

Accordingly, it seems clear that there are several difficulties with this so-called "Price Cap Regulation." Further, it will be wrong to say that this regulation is an ideal but complete calculating method.

391 Introducing a rational charge system while creating a healthy and competitive market is a truly important task for the implementation of current

liberalization in the telecommunication sector.

Conclusion

With the passing of the Three Telecommunication Laws amendment proposal in January 1996, the foundations of the liberalization in the telecommunication sector were crudely constructed. Looking at the liberalization process, it seems clear that the DGT had little time to spare after the amendment to the three Telecommunication Laws because the GDT reorganized itself while, simultaneously, established the CTC. Meanwhile, the GDT began to issue market entry approvals for mobile communication enterprises. Consequently, the legal administration expertise that was necessary for coping with liberalization was lacking. This lacking of legal administration expertise resulted in a frequent trouble over approval adjudications.

Nevertheless, Type I group is now consisting a total of 53 companies while a complete liberalization of Type II group has been carried out. By introducing the principles of competition, the telecommunication market shall function effectively and attract matured telecommunication enterprises into this sector.

At present, the four issues that we are facing now are profoundly connected with these expectations. The present stage of liberalization in Taiwan's telecommunication sector is a phase of "trial and error" because Taiwan has little experience with regard to this matter. And, the future direction of policy is still in the stage of discussion.

References

*1) Council for Economic Planning and Development Executive Yuan: Developing Taiwan into Asia Pacific Regional Operation Center Plan, Executive Yuan No. 2414 Jan. 5th, 1995; pp 54-58.

*2) Toshio KOSUGE, Poli LIU: The Reformation of Telecommunications Policy in Taiwan, Johotsushin Gakkaishi Vol. 14, No. 3; pp 70-80.

*3) TIER: Taiwan Business Forecast 12/1995; p 494.

*4) Keiji TACHIKAWA, et al.: Pasonaru Tsuushin No Subete, NTT Shuppan 6/95; p 216.

*5) In mid-December 1997 business licenses for private sector mobile phones were granted, and the number of users is growing quickly having reached 270,000 circuits by January 21st, 1998.

*6) Taiwan Telecom: 7/1997; p 35.

*7) Masahiro OKUNO, et al.: Nihon No Denkitsuushin, Nihon Keizai Shinbunsha, 3/1995; p 247.

*8) Economic Daily News: 7/19/1996

*9) Commercial Times: 2/18/1998

*10) Poli LIU: A Study of the Japanese Telecommunications Service Charge, Taiwan Economic Research Monthly, 4/197; pp 87-95

*11) Susumu NAGAI ed.: Gendai Telecom Sangyou No Keizai Bunseki, Housei Daigaku Shuppankyoku, 3/1994; pp 232-243

*12) Toshihiko HAYASHI ed.: Kouza: Kouteki Kisei To Sangyo (3), Denkituushin, NTT Shuppan, 7/1994; pp 75-78

Return to Top   View Full-screen

Local Service Competition: Breaking the Bottleneck

Peter Falshaw and Jim Holmes

Ovum Pty Ltd, Australia

ABSTRACT

Overall the opening of local service markets to competition is seen as a non-event to date. The focus of telecommunications competition has been on taking monopoly rents out of the market – particularly in the long distance and high teledensity access service markets. This approach to competition has a limited future. In the next 10 years, sustainable local service competition must and will occur, based on achieving continuing added value using a combination of access strategies. The role of regulation in this process is critical. Pro-competitive regulation has a long way to go in most countries to approach the level required for establishing sustainable and effective local service competition frameworks.

View Full Text

Local Service Competition - The Next Ten Years

I. INTRODUCTION

The local services market - fixed network access and the call services that can be supported on the access network, are the last bastion of incumbent monopolies around the world.

Significant global and regional initiatives – including the WTO agreement and EU initiatives, for example - will increase the speed with which individual country markets throughout the world are deregulated and opened to local service competition.

The new competitive model for local services markets is evolving in an environment of increasing technical and market convergence. Cost structures and the characteristics of market demand are also changing rapidly as data services replace voice services as the dominant industry paradigm. This dynamic environment presents major challenges and opportunities for regulators, incumbent operators and new market entrants throughout the world.

In the future, local services will become the essential platform for a wider range of innovative multi-media, and IP based services, and the key driving force behind effective competition. For the first time, customers will have a range of operator and service choices - and the ability to mix and match product and service offerings to match their particular needs. The challenge for operators - both new and established, will be to create unique customer value through product and service innovation.

II. OVUM'S VIEW OF LOCAL SERVICE MARKET DEVELOPMENT TO 2008

Ten years from now the local service market will be a substantially different market – how different depends on whether the enablers of competition – many of which require good regulatory judgement and careful application – are put in place now. Assuming that the regulatory frameworks now being established permit the dynamics of the local service market to determine the way in which it develops, then 2008 will see:

- Reduced, but still significant market power in local access markets by present day incumbents or their successors. The development of cable- and radio-based alternative access networks will create countervailing pressures in this market

- Full development of wholesale operations, both by incumbent operators and new entrants

- The heavy presence of globally branded operators and their local franchisees in all local service markets

- Strong emphasis in competition on full service, service bundling, convenience, reliability and branding, rather than price and specific functionalities, with the consequent decline in pure resale and arbitrage operators.

The relative importance of national and provincial brands, and specialist operators targeting local service market niches, will depend upon the many factors including the existence of regulation which obstructs competition and industry rationalisation, the success of the incumbent's defence strategies, and the extent that tariff imbalances and social obligations have permitted robust competition to occur.

III. THE SCOPE AND SIZE OF THE LOCAL SERVICE MARKET

The traditional approach of incumbent operators has been to bundle together fixed network local access services with local calls as a single service. However, the local services market is now much more dynamic due to the introduction of new broadband and wireless access technologies and services.

The global local service market comprises an installed base of 700 million access lines and generates local call and access rental revenues of USD 150 billion per annum.

IV. THE DRIVERS OF MARKET DEMAND

On a worldwide basis the major driver of local service demand is still the demand for new connections to support plain ordinary telephone services (POTS). But there is now a shift in demand away from traditional voice services to data services, including facsimile, Internet access and multi-media services. These new services are creating an ever increasing demand for local access services and increasing bandwidth to support new and sophisticated applications.

The growth in data communications is being driven by the emergence of the on-line economy and a transformation in the way in which economic and social transactions are conducted throughout society. Internet based applications such as web browsing and e-mail are now becoming commonplace for both business and consumer applications.

1. *Drivers of demand in mature markets*

In the mature markets of Western Europe, North America and parts of Asia-Pacific, local service penetration rates are 40-70 lines per 100 population. Demand for new access lines is driven by population growth, second lines for Internet access and facsimile services, customer churn, and substitution with mobile services. In some of the most mature markets, such as Japan, there is now a measurable substitution effect as cellular services begin to replace fixed network services for some applications.

However, despite increased usage of mobile services, the average number of calls per fixed network services is still increasing in mature markets due to increased call completion rates, and the increased usage of telephone based transaction services such as telephone banking. The average call duration is also increasing due to an increasing proportion of on-line services such as Internet access.

2. *Drivers of demand in developing markets:*

In developing markets such as Eastern Europe, Africa, Indian, China, South America and some other parts of Asia Pacific, local service penetration rates range from less than 1 line per 100 population up to 30 lines per 100 population. In these markets demand is closely linked to economic development and the potential demand is enormous.

To increase the world average telephone penetration rate to that of most developed countries would require the installation of approximately 1.5 billion telephone lines. The investment required to achieve this would be massive and many countries lack the ability to pay or the access to finance.

In some of the least developed markets the penetration rate of cellular services exceed those of the fixed network services due to the wider availability of cellular services - despite there being a price premium.

V. CUSTOMER ACCESS IS THE KEY TO EFFECTIVE COMPETITION

At the beginning of market deregulation, new entrants into fixed network services focused on domestic long distance and international long distance call markets. Barriers to entry in these segments were low, growth rates were high, and potential profits were also high. Long distance services generated supranormal profits and contributed a hefty cross subsidy to local services which in many markets operated at a loss.

The first inroads into the local access market appeared with the emergence of Mercury (now C&W Communications) and Competitive Access Providers (CAPs) such as MFS, Teleport and Colt in the US and UK. The CAPs invested in optic fibre and microwave access networks in the central business districts of major cities. In this way they were able to bypass the bottleneck of the incumbent access networks and connect customers directly, either to their own switch or the switch of a long distance operator.

However, the geographic scope of CAP networks was quite limited and there remained no effective choice of access network for more than 99% of customers.

In the absence of a direct link to the end customer, new entrants had limited scope to differentiate their services from the incumbent. The scope for service innovation was limited by the performance characteristics of the incumbent's network and industry cost structures were ultimately determined by the incumbent's interconnect charges.

VI. THE DEATH OF LOCAL LOOP MONOPOLY

The telephony access network, or local loop, has traditionally been seen as a natural monopoly. It was considered that the level of investment required and the economies of scale involved in rolling out an access network were such that, once an access network had been built, it would be uneconomic for another operator to duplicate the network.

The natural monopoly argument still has considerable force but it is breaking down. The growth of CAP business has clearly demonstrated that it is quite feasible for a number of operators to have their own competing dedicated access networks in locations with high teledensity. Similarly, the development of cellular mobile networks, and CATV networks that can also support telephony, has demonstrated that alternative access networks can viably provide telephony services across a wide geographic area.

However, past monopoly practices of incumbent operators - often directed or at least supported by government policy, have created gross tariff imbalances between local call charges and line rentals and those for long distance and international calls. In many markets these tariff distortions are so large that local services are provided at a substantial loss. Under such conditions, a new operator, even with the lowest cost technology in the world, could not hope to match the incumbents tariffs and cover costs - let alone make a profit.

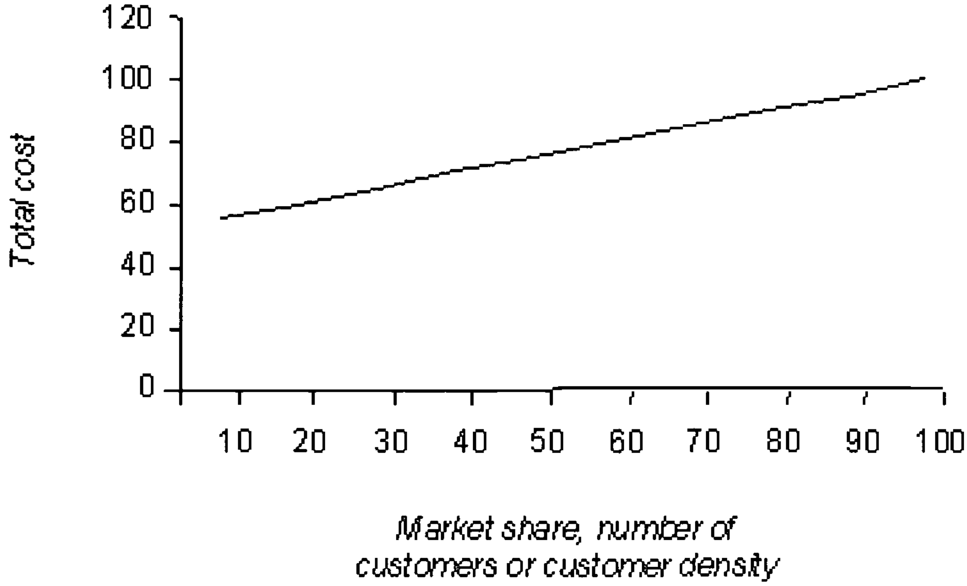
A range of pro-competitive regulatory initiatives is now set to transform the relative profitability and importance of local services. They will cease to be the bottleneck that prevents new entrants from offering customers a full range of services.

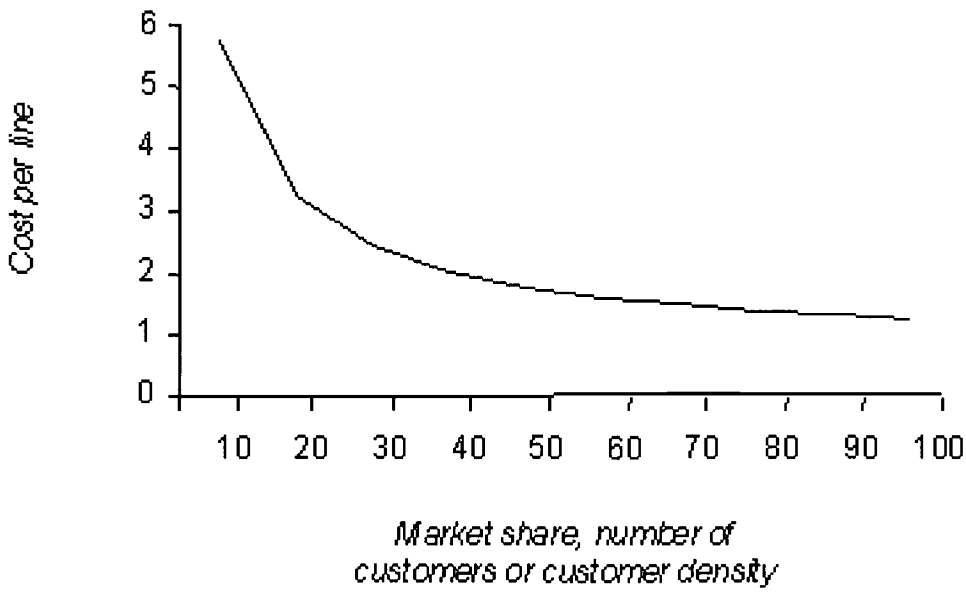
VII. OVERCOMING THE BARRIERS TO LOCAL SERVICE COMPETITION

Local service provision is a high fixed cost business. Therefore, in order to achieve a sustainable competitive position, new entrants must achieve unit costs equivalent to or better than those of the incumbent operator as quickly as possible. There are six generic strategies for achieving this:

- ***Build a conventional fixed telephony network*** – this approach has only been tried in developing countries where there is a high level of unsatisfied primary demand, such as the Philippines

Figure 1: Wireline total cost and cost per line



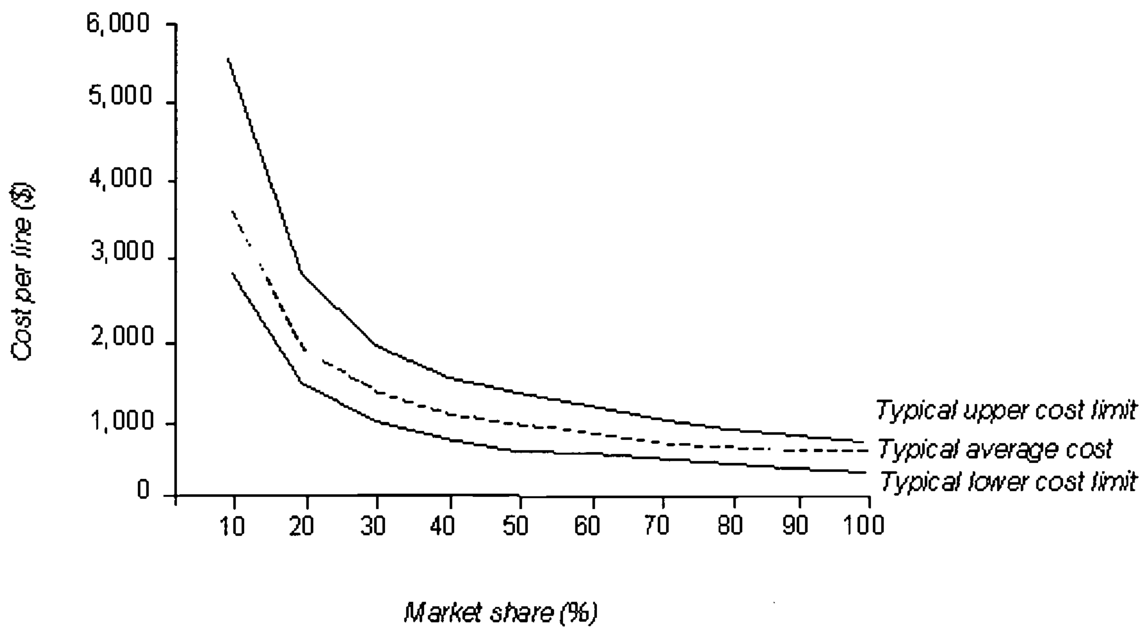


and Chile. However, to be economic, it requires the new entrant to have discretion in where the network is rolled out so that it can focus on areas with high revenue potential.

- ***Build multi-purpose CATV and telephony networks***– this is the approach that has been adopted by CATV operators in countries such as the UK where exclusive (or effectively exclusive) franchises have been granted for the provision of cable TV. Having access to revenue streams for cable TV, broadband data (such as high speed Internet access) and telephony improves the viability beyond that available for a single purpose network.

- ***Variabilise costs*** – ie, reduce the proportion of fixed costs in favour of costs that vary directly with the number of customers connected. This strategy requires substantially better efficiencies in construction and operation than can be achieved by the incumbent operator. Wireless local loop technologies have held out the promise of lower fixed costs per connection that conventional access technologies but this promise is yet to be realised on a broad scale.

Figure 2: Wireline costs per customer



In any event, the same technology is available to incumbent operators, and may not constitute a unique competitive advantage in the hands of new entrants.

- ***Build only in high teledensity areas*** – ie, build where low unit costs can be achieved with a relatively small market share. This strategy has been widely adopted by new entrants in mature markets such as the US and UK by organisations such as Worldcom and Colt. It typically involves the construction of optic fibre cable loops to connect selected buildings in the CBDs of large metropolitan centres. The approach is not applicable to the mass market.

- ***Target market segments with high revenue per unit cost*** – this strategy is similar to the high teledensity strategy. It includes the ad hoc provision of point-to-point access services to high value customers. This may involve the establishment of spurs off an established optic fibre loop network. Once again, the approach is not applicable to the mass market.

- ***Use unbundled elements of the incumbent's access network*** – this strategy requires regulatory sanction as it is unlikely that the incumbent would willingly provide such services on a commercial basis. This approach is expected to become increasingly important in mature markets as it is one of the few means available of achieving effective competition. It also can be part of a strategy involving the variabilisation of costs. However, it may be complex to implement due to the high level of coordination required at an operational level between incumbents and new entrants.

The nature of fixed and variable costs in providing local service is shown in Figure 1 in the case of wireline systems. The vertical axis is an arbitrary cost unit and the horizontal axis is the number of lines being served.

The traditional view of wireline cost structures is shown in Figure 2. This illustrates the case where 50% of the cost is fixed and the remaining 50% is variable. This is broadly the case for conventional wireline local access.

This analysis of the cost structure of the local loop shows that, at anything less than 25% market share, it is almost impossible for a new entrant to be cost competitive, given that the incumbent would retain 75% market share. It also supports the argument that the local loop is a natural monopoly and that regulators should therefore ensure that local loop unbundling is available on cost based terms to prevent exploitation of the natural monopoly to the detriment of competition.

Alternative access networks may be successful in areas of unusually high teledensity, such as central business districts of large urban centres, with market shares well below 25%, but this can only be achieved by carefully targeting specific buildings and customers with high service volumes. Such a strategy is not possible in the mass market.

VIII. THE ENABLERS OF LOCAL SERVICE COMPETITION

The development of effective local service competition requires a regulatory framework to be in place that supports a number of key competition enablers. These include:

1. ***Cost based interconnect***

Some of the key aspects of interconnect arrangements that need to be considered include:

- The impact of interconnect terms
- Any-to-any connectivity
- Cost based interconnection charges
- Technically feasible points of interconnection
- Commercial negotiation timetables
- Publication of Interconnection Agreements

2. *Local loop unbundling*

Local loop unbundling is the process whereby the incumbent local network providers offer rental of their local loops to new market entrants, without any obligation to use the incumbent's switching or other local network facilities. Fair and reasonable terms for the new entrant, and fair compensation for the incumbent owner, require that such leases will be based on costs, including a normal commercial return.

Instead of building its own access lines, the new entrant builds a link to the incumbent's local switch and cross-connects via its main distribution frame to the existing local loops of customers. These customers can then take their telecoms service from the new entrant rather than the incumbent. In this way a customer is connected directly and transparently to the new entrant's service, even though the incumbent continues to provide a local loop service (for that customer) to the new entrant.

3. *Number portability*

Number portability provides customers with the ability to retain their telephone number irrespective of the operator providing the service. In the absence of number portability many customers would be unwilling to switch carriers and this is seen to be a significant impediment to competition, particularly in mature markets.

However, although number portability can be a significant enabler of local service competition, most regulators have only recently mandated number portability and are still planning for its introduction.

From a marketing perspective, new entrants generally prefer to obtain customers who are willing to switch and change numbers as this is seen to engender greater customer loyalty. It is therefore not necessarily in the interests of new entrants to promote number portability in the first instance.

4. ***Local call resale***

The geographic nature of local service networks is such that there will always be customers that new entrants are unable to serve cost effectively by using their own infrastructure, or unbundled network elements sourced from the incumbent. In these circumstances, local call resale provides customers with the only opportunity of placing all of their requirements with a single service provider.

5. ***Access to operational support systems***

New entrants require access to the incumbent's Operational Support Systems (OSS) to place orders for services and to facilitate the transfer of customer services where a customer elects to change carrier from the incumbent to the new entrant. They also require access to OSS in order to respond to service faults and enquires.

A major difficulty is that the OSS of most incumbents have been developed for a vertically integrated service environment and are not easily adapted to multi-carrier operations. There are also issues related to the confidentiality of customer information and the protection of commercially sensitive information between carriers.

6. ***Access to rights of way and buildings***

Incumbent operators have traditionally been granted a range of privileges by governments in relation to access to rights of way, the use of public space for telecommunications infrastructure, and rights to enter private land and buildings. Local service competition requires that comparable rights are extended to new entrants if they are not to be disadvantaged in building and operating their networks.

7. ***Equipment collocation***

Equipment collocation involves the housing of new entrants' equipment on the incumbent's premises such as exchanges and flexibility points in the customer access network, to facilitate network interconnection and access to local loops.

Collocation also involves provision of essential support services and facilities such as power supplies, security and air conditioning, as well as the provision of access to premises so that the new entrant's staff can perform construction, service provisioning and maintenance activities.

Without such collocation, new entrant would incur substantial set up costs in establishing their own separate facilities, as well as the cost of additional transmission links. This would be a major inhibitor to competition, particularly in the early stages when the numbers of competitive services required in a particular exchange area may be small.

8. *Tariff rebalancing and price control*

Tariff rebalancing is the process of aligning the tariffs of services to reflect the costs incurred in providing them, and to eliminate cross subsidies between services. In the local service market the primary rebalancing issue relates to:

- The prices charged for local calls relative to access line rentals
- Timed, fixed rate or zero rate call charges
- Cross subsidies between CBD, metropolitan and country services (national uniform tariffs for local services)
- Cross subsidies between business and residential services
- Cross subsidies between long distance and local services

Traditionally there have been cross subsidies in the local services market to support government social and economic policy objectives and incumbents have been subject to service specific price controls. Typically there has been national uniform pricing despite substantial differences in cost between metropolitan and rural areas; residential services have been subsidised by business services; long distance services have subsidised local services; and, in many countries local calls have been "free" or charged at a fixed rate per call.

These gross tariff imbalances distort the market mechanism and limit the scope for local service competition. Regulators and government policy makers must therefore address the rebalancing issue if local service competition is to succeed. The following options are available:

- Maintain price controls and uniform tariff obligations

- Remove price controls only where effective competition exists
- Allow price deaveraging subject to an affordability cap
- Maintain price caps with flexibility for the incumbent to rebalance

9. *Universal service funding*

In most countries universal service policy requires the ubiquitous provision of basic telephony service throughout the community at affordable tariffs. In some countries, the emphasis is on community access rather than provision of a service to each household. In others the service definition has been extended to encompass data services suitable for high speed Internet access.

Regulators and policy makers have a number of options for universal service funding in a competitive local services environment:

- continued incumbent funding
- funding in exchange for profitable licences
- contributory funding by all carriers
- funding from the State Budget

Ovum's view is that clearly defined universal service funding and implementational arrangements are essential to the development of effective local service competition. All carriers should contribute to universal service funding based on shares of eligible revenues, and all carriers should be able to draw on universal service funds to the extent that they establish infrastructure to support services eligible for funding.

The scope of services subject to universal service funding is expanding in some mature markets to include data and Internet access services. However, compelling justification does not seem to have emerged at this stage for such extensions. This applies particularly to developing markets with more pressing fundamental issues.

IX. MARKET DEVELOPMENT SCENARIOS FOR THE NEXT TEN YEARS

1. Scenario development

There is a wide range of complex global and local forces which will shape the environment for local service competition over the next ten years. In developing a range of future market scenarios it is important to identify a range of underlying forces that will have high impact on strategic decisions but which also have a high degree of uncertainty attached to possible future outcomes. The key "axes of uncertainty" identified for the local service competition market are:

- ***Regulatory convergence*** – the extent to which similar regulatory and competitive market models are applied around the world

- ***Technology convergence*** – the extent to which digital, IP and other technologies promote convergence and substitution between mobile and fixed networks; CATV and telephony networks

- ***Service convergence*** – the extent to which multi-media voice, data and video blur the boundaries between previously discrete services

In any event, the same technology is available to incumbent operators, and may not constitute a unique competitive advantage in the hands of new entrants.

- ***Build only in high teledensity areas*** – ie, build where low unit costs can be achieved with a relatively small market share. This strategy has been widely adopted by new entrants in mature markets such as the US and UK by organisations such as Worldcom and Colt. It typically involves the construction of optic fibre cable loops to connect selected buildings in the CBDs of large metropolitan centres. The approach is not applicable to the mass market.

- ***Target market segments with high revenue per unit cost*** – this strategy is similar to the high teledensity strategy. It includes the ad hoc provision of point-to-point access services to high value customers. This may involve the establishment of spurs off an established optic fibre loop network. Once again, the approach is not applicable to the mass market.

- ***Use unbundled elements of the incumbent's access network*** – this strategy requires regulatory sanction as it is unlikely that the incumbent would willingly provide such services on a commercial basis. This approach is expected to become increasingly important in mature markets as it is one of the few means available of achieving effective competition. It also can be part of a strategy involving the variabilisation of costs. However, it may be complex to implement due to the high level of coordination required at an operational level between incumbents and new entrants.

The nature of fixed and variable costs in providing local service is shown in Figure 1 in the case of wireline systems. The vertical axis is an arbitrary cost unit and the horizontal axis is the number of lines being served.

The traditional view of wireline cost structures is shown in Figure 2. This illustrates the case where 50% of the cost is fixed and the remaining 50% is variable. This is broadly the case for conventional wireline local access.

This analysis of the cost structure of the local loop shows that, at anything less than 25% market share, it is almost impossible for a new entrant to be cost competitive, given that the incumbent would retain 75% market share. It also supports the argument that the local loop is a natural monopoly and that regulators should therefore ensure that local loop unbundling is available on cost based terms to prevent exploitation of the natural monopoly to the detriment of competition.

Alternative access networks may be successful in areas of unusually high teledensity, such as central business districts of large urban centres, with market shares well below 25%, but this can only be achieved by carefully targeting specific buildings and customers with high service volumes. Such a strategy is not possible in the mass market.

- ***Competitive convergence*** – the extent to which global players are able to take over the market positions previously dominated by incumbents

2. *Market positions of operators*

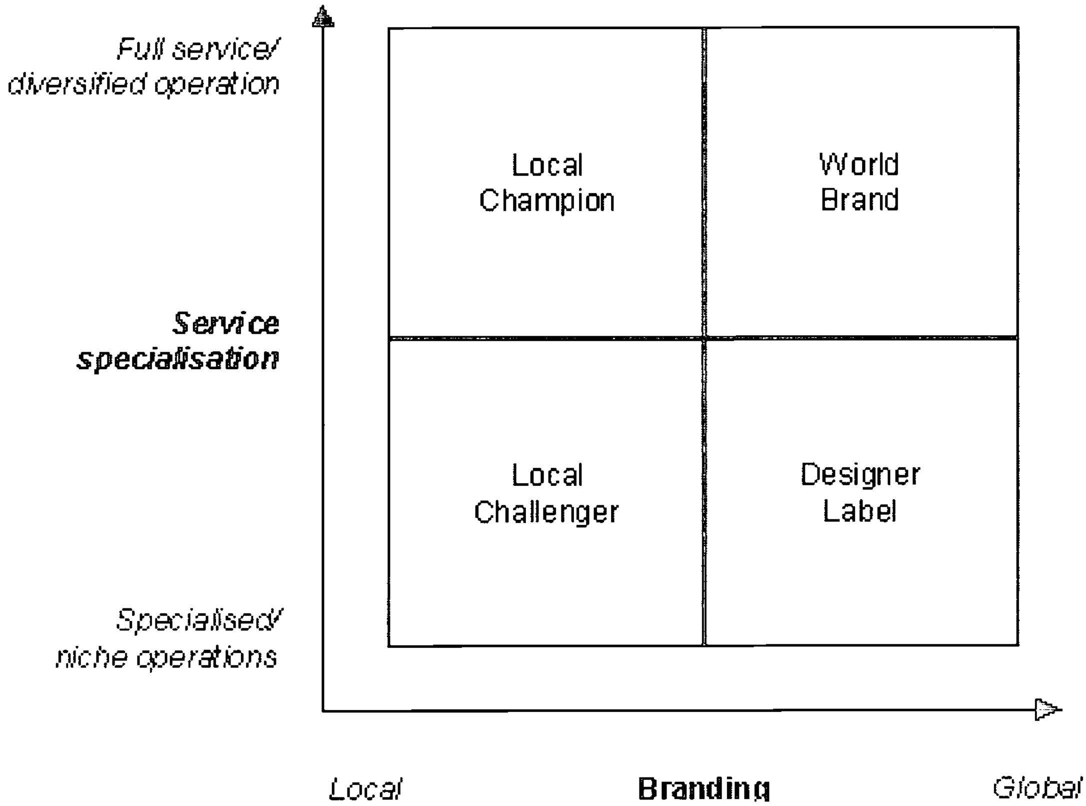
The two most important descriptors of market position for operators in local service markets over the next ten years are:

- ***Service specialisation*** – the extent to which the operator seeks to establish a specialist niche position (defined by customer or service segment) or seeks to be a full service operator

- ***Branding*** – the extent to which the operator seeks to develop a localised brand (uniquely identified culturally with the local market) or develops a global brand applicable across many markets.

Figure 3 illustrates the market positions that an operator might adopt in terms of the above descriptors.

Figure 3: Future market development scenarios



X. LOCAL CHAMPION

TheLocal Champion market position is the one adopted by operators who are local in terms of branding and who to seek to provide a full range of services within their territory. This is typically the starting position of the vertically integrated incumbent and former monopolist. This position is under threat from Local Challengers who need to become full service operators in order to achieve a sustainable market position, as well as World Brands who seek scale economies through global expansion.

XI. WORLD BRAND

The World Brand market position is an emerging one and is being developed by the global expansion of major carriers such as AT&T, BT, C&W, MCI-Worldcom and various RBOCs. These mega-carriers are increasingly seeking to expand geographically and to replicate businesses developed in their home markets into other country markets. This may be via acquisition of a strategic stake in a Local Champion or the purchase of a new Local Challenger licence in consortium with local investors.

XII. LOCAL CHALLENGER

The Local Challenger invariably starts out as a consortium of local investors and overseas carriers - many of them World Brands, in order to meet foreign investment requirements in licence conditions. Such consortiums are often unstable and ownership structures become rationalised over time. Relaxation of foreign ownership rules under the WTO Agreement is likely to result in the increasing dominance of the Local Challengers by World Brands. The Local Challenger may be a start-up company such as many of the CLECs in the US.

XIII. DESIGNER LABEL

The Designer Label market position is occupied by specialised global players such as Equant, Worldcom (prior to the MCI merger) and Global One (a consortium of Sprint, France Telecom and Deutsche Telecom). A number of other carriers such as Telstra, TMI, SingTel and NTT also occupy this space offering a limited range of services in selected overseas markets. Designer Label's tend to specialise in offering international VPN solutions to MNCs.

XIV. THE FUTURE BASIS OF COMPETITION

Market convergence and globalisation over the next ten years will rapidly blur the boundaries of what have to-date been discrete geographical or technology defined markets. Ovum believes that in the future local service operators must compete on the delivery of unique customer value. This will not be a static concept but will require local service operators to continuously adapt to rising customer expectations. Global branding will be a major factor in reinforcing customer value perceptions in all market segments:

- Unique value in the residential market will comprise bundled offerings that encourage loyalty through convenience with good price perceptions.

- Unique value in the SME business market will be based on convenience, price and means of reducing a range of office costs through innovative services, seamless convergence of voice and data, and of fixed and mobile, and 24 hour localised service support.

- Unique value in the corporate business market will be based on service quality, responsiveness, account management, and specialised high speed data and other innovative services on a globalised support basis.

1. ***Market entry strategies***

The local service markets of the future will be stamped by a number of important characteristics, including:

- ***Consumerisation:*** Local service markets will become consumer markets, in terms of service development and adaptation.

- ***Mass market features:*** Niche markets will continue to emerge and decline, but the scale economies associated with global operations, branding and systems in a digital environment will cause niches to be readily hollowed out and absorbed into the norm.

- ***Global branding:*** The market will become increasingly dominated by relatively few global brands and their local franchisees. These brands, in particular, will increasingly pressure niche operators and locally branded operations in local service markets.

- ***Commoditisation:*** The trend to commoditisation in local service markets will be accelerated by the development of wholesale markets that have not previously existed.

The key strategic decisions that a local service market operator has to make relate to:

- ***Segmentation strategy:*** what market segments to target, given its core strengths and capabilities.

- ***Sourcing strategy:*** the classic make/buy decisions in relation to the infrastructure and service elements that it will use as a platform for developing and defining its own services. Its options in this regard will likely depend on the view of competition and outcomes of the regulator.

- ***Differentiation strategy:*** The new entrant must differentiate itself by providing sustainable unique value to its customers. In the short term it might do this through price, latest technology defined services, and overall customer responsiveness. These advantages are transient and readily emulated by other new entrants, and by the incumbent.

In the longer term a sustainable differentiation strategy will be linked with full service operations, controlling the access network to the customer's premises, and adding unique value based on that relationship.

A significant element in building sustainable value will be in bundling services into packages of interest to specific sectors and segments. This extends well beyond the oft-repeated example of bundling all offerings on one bill (which has value for a significant group of customers) to embrace single number options, convenience bundling of telecommunications and non-telecommunications services, and the like.

Of course strategic choices are not completely open – ultimately an entry strategy must reflect the strengths and pre-entry positioning of the operator in question, as follows:

- ***Start up operators:*** Start up operators may have commenced existence in many guises, including as entrepreneurial investors, resellers, facilities managers or infrastructure owners. In each case the entry strategy will be to target a segment with which the company has worked or of which it has good understanding, and which is likely to support a cash flow positive or profitable operation in the short term.
- ***Long distance carriers:*** The strategy of long distance carriers will be to secure their long distance traffic and revenues, and reducing exposure to interconnect charges, by establishing direct access to those of their major customers who are capable of being economically connected. As examples in the United States show, it may be easier to acquire a local service operation than to build access networks from scratch or to negotiate local loop rentals from incumbent local exchange carriers.
- ***Cable TV companies:*** Cable TV companies originally entered the market off the back of their television services, but the past few years in countries such as the United Kingdom, telephony offerings have been primary. Cable

TV companies have targeted residential and SME customers within their franchise territories and have extended their reach through merger and acquisition. They have developed service bundling to include television, telephony, and Internet access.

- ***Utilities***: Utilities have a range of entry strategies all of which seek to leverage advantage from their asset potential, ubiquity, and customer relationships. The extent of the range matches the attitude to risk and risk management of the utility in question. Strategies include adopting a low exposure role as infrastructure provider and lessor, leased line and capacity provision, partnering with a telco to provide a full service range, and going it alone as an operator. All of these approaches can be successful. The use of specialised access techniques based on power distribution networks has yet to be proven in full commercial operation.

XV. ALTERNATIVE ACCESS NETWORK TECHNOLOGIES

New market entrants and incumbent operators throughout the world are now building and operating a wide range of alternative access networks. Figure 4 summarises Ovum's assessment of which types of suppliers are most likely to build significant access networks for the mass market by 2008.

Figure 4: The prospects for alternative access networks

Access network type	*Probability of significant (1) access networks for:*	
	corporate users	*mass markets (2)*
Cellular mobile	happened	happening
Fibre/microwave link network built from scratch	happening	very low
Hybrid fibre coax networks built from scratch (3)	low	low /medium
Hybrid fibre coax network upgrades (3)	medium	medium/high

Fixed narrowband wireless local loop	very low	low
Fixed broadband wireless local loop	medium	very low
Satellite access	medium	very low
Powerline technology	low	medium
Existing duct owners (4)	high	medium

(1) >1% of fixed access network lines by 2004 (3) for CATV and telecommunications applications
(2) residential and small business users (4) eg utilities and city governments

XVI. THE WAY FORWARD

The development of effective competition in local service telecommunications markets remains a major challenge for governments and regulators in both mature and developing economies. The local service market involves direct customer access and increasingly this will be the key to service innovation and carrier profitability.

Underlying telecommunications service economics are changing such that distance is ceasing to be a predominant measure of service cost. What is becoming increasingly relevant is access, bandwidth and the ability to integrate a range of voice, data, Internet and multimedia services on a common user access.

The introduction of effective and sustainable competition in local service markets is even more dependent on regulatory agency intervention and leadership than competition in other sectors of the telecommunications market. The high cost of market entry and the economies of scale enjoyed by incumbent operators mean that local services will retain natural monopoly characteristics not present in long distance and cellular markets. To date local service regulation has been ineffective in delivering sustainable and robust competition.

New entrants therefore need the flexibility to be able to choose between building their own infrastructure and using the incumbent's infrastructure and services, made available on a cost reflective, regulated basis.

Within the next ten years, the processes of market rationalisation and the development of global scale economies in service development and operations will see the emergence of a small number of globally branded operators. Opportunities for implementing niche entry strategies will continue, but niche operators will come under increasing pressure from global brands and their local franchisees.

During this period there will be increased pressure on the local service markets in developing countries. To be globally competitive, their business and commercial sectors will want access to current services at world-parity prices delivered with high levels of quality and reliability by world class operators. These benefits can only be delivered and sustained in a rigorously competitive telecommunications environment. On the other hand, social and political goals require that other sections of the economy of developing countries have improved access to services. The continuing dilemma will be to satisfy all goals simultaneously.

** PJ Falshaw, JR Holmes and DR Baker: **Local Service Competition: Breaking the Bottleneck**, published by Ovum, 1998.*

Return to Top View Full-screen

The WTO Agreement on Basic Telecommunications Services:

How is it Affecting the Pacific Rim?

Thomas K. Crowe and Elizabeth Holowinski

Law Offices of Thomas K. Crowe, U.S.A

ABSTRACT

The WTO Agreement is having a profound impact on the Pacific Rim as well as the rest of the world. The WTO Agreement is now almost two years old and the emerging effects of its implementation are becoming clear. Not only has it eased and simplified entry by businesses from Pacific Rim countries into the U.S. telecommunications market, but it has also led to changes in Pacific Rim countries' own entry policies. The WTO Agreement has lead to increased competition with enormous benefits, including reduced prices for consumers as well as the promotion of universal service. Critics of the WTO Agreement, however, claim that it is having a negative impact on telecommunications markets of the developing world. While not everyone agrees on its benefits and/or disadvantages, it is clear that the WTO Agreement has forever changed the face of the telecommunications world.

View Full Text

The WTO Agreement on Basic Telecommunications Services:

How is it Affecting the Pacific Rim?

Introduction

Before 1996, very few telecommunications markets in the world were open to resale or facilities-based competition in international services. At that time, dominant carriers and above-cost accounting rates constrained international trade in telecommunications services. As such, market entry for basic service providers was limited to investments in privatized former monopoly companies or wireless or cellular service. The passing of the landmark World Trade Organization Basic Telecommunications Agreement ("WTO Agreement"), on February 15, 1997, after ten years of negotiations, changed all of that.

The WTO Agreement replaced the traditional regulatory regime of monopoly telephone service providers with pro-competitive and de-regulatory policies. Like never before, under the

WTO Agreement, the telecommunications industry is operating under a trade regime. At presstime, 72 countries have made commitments under the WTO Agreement, collectively accounting for approximately 93 percent of the global telecommunications market by value. This paper examines the effects of the WTO Agreement on the U.S. and Pacific Rim countries. Part I discusses the general obligations imposed by the WTO Agreement on its U.S. and Pacific Rim signatories. Part II reviews the implementation of obligations by the United States under the WTO Agreement. Part III presents a case study of Hong Kong's implementation of the WTO Agreement. Part IV discusses the effects of the WTO Agreement on the telecommunications markets in the Asian-Pacific region. Part V concludes that although opinions differ on how or whether the Asian-Pacific region will benefit from the WTO Agreement, it is clear that it has forever changed telecommunications markets around the world.

Part I: The WTO Agreement on Basic Telecommunications Services

A. WTO Agreement Components

The WTO Agreement was concluded under the auspices of the General Agreement on Trade in Services ("GATS"), one of the agreements negotiated in conjunction with the creation of the WTO. The WTO Agreement, which consists of general obligations and specific sectoral commitments contained in individual member schedules, contains three main components: (1) general obligations and disciplines which apply to all WTO Members; (2) specific commitments relating to market access, national treatment, and other commitments, which are embodied in individual WTO Member schedules; and (3) specific exemptions from obligations made by WTO Members.

The first component consists of general obligations which apply to all WTO Members. The most important general obligation is the Most Favored Nation ("MFN") principle. Essentially, MFN is a non-discrimination rule that requires each WTO Member to treat like services and service suppliers from all other WTO Members similarly. The MFN principle requires all WTO Members to accord MFN treatment to like services and service suppliers of all other WTO Members, no matter what specific commitments a particular WTO Member has made. Other general obligations relate to transparency, monopolies, exclusive service suppliers, business practices, economic integration agreements, and recognition standards for the authorization, licensing or certification of service suppliers. All WTO Members are obligated to follow these general principles, unless specific exceptions are taken.

The second component consists of the specific commitments to which each signatory nation agrees. Such commitments typically include market access, national treatment, domestic regulation and the additional commitments embodied in a document known as the "Reference Paper." Market access prohibits a member from maintaining limits (such as the number of service suppliers) unless the member has specifically listed such limitations in its Schedule. National treatment is a non-discrimination rule that requires a WTO Member to treat like services and service suppliers from other WTO Members no less favorably than it treats its own services and service suppliers. Domestic regulation refers to the obligation for members to administer in a reasonable, objective and impartial manner consistent with the specific commitments undertaken. The Reference Paper contains pro-competitive regulatory principles relating to competition safeguards, interconnection, universal service, transparency of licensing criteria, regulator independence, and resource allocation.

The third component allows WTO Members to take exceptions to any general or specific commitments undertaken, including MFN, national treatment or market access commitments. The U.S., for example, took an MFN exemption for direct-broadcast satellite services, direct-to-home satellite services and digital audio radio satellite services. Thus, the U.S. may establish different rules for different WTO signatories concerning the provision of those services in the U.S.

In summary, all member countries are required to commit to the MFN principle and other general obligations. Further, member countries can commit to additional principles, including market access and national treatment obligations. However, a member country is permitted to take exception to any of the obligations committed to, including the MFN principle. Together, these three components constitute, with a certain degree of flexibility, each countries' legal obligations under the WTO Agreement.

B. Scope of the WTO Agreement

The obligations contained in the WTO Agreement apply only to trade in basic telecommunications services. Basic services are defined as all telecommunications services, both public and private, that involve end-to-end transmission of customer supplied information. Basic services include voice telephony, data transmission, telex, telegraph, facsimile, private leased circuit services, fixed and mobile satellite systems and services, cellular telephony, mobile data services, paging, and personal communications systems. Value-added services, such as e-mail, on-line data processing and database retrieval, are outside the scope of the agreement.

C. Commitments of U.S. and Asian-Pacific WTO Members

A number of countries made competitive access commitments to local, domestic long-distance, international and resale services concurrent with the January 1, 1998 entry into force of the WTO Agreement. A summary of such commitments by the U.S. and certain Asian-Pacific WTO Members follows.

United States--The U.S. commits to provide market access to all basic telecommunications services and national treatment to service suppliers of WTO Members. Its schedule also commits to the principles contained in the Reference Paper. However, the U.S. Schedule of Specific Commitments limits direct access to INTELSAT and Inmarsat to Comsat for the provision of basic telecommunications services and limits direct foreign ownership of common carrier radio licenses to 20 percent. In addition, the U.S. makes no market access commitments and takes an MFN exception for direct-broadcast satellite services, direct to home satellites services and digital audio radio satellite services.

Japan--Japan commits to provide full market access in all market segments and commits to the principles contained in the Reference Paper. However, Japan maintains the 20% foreign equity limitations on NTT and KDD.

Australia--Australia commits to unrestricted competition in virtually all basic telecommunications services with no limits on foreign equity for new carriers. However, its schedule only permits foreign equity of up to 11.7% of the government controlled carrier, TELSTRA, and requires majority Australian ownership of the mobile carrier, Vodaphone. In addition, it commits to the principles contained in the Reference Paper. Australia's schedule, however, contains an MFN exemption list on telecommunications services involving the supply of fixed satellite services by geostationary satellites.

New Zealand--New Zealand commits to open markets for all basic telecommunications services for all market segments. However, its schedule contains a national treatment limitation which indicates that no single foreign entity is permitted to hold more than 49.9% of Telecom New Zealand. New Zealand also commits to the Reference Paper's regulatory principles.

Other countries maintain limitations on foreign ownership and access to telecom facilities, but some also make strong commitments to liberalize their telecommunications markets in the near future. Summaries of such obligations made by WTO Members from the Asian-Pacific region follow.

South Korea--South Korea commits to increasing its foreign equity participation limits on facilities-based suppliers from 33% to 49% starting in 2001. Its schedule also increases the foreign equity limit in the national supplier KT from 20% to 33% from 2001. Its schedule promises to permit competition in wire-based telephone services. South Korea also permits market access for domestic voice resale as of 1999, and phases in competition in international simple voice resale by 2001.

Singapore--Singapore commits to competition in facilities-based telecommunications services in April 2000, when up to two additional operators will be licensed. Additional licenses will be granted thereafter. Its schedule opens markets for mobile data, cellular telephony and trunked radio services and for paging services as of April 2000. It also commits to the provision of domestic and international resale of public-switched capacity (not including the connection of leased lines to public network) for most basic services, including voice, data and ISDN. Singapore limits foreign equity to 49% for facilities-based suppliers. Its schedule also commits to the Reference Paper on regulatory principles.

Philippines--The Philippines commits to competition in facilities-based voice telephone, data transmission, and cellular mobile services in all market segments for public use by means of all types of technologies except cable television and satellite. However, new entrants must meet certain legal criteria before they will be permitted to provide service. Its schedule limits foreign equity to 40%, and adopts some of the regulatory principles contained in the Reference Paper.

Other countries make no specific commitments to liberalize telecommunications markets, but generally promise to review commitments at a future date. For example, Thailand committed to only review commitments in public, long distance and international voice telecommunications services in 2006, conditional upon the passage of and consistent with new national communications laws.

Despite the varying degrees of each of these countries' commitments, according to the MFN principle, each WTO Member is obligated to afford all WTO Members the same treatment, regardless of the extent of the commitments contained in a particular member's schedule.

D. Dispute Resolution Under WTO Agreement

If a WTO Member fails to give a carrier market access consistent with its WTO obligations, such obligations can be enforced through the dispute settlement process at the WTO. If the complaining country prevails, the losing WTO Member has the obligation of fulfilling its market access commitments. If the losing WTO Member fails to do so, it is required to compensate the winning WTO Member in trade terms or else the winner may take compensatory trade action in the services or goods sectors. Thus, if a WTO Member has committed to allow market access to provide international service but denied a license to a carrier from a WTO Member country on the grounds of its nationality, the carrier's home country would have the right to take the dispute to the WTO.

For example, suppose that a dominant carrier in Australia provided interconnection to Japanese carriers on less favorable terms than it provides to its own affiliates or carriers from a third WTO Member country. In this case, Japan could take to the WTO a dispute against Australia for failing to maintain measures to ensure non-discriminatory interconnection. While companies from Australia might not be interested in entering Japan's telecommunications market, its industry has substantial volumes of trade with Japan in a variety of other goods and services sectors. Thus, if Japan prevailed in the dispute, Australia would most likely agree to fulfill its market access or regulatory principle commitments rather than provide trade compensation.

Part II: U.S. Implementation

A. Before WTO Agreement

In November 1995, the Federal Communications Commission ("FCC") established rules regarding foreign carrier entry into the U.S. telecommunications market. As a condition of its entry into the U.S. market, a foreign carrier was required to meet the effective competitive opportunities ("ECO") test as well as demonstrate its entry was in the public interest. The ECO test required foreign carriers to demonstrate that there were no legal or practical restrictions on U.S. carriers' entry into the foreign carrier's market. Even if a foreign carrier could meet the ECO test, it was also required to meet certain public interest considerations. Such considerations included the significance of the proposed entry on competition in the U.S. telecommunications services market, the presence of cost-based accounting rates, national security and law enforcement issues, and foreign policy and trade concerns. Thus, only if a foreign carrier could demonstrate that its home telecommunications market was legally and practically open to competition to U.S. carriers, and that the application met the relevant public interest considerations, would the foreign carrier be granted a license to operate in the U.S. telecommunications market.

Moreover, if a foreign carrier wanted to secure authority to provide basic telecommunications services using resold international private lines (known as international simple resale), it was required to meet the equivalency test. The equivalency test requires a foreign carrier applicant to demonstrate the country at the foreign end of the private line affords U.S. carriers resale opportunities equivalent to those available under U.S. law. Thus, if a foreign carrier's home country did not afford U.S. carriers the same resale opportunities afforded by U.S. law, it would not be allowed to provide international simple resale services from the U.S.

B. <u>After WTO Agreement</u>

Consistent with U.S. obligations under the WTO Agreement, on November 26, 1997, the FCC released a ruling which significantly reformed the regulations governing foreign participation in U.S. telecommunications markets. The <u>WTO Order</u> removed the ECO test and replaced it with an open entry standard for applicants from WTO Member countries. Under the new rules, entry of a foreign carrier from a WTO Member country into the U.S. telecommunications market is presumed to be in the public interest. Applications to enter the U.S. telecommunications market for non-dominant foreign carriers (carriers which have less than 50% of market share) would be subject to streamlined procedures (which typically allow a carrier to commence providing services on the 36th day after publication of the application). For dominant foreign carriers, action should be taken by the FCC within 90 days of publication of the application, unless special circumstances warrant further extension.

Further, the <u>WTO Order</u> removed the equivalency test for carriers seeking to provide switched services over private lines that terminate in WTO Member countries. Thus, foreign carriers from WTO Member countries no longer need to demonstrate that their home countries afford U.S. carriers the same resale opportunities afforded by U.S. law to provide international simple resale services.

The WTO Order, however, established numerous "safeguards" to protect competition in the U.S. telecommunications market. First, dominant foreign carriers that possess market power on the foreign end of a U.S. international route are prohibited from providing special concessions to U.S. carriers. The FCC also requires a foreign carrier's settlement rates to be at or below the FCC's relevant benchmark before its U.S. affiliate may provide facilities-based service to an affiliated market. However, the settlement rate benchmark does not apply to switched resale providers. Dominant foreign carriers will also be required to maintain a minimal level of structural separation between the U.S. international carrier and its foreign carrier affiliate that possesses market power in a foreign market for international services. Foreign-affiliated dominant carriers are also required to file quarterly traffic and revenue reports for their dominant routes. In addition, such carriers must file quarterly reports summarizing the provisioning and maintenance of all basic network facilities and services they procure from their foreign affiliates. Lastly, all dominant foreign-affiliated facilities-based carriers are required to file quarterly circuit status reports.

The new streamlined application procedures for foreign entry into the U.S. telecommunications market apply only to foreign carriers from WTO Member countries. Thus, carriers from countries which are not signatories to the WTO Agreement, such as China, but seek to enter the U.S. market, are required to demonstrate that their home countries' markets meet the ECO test and that grant of the applications furthers the public interest. Additionally, such carriers are also required to meet the equivalency test to provide simple international resold services.

Part III: Case Study: Hong Kong

Telecommunications services in Hong Kong are regulated by the Office of the Telecommunications Authority in two separate categories, local fixed and external telecommunications services. Local fixed telecommunications services are communications which both originate and terminate within Hong Kong. External telecommunications services are communications which either originate or terminate outside of Hong Kong.

A. Local Fixed Telecommunications Services

Prior to 1995, only one carrier, the Hong Kong Telephone Company ("HKTC") was authorized to provide local fixed telecommunications services. HKTC's exclusive license expired on July 1, 1995, after which it was granted a non-exclusive license to continue providing local fixed services.

In 1995, after the expiration of HKTC's exclusive license the government licensed three additional service providers in Hong Kong's local fixed telecommunications services market. To provide the new entrants a period of time to establish their operations and commence their network deployment without facing further competition, a three year licensing moratorium was granted.

The moratorium expired on June 30, 1998, and at presstime the government was in the process of considering issuing additional local fixed licenses.

B. External Telecommunications Services

In 1981, Hong Kong Telecom International Limited ("HKTI") was granted an exclusive 25 year license to provide external telecommunications services, which was scheduled to expire on September 30, 2006.

In an attempt to speed-up the deployment of competition in the external telecommunications market, the government negotiated an early surrender of HKTI's license. HKTI agreed to surrender its monopoly control over external fixed services on March 31, 1998. As a result, the government integrated its approach to licensing local and external fixed telecommunications services.

On October 23, 1998, the government opened the external resale services market to competition. An unlimited number of licenses were authorized to be issued by the government for resold external telecommunications services, including voice, facsimile, or data, operated over leased circuits. After January 1, 2000, the government plans to issue an unlimited number of facilities-based external telecommunications licenses, fully liberalizing the external telecommunications services market in Hong Kong.

C. WTO Obligations

The above-discussed market opening steps taken by the Hong Kong government appear to be consistent with its obligations under the WTO Agreement. In its WTO schedule, Hong Kong committed to competition in the following services: (1) international simple resale for facsimile and data transmission; (2) basic telecommunications including voice and data transmission; and (3) mobile radio telephone and mobile data services. Its schedule also promises to permit callback and other alternative international calling services, certain satellite services, virtual private networks, and mobile satellite services. The Hong Kong schedule commits to the Reference Paper on regulatory principles. By liberalizing its local and external telecommunications markets, Hong Kong appears to be at least partially fulfilling its obligations under the WTO Agreement.

Part IV: Effects of WTO Agreement on the Asian-Pacific Region

The WTO Agreement is having a profound impact on telecommunications markets in the Asian-Pacific region and around the world. As recognized by the U.S. government, the agreement is promoting private sector competition, dramatically lowering the cost of providing service, and stimulating the creation of innovative services and investment in infrastructure deployment.

Many commentators have observed that because the WTO Agreement promotes competitive entry and permits self-termination of traffic, accounting rates may become irrelevant between competitive markets in the future. Excessive accounting rates appear to be keeping prices for international calls artificially high--approximately six times the average price for domestic long distance calls--despite minimal differences in underlying costs. Thus, a reduction in settlement rates will likely lead to a decrease in prices for international services, which will undoubtedly lead to an increase in usage. In fact, ITU research indicates that, in terms of growth in international traffic per subscriber line, competitive markets are growing by 15% per year compared with just 3% per year in non-competitive markets.

WTO Members from the Asian-Pacific region are also noticing an increase in private investment in their telecommunications markets. ITU research indicates that domestic networks in competitive markets grow approximately 10 times faster than the domestic networks of non-competitive markets. Thus, the influx of private capital in telecommunications markets may be leading to efficiency and increased infrastructure development.

This increase in infrastructure development could promote universal service (the regulatory objective that all persons have access to a telephone). A recent study conducted by the ITU found that if telecommunications services were uniformly available and sensibly priced, an additional 300 million households world-wide would have telephone service, many of which are located in the Asian-Pacific region. Thus, the WTO Agreement may be promoting universal service among its signatories.

Not everyone believes that the WTO Agreement's pressure on the accounting system is necessarily in the public interest. Critics explain that, due to the WTO Agreement, countries which depend heavily on settlement receipts from international telecommunications services could see these receipts fall sharply. Those countries could then be faced with tough decisions involving structural and price adjustments in their home markets due to lost revenues. Such revenues in many countries were used to develop networks and may have to be replaced by higher domestic prices and increased reliance on foreign investment. Thus, instead of leading to a decrease in prices, critics argue that for some countries, prices for services could actually increase due to the WTO Agreement, leading to a decrease in usage as well as a reduction in telephone subscribership rates.

Part V: Conclusion

It is impossible to accurately predict the long terms effects of the WTO Agreement on the Asian-Pacific region. However, in the two years since its passing, WTO Members from the Asian-Pacific region have seen markets--which never before allowed competition or foreign investment--opening up. The short term results appear to have lead to a decrease in prices for international services and an increase in infrastructure deployment. Further, countries which have not joined the WTO Agreement are beginning to find themselves falling behind in the deployment of telecommunications services in their markets. Although not everyone agrees on the benefits and/or disadvantages of the WTO Agreement, it is clear to all that the WTO Agreement has forever changed the face of the telecommunications world.

ENDNOTES

Return to Top   View Full-screen

Can the Competitive Model of Telecommunications Governance Deliver the Goods?

MICHAEL JANIGAN

Public Interest Advocacy Centre, Canada

ABSTRACT

The question that policymakers and public interest advocates must confront is whether the competitive model of communications oversight currently espoused will be capable of delivering the goods in the form of universal affordable access to those communications technologies, and services that are recognized as socially useful and necessary. It is first perhaps necessary to look at the essential components of the conceptual competitive model. The selling points of this model will certainly vary by jurisdiction. For the purpose of the paper, its development is primarily predicated on the Canadian experience. However, even given its country specific limitation, the description of this model will be admittedly general and broad brush. In fairness, it is likely that no industry actor ever finds its position entirely within the construct of this model as elaborated herein. However, the description of the model does serve to focus the discussion as to whether the full implementation of the model broadens or narrows access to the services enabled by the new technologies.

View Full Text

Can The Competitive Model of Telecommunications Governance Deliver The Goods?

I. INTRODUCTION

By now, few of us have not been exposed to the visionary rhetoric that has accompanied the dawning of the so-called information age. Fortunately, there is no amount of cynicism engendered by the hype surrounding the Information Highway that can fully extinguish the sense of awe that most of us have when we contemplate the potential of the new communications technologies. On a worldwide basis, these technologies are establishing an infrastructure that is transforming the way we do business and, to a large extent, the way we live.

For public interest advocates, the allure of these technologies has not been their ability to change a resource based economy to an information based economy, a change largely effected by the marriage of the computer and communications technologies. The attraction is rather that these technologies offer an opportunity to deliver societally important public goods and services in dramatically more effective ways, both domestically and internationally. These new methods of delivery connote an opportunity to better everyone's lot.

But as we all know, the delivery of these new goods and services does not take place in a governmental or regulatory vacuum. First of all, the technological advances themselves have served to rebut the notion of the telephone system as a natural monopoly. Developments in digitization, transmission and traffic switching technology enabled new entrants to challenge incumbent hegemony in telecommunications services.

However, the advent of the digital age, and the ability to reproduce products and services in electronic form, has also served to focus industry dissatisfaction on the alleged shortcomings of the traditional methods of communications regulation. It is particularly interesting how the potential application of the new technologies has been used a lever to advocate for dramatic changes in the regulatory environment. Despite the fact that reliance on market forces is largely at odds with the broad based social goals promised by the new technologies, there has been a consistent clamour, particularly from the former incumbent monopolists, to be released from the chains of regulatory oversight.

It would be an exaggeration to claim that the regulatory models currently evolving are solely the result of the aggressive posturing of telecommunications players to the effect that fantastic new developments cannot be achieved under existing regulation. However, it is important to note that the promise of seductive new technologies and new services on the horizon has been successfully married by industry spokespersons with the plea to be set free from regulatory "bondage."

The question that policymakers and public interest advocates must confront is whether the competitive model of communications oversight currently espoused will be capable of delivering the goods in the form of universal affordable access to those communications technologies, and services that are recognized as socially useful and necessary. It is first perhaps necessary to look at the essential components of the conceptual competitive model. The selling points of this model will certainly vary by jurisdiction. For the purpose of this paper, its development is primarily predicated on the Canadian experience. However, even given its country specific limitation, the description of this model will be admittedly general and broad brush. In fairness, it is likely that no industry actor ever finds its position entirely within the construct of this model as elaborated herein. However, the description of the model does serve to focus the discussion as to whether the full implementation of the model would broaden or narrow access to the services enabled by the new technologies.

The essential features of this model are:

a. Internal subsidies to enable network access are sought to be eliminated.

b. Individual components of network access are, to the greatest extent possible, unbundled and repriced.

c. Consumer choice and individualized programs of service are a network priority.

d. Market forces are sufficient to ensure service quality.

e. Universal public access is a public goal to be ensured with public monies.

f. Telecommunications objectives are best achieved through competitive means.

g. Consumer protection is best achieved through competition or anti-trust policy rather than regulatory oversight.

II. FEATURES

A. *Internal Studies To Enable Network Access Are Sought To Be Eliminated*

I do not intend to revisit the debate of the last two decades concerning who should pay the costs of network access. The impact, however, of the migration of greater costs in telephony to local basic service has had two principal effects:

a. Savings, particularly for high volume customers of competitive services such as long distance

b. A substantial escalation of the basic costs to get on the network.

For competitive model adherents, this reallocation of costs reflects simple market realities and allocates costs to telecommunications services using the network in a market-based fashion.

To consumer and public interest advocates, the costing results are decidedly subjective, geared more to ensure competitive entry by service providers than allocative efficiency and value. (One wag has termed the process the evolution from cost based pricing to price based costing).

A forthcoming study by my organisation, the Public Interest Advocacy Centre, has found that during the first five years of long distance competition, the savings for most Canadian consumers from lower LD prices were cancelled out by higher local prices for most Canadians. Low volume LD users who tend, in the main, to be low income Canadians have significantly higher overall telephone bills than they did before competition was introduced .

Whatever the merits of the different applications at this costing principle, it is undeniable that its impacts are most heavily felt by those with the least ability to pay. Access to advanced applications of communications technologies may be a moot point if a subscriber has already dropped off the network. On the other hand, a rebalancing of network costs may make start-up and delivery of new applications on the network more cost effective.

B. *Individual Components Of Network Access Are, To The Greatest Extent Possible, Unbundled And Repriced*

In a competitive telecommunications universe, there is a perpetual squeeze between the desire for a return on investment and the fulfilment of the important telecommunications objective of maintaining basic universal service. In Canada, consumer and public advocates have seen a wholescale attack in telephony on the collaterally important functions of the telephone system that were either formerly or realistically part of a package of basic services. Network functions such as local information services, long distance information services, repairs to subscriber lines and touchtone service are classified as services additional to local basic service for which the telcos assess an additional fee. Other U.S. jurisdictions have allowed the introduction of local measured service. The erosion of the content of basic network service that ensures functional access to the communications network and full participation in the community of interests served by the local network presents a substantial irritant, if not a road block to establishing or maintaining universal accessibility.

C. *Consumer Choice And Individualized Programs Of Service Are A Network Priority.*

The discipline of competition has meant a quicker and better response by industry participants to those customers whose consumption of services represent a significant market share to be obtained or retained. As well, new providers of communication services have been able to enter and provide services to emerging markets particularly through the use of wireless technologies where traditional networks could not have been implemented. The presence of competing players in the communications market does present possibilities for expanding access to consumers whose needs cannot be met in the traditional monopoly environment.

D. *Market Forces Are Sufficient To Ensure Service Quality*

While competition has produced increased efficiencies and choice for consumers in desirable markets, it has also had the effect of inducing ambivalence by network providers concerning markets whose economies of scale or scope, or net revenue, make them unattractive for industry participants. This is particularly been evident in US jurisdictions where the local network provider has in many instances virtually abandoned its responsibility to provide local service and failed to address service quality problems in a suitable fashion.

In Canada, the CRTC has been non-compliant with requests from local service providers that they be exempted from accountability on quality of service matters, and resistant to the claim that market forces can provide incentives to ensure that quality of service is maintained. The CRTC, as the national telecommunications regulatory body, has insisted upon the maintenance of appropriate quality standards in that "market forces are not sufficient incentives to ensure that quality of service with respect to essential utility segment services and bottleneck facilities does not deteriorate...". The CRTC , however, did refuse to incorporate an incentive/penalty system for quality of service into the price caps formula for local telephony, which might have provided consumers with greater insurance against potential deterioration of standards.

The experience to date in Canada and the United States, arising in jurisdictions where regulation has not been completely ceded to market forces, represents a significant counsel of caution to those who would advocate an abandonment of the maintenance through regulatory authority of quality of service network standards as a result of the introduction of competition.

E. *Universal Public Access Is A Public Goal To Be Ensured With Public Monies*

While there is agreement among government, industry and consumers that the telecommunications networks of the present and future represent a substantial national and public interest, there is an ever- widening divergence of views between industry and public interest advocates as to the responsibility for ensuring network access. While the industry players continue to publicly highlight the importance of the applications of new communications technologies as the lifeblood of future economic development, the responsibility to ensure delivery of access to all elements of society is increasingly looked upon by industry as a non-network cost.

In Canada, we appear to be committed to access as an objective, yet we are indefinite as to how access will be achieved in the current environment without government subsidy. Clearly, the most successful efforts to promote access to new technologies, outside of industry pilot studies, have involved direct federal funding.

The Canadian government's Information Highway Advisory Council recognized the critical necessity for developing access to the Internet and ensuring equitable participation in a knowledge society. Its September 1997 report contained far-reaching recommendations to enable such participation. Through the Community Access Program, the federal government is committed to the goal of connecting up to 10,000 rural and urban communities across Canada by 2001 through the establishment of public access sites in low cost public locations. The SchoolNet program is a collaborative effort sponsored by federal, provincial, and territorial governments and is projected to take in Canada's 16,500 schools with hundreds of on line services by the end of 1999.

While the government has been forthright in its desire to put money into range of partnerships to expand access to new telecommunications services, the traditional industry players have resiled from their longstanding notion of stewardship over network access to a position of "show me the money".

In a current CRTC proceeding examining service to high cost serving areas in Canada, the submission by the Stentor Resources Centre Inc., the alliance of Canada's former monopoly telephone companies, contains the following statements:

> *"Stentor believes the following principles should apply in achieving the objectives of this proceeding: First, market forces should be relied on to achieve public policy goals whenever possible. Second in cases where it is determined that market forces are insufficient to achieve public policy goals relating to accessibility, then governments should accomplish such goals directly through spending and tax measures."*

I do not quote from this document to illustrate that Stentor is callous or indifferent to the needs of Canadian society. It is rather that some of the goals associated with the implementation of a competitive model of telecommunications are difficult to reconcile with the notion of expanding access by consumers in undesirable markets. As a matter of policy, you are unlikely to accomplish access goals simply by reliance upon market forces, notwithstanding the promise associated with some of the new technologies.

In Canada, it is also interesting to note that the ongoing debate concerning the achievement of other important national communications goals is taking on the same characteristics as the struggle to ensure public access. The touchstone of Canadian communications and broadcasting policies for more than half a century has been the maintenance of Canadian content in creation and distribution. However, a verity of equal importance in the regulatory arena, has been the continual, and occasionally successful, whining from the non-governmental providers of broadcasting services that the content restrictions constitute an unacceptable straightjacket on their ability to earn a fair rate of return.

As I write this paper, the news media is covering a squabble between the two main private networks concerning Canadian content programming. One network is accusing the other of profiting by maintaining smaller Canadian content quotas. Predictably, the response from the network accused of such delinquency is:

> *"if you are going to regulate free enterprise in the private sector, you've got to give them some room to do well."*

In Canada, the traditional telecommunications players are increasingly focussing on the prospect of providing services that would be traditionally looked upon as broadcasting through their own networks. These services have been principally enabled by new developments in Internet streaming audio-video technology. However, similar to the industry attempts to winnow down the statutory responsibilities of ensuring public access in local telephony networks, there is an increasing attack on the framework of Canadian broadcasting policy and ,in particular, its emphasis on the maintenance of Canadian content. This attack comes principally from the high powered aspiring new entrants.

In a remarkable discussion paper issued by Stentor in March of 1998, there is an attempt to revisit all of the largely successful themes that have been played in the telecommunications market.

First of all, the promise of flourishing Canadian industry created by the new technologies and the intersection of telecommunications and computing in the creative content industries is provocatively dangled before government policymakers. However, after whetting the appetite with the carrot of the economic promise of the brave prosperous new media world, the stick is applied when it is stated that investment in new media services requires minimal regulatory intervention to expedite new entry and limitations on the application of longstanding licensing requirements.

To assist in the bulldozing of the current regulatory framework, the viewing preferences of Canadians are attempted to be enlisted:

> *"Changes in consumer behaviour and technology will demand a economic framework aimed at promoting rather than protecting and encouraging access rather than relying on barriers as the means to success."*

In any event, the discussion paper predictably argues that government funding and tax incentives should be used to assist Canadian content creators for new media services, and certainly no further financial demands should be put upon the providers of new services. Finally , the admonition of potential impotence is given to government policymakers:

> *"A number of changes in the market - in consumer attitudes and technology and international agreements are raising questions with respect to our ability to maintain such restrictive (ie Canadian content approaches), all be it for a public policy purpose that continues to be important to Canadians."*

Now one can scarcely expect that traditional telecommunications companies, about to embark upon new ventures, would embrace schemes of national regulation which may prove burdensome to their bottom line. But it is important to note, it is implicit in their approach, that the creation of a competitive framework, which may enable the new technologies to deliver services, does not guarantee the achievement of national goals such as Canadian content and public access, particularly without public finance. In fact, it may create an aggressive lobby for the alteration of the national public goals.

F. *Telecommunications Objectives Are Best Achieved Through Competitive Means*

Most governments are now of the belief that market forces represent the preferable way of achieving telecommunications goals.

For example, in Canada, the 1993 *Telecommunications Act* explicitly instructs the national regulator, the CRTC, to forebear from regulation where a service or class of services is or will be subject to competition sufficient to protect the interest of users. In addition, the *Act* recognizes as an objective:

> *"To foster increased reliance on market forces for the provision of telecommunication services and to ensure that regulation where required, is efficient and effective."*

The current framework of Canadian communications governance has evolved from a series of decisions that permitted entry into the local market by striving to ensure that the right economic and technical conditions existed for open access. A price cap regime has subsequently been put in place governing local network services until competition is established. Finally the CRTC has recently forborne from regulating long distance services offered by the former monopoly telcos.

While the introduction of competition as a principal tool of industry governance is not controversial, its establishment as the only tool certainly is. The adherents of this view are, not surprisingly , the same interests that opposed competition in the first place. The former incumbent monopolists are anxious to hasten the transition to what is termed "a fully competitive communications market". A recent study by the Stentor companies concluded:

> *"Regulation in a fully competitive communications market will be considerably different. The market failures which required industry specific economic and technical regulation will no longer be present as new players compete aggressively for customers."*

In Canada, Stentor's enthusiasm for unrestricted competition does not have industry-wide enthusiasm. A wireless competitor notes:

> *"As competition is introduced into markets still dominated by telephone companies, whose actions and positions have been influenced by the regulated past, it is important to evaluate carefully then correct for the ways in which these markets are distorted by the lingering effects of the past."*

As well, the claims of some that allowance of market entry has obliterated the vestiges of monopoly power, has attracted the expressed disbelief of notable industrial economists. As a recent study notes:

> *"The hope that monopoly and dominance will quickly disappear are contrary to industrial experience. ...New entry is actually a complicated process; it is rarely a strong force in mainstream markets that is able to discipline incumbent dominant firms."*

The efforts of the Regional Bell Operating Companies to enter the long distance market following passage of the 1996 *Telecommunications Act* in the United States has also spurred renewed interest in the examination of whether workable competition in the local market actually exists, notwithstanding the legislative and regulatory seal of approval. In a petition filed by the American Association of Retired Persons, the Competition Policy Institute and four other state based public advocates, the FCC was recently requested to ensure that consumers have a realistic choice of alternative local telephone companies before any assumptions were made concerning competitive entry into the local markets.

The significance of the lingering effects of monopoly in a deregulated environment are devastating for the constituencies that formerly relied upon regulation as their consumer protection. Without sufficient market power to ensure the best value for the best price, vulnerable consumers will struggle to maintain their current access to networks, let alone expanded levels of services and technologies.

G. *Consumer Protection Is Best Achieved Through Anti-Trust Or Competition Policy Rather Than Regulatory Oversight*

In many utility markets, there has been a marked tendency on the part of the former incumbent monopolist to embrace the concept of oversight to be exercised only by anti-trust or competition policy authorities. This idea is trenchant, as it appears to logically coincide with the use of competition as a principal tool of protection.

It is undeniable that competition law and policy has a significant place in maintaining the level playing field upon which all industries including the communication industry must play.

> *"The anti-trust laws...are the Magna Carta of free enterprise. They are as important to the preservation of economic freedom and our free enterprise system as the Bill of Rights is to the protection of our fundamental freedoms"*

However, there are significant differences between the approach of a tribunal implementing competition policy ,and those that are concerned with the responsible delivery of telecommunication services in the public interest. Some of the difficulties inherent in the proposal to substitute competition policy for regulatory oversight include the following:

- Enforcement of anti-competitive statutory prohibitions tends to be isolated episodes of intervention rather than maintenance of a particular industry end state (hence its attraction for a dominant industry player). In competition or anti-trust policy, the goal is to intervene, fix the problem, and exit. This works well when there is a particular instance of preferential pricing or restrictions to deal with. Its application is more problematic where a pattern of industry behaviour has created market conditions which stifle competition in important market segments. Such problems may call for timely and repeated intervention and monitoring - a function which is not always compatible with the mandate of the competition or anti-trust authorities.

- The economic underpinnings of competition policy are not universal static equations which are easy to apply, particularly with respect to the concept of market power. In Canada, our Competition Bureau has been far more successful in rooting out conduct injurious to competition brought about by the conduct of multiple firms, rather than the problems of market dominance by a single firm. This is largely because remedial action associated with market dominance in competition or anti-trust law mostly involves the removal of market entry barriers. In large part, the theory of contestable markets holds sway in relation to the solution of barrier removal as a principal remedy. Much simplified, this theory holds that if it is easy for firms to enter the industry then the firms already engaged in the industry will be unable to raise prices above the competitive levels lest such entry occur and the increased industry output will cause prices to fall. However, as critics have noted that empirical evidence for this theory is weak.

- For national telecommunications regulators, the rather abstruse debate among economists concerning different methods to affect price involves more than a matter of philosophy. The migration from regulation to competition requires workable competition in order to protect consumers in the delivery of essential services. It is important that a regulator entrusted with public goals has the ability to monitor and implement regulatory process to effect publicly desirable results when market failure occurs.

- National goals do not fit neatly into competition policy analysis. It is all well and good to theorize on a basis of competition economics that prices will eventually fall to enable network access. The real question is whether there is a higher societal cost associated with the denial of access while we are waiting for competition policy doctrine to do its stuff. One commentator has objected to reliance upon competition law to regulate telecommunications policy as follows:

  "Competition law is a blunt instrument, mainly designed for manufactured goods, such as toothpaste, cameras and gasoline, where many companies compete. To the contrary, communications is a public utility, an essential infrastructure, where a range of economic, social cultural and political objectives must be satisfied."

III. CONCLUSIONS

I do not intend that the message of this paper to be that the increasing reliance upon market forces to deliver new communications technologies is a mistaken policy. The difficulty is that there is considerable, and sometimes, intentionally generated confusion about what a competitive model of telecommunications governance can deliver and what it can't. While the new technologies, particularly in wireless fields, hold the potential of being able to engender enormous cost efficiencies in the maintenance of universal networks, competitive providers will implement these technologies to maximize returns without the presence of protections to ensure public access and other desirable national goals.

In Canada, we have been able to effect significant inroads in broadening access to new technologies by negotiating with providers of new wireless technologies to "set aside" for public lanes in which access by non-commercial providers of communications content are assured. This strategy represents a symbiotic confluence of competition policy and the national goals of access that is preferable to the simplistic call to obliterate telecommunications regulators.

As well, critical governmental choices loom on the horizon as the principal providers of telecommunications services evolve from their heretofore paternalistic roles as the monopoly trustees of the national interest, to market participants with a steadfast devotion to shareholder expectations. The current policy solution that seems to be provided by these transformed companies, is that any vestige of their former public interest role should be provided and funded by national governments.

However, most governments find themselves in a position where there is fierce competition for their scarce resources. Before wholly embracing the chief tenets of the competitive model elaborated above, we would suggest that government policymakers may wish to ensure that there is a regulatory framework in place that can satisfy public goals without the necessity for extensive public subsidization.

Return to Top View Full-screen

Organizational Adaptation

Under Privatization and Liberalization

Abdul Rauf Parker and Stefan Weigand

Corporate Planning, Qatar Public Telecom Corporation, Qatar

Strategy & Organisation Group, Detecon Gmbtt, Germany

ABSTRACT

The paper proposes a framework through which monopolistic organisations undergoing privatisation and liberalisation can formulate strategic actions in order to adapt their organisations to the new competitive environment.

The framework is based on two key factors – the degree of privatisation and the degree of competition. The framework was tested on a number of telecommunications organisations (telcos), which have undergone change or are in the process of undergoing change.

The major findings of the study are that the degree of privatisation requires strong process oriented efforts whereas the degree of competition requires strong marketing oriented efforts. For State Owned Enterprises (SOEs) undergoing changes will require a combination of both process as well as marketing oriented efforts.

View Full Text

ORGANISATIONAL ADAPTATION UNDER PRIVATISATION AND LIBERALISATION

I. INTRODUCTION

The world of telecommunications has been changing dramatically during the last ten years and likewise it will change in the near future. Technological developments such as digitalization and satellite technologies are only one aspect of this change.

There is a global trend whereby the regulatory framework is driving state-owned telcos into the hands of private shareholders while simultaneously home markets are being opened in order to allow competition. Telcos in many countries nowadays have competition in at least some areas and some of them also have private shareholders.

The deregulation of the telecommunications industry is an essential mandate of the World Trade Organisation (WTO) under its Basic Agreement Telecommunications.

How Telcos operating under a monopolistic regime adapt to the new environment is one of the key questions addressed in this paper.

II. GLOBAL TRENDS IN THE TELECOMMUNICATIONS INDUSTRY:

As the world develops towards a liberal telecommunications policy, international organisations like WTO and ITU support this development and only a few countries like Cuba or North Korea believe they can afford not to join this movement. And even in those countries that resist the liberalisation trend, new developments like call-back exert an external competitive impact, in that they are forcing governments to rebalance their tariffs.

In this paper we intend to demonstrate the impact of privatisation and liberalisation on corporate policy. In order to make the organisational changes more illustrative, we have chosen two examples of incumbent carriers that are at different stages in the privatisation and liberalisation process: Deutsche Telekom in Germany, and Q-TEL in Qatar.

In Germany Deutsche Telekom is in competition in all areas of business and a part of its shares is available on the stock market. Until as recently as 1988, telecommunications in Germany was within the overall responsibility of Deutsche Bundespost, the national post and telecommunications monopolist. This monopoly was based on laws dating from the end of the last century.

Of course a lot has happened between the end of the last century and the mid-eighties of this century, with tremendous developments on the technical side, the creation of digital and mobile services among many other examples. But what we have seen since the mid eighties has been a real quantum leap induced by the organisational change from a monopolistic state owned enterprise (SOE) into a privately (partially) owned competitive enterprise. Though there are different models and beliefs about the right approach on how to change a SOE into a company, the German example is typical of many others in Europe or other parts in this world.

Though we tend to regard these global developments as normal we should be aware of the enormous efforts required by SOEs as they move from a bureaucratic structure into competitive organisations. A deeper insight behind this development would provide us with insights into aspects of organisational changes needed and on corporate policies which have to be adjusted in order to drive towards privatisation and liberalisation.

It is clear that a deep understanding of the regulatory situation and its economic impacts and especially an understanding about how others behaved in specific situations is extremely helpful.

As we experienced that telcos in similar regulatory situations often have the same problems, it can be stated that telcos can learn from those who have already gone through this specific situation.

III. A MODEL FOR ORGANIZATIONAL CHANGE

The development that SOEs in all parts of the world are going through can illustratively be described on two dimensions:

- The degree of competition allowed, and
- The degree of privatisation.

Almost every country in the world has started its telecommunication activities with a state-owned monopolistic operator, in many cases a PTT (Posts, Telegraph and Telephone), a governmental agency usually under the control of a Ministry.

Over the past ten years traditional telcos have come under increasing pressure to change for a number of reasons namely:

1. The perception that competition and shareholders' influence leads to increasing productivity and more customer orientation (especially for incumbents)

2. The great investment required in developing the infrastructure, which the governments in developing countries are finding difficult to fund

3. Increase in the range of services being offered – fixed, mobile, etc. - which again one entity can not in most cases provide due to the high level of investment required

4. Pressure on international traffic due to technological developments such as call-back services and potentially "Voice over IP"

Though different countries have preferences whether first to privatise and then to allow competition or vice versa the overall trend is generally the same: SOEs are being privatised and they are put into competition with other operators.

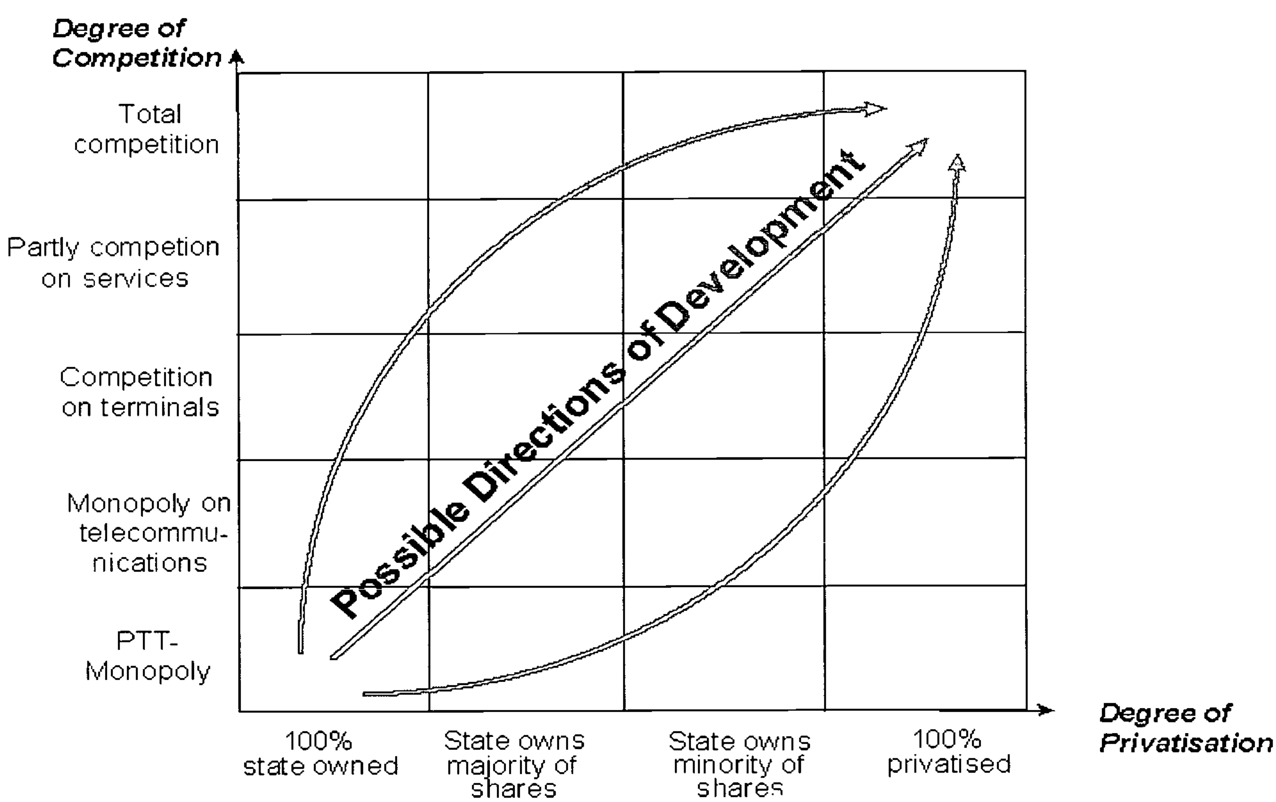


Figure 1: A Deregulation Model

What are the hurdles that SOEs have to be overcome? The answer is quite simple: there is simply a lot to do. And all the actions have to be well planned and professionally organized. The question remains: "What specific actions have to be taken in this transition?"

A simple example will help to answer this question: Being asked about the differences between a state-owned monopolistic PTT (bottom-left in Fig.1) and a fully privatized operator in competition (top-right in Fig. 1) the answer would probably be easy without even knowing these organisations.

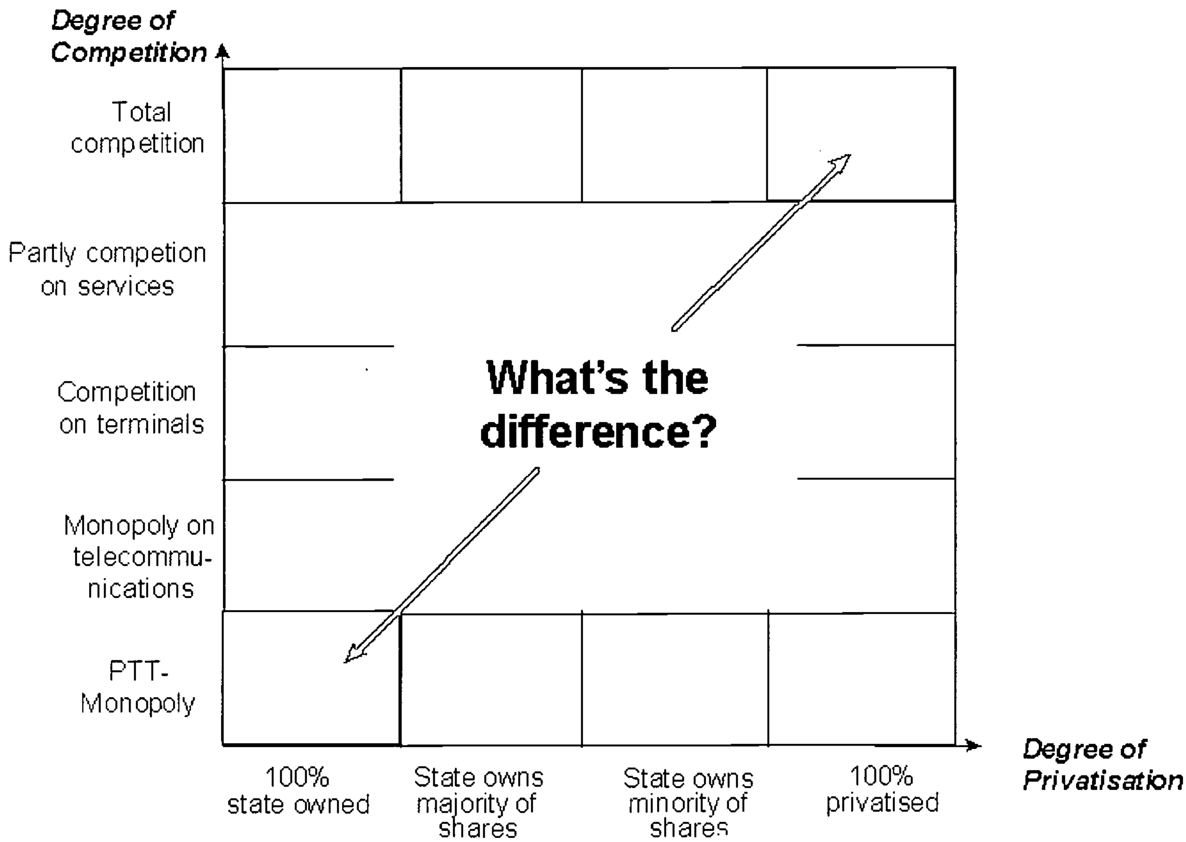


Figure 2: An Illustrative Comparison

Even disregarding technological aspects like network technology, we think that many areas of corporate policy are extremely different if a state-owned monopolist is compared with a private competitive company. These differences include:

- Pricing
- Organisational issues and productivity
- Customer care
- Customer segmentation

- Branding and image
- International policy
- Product design
- Distribution channels
- Human resources policy

This list could be extended endlessly. But we think that some major issues will be sufficient to explain what the main areas of effort will be on the road to liberalisation. In the following pages we try to explain the development from a state-owned monopolist to a private competitive company. In order to make this development more illustrative we would like to show examples wherever it is possible by concentrating on the following areas:

- Pricing policy
- Organisational issues
- Internationalization

IV. ORGANIZATIONAL CHANGE: EXAMPLES FOR DEVELOPMENTS IN SELECTED AREAS OF CORPORATE POLICY

The way from a state-owned monopolist to a private competitor is a long one. To give an example, if we watch the development of Deutsche Telekom, in Germany, it took eleven years to achieve full competition, and yet Deutsche Telekom is not fully privatized.

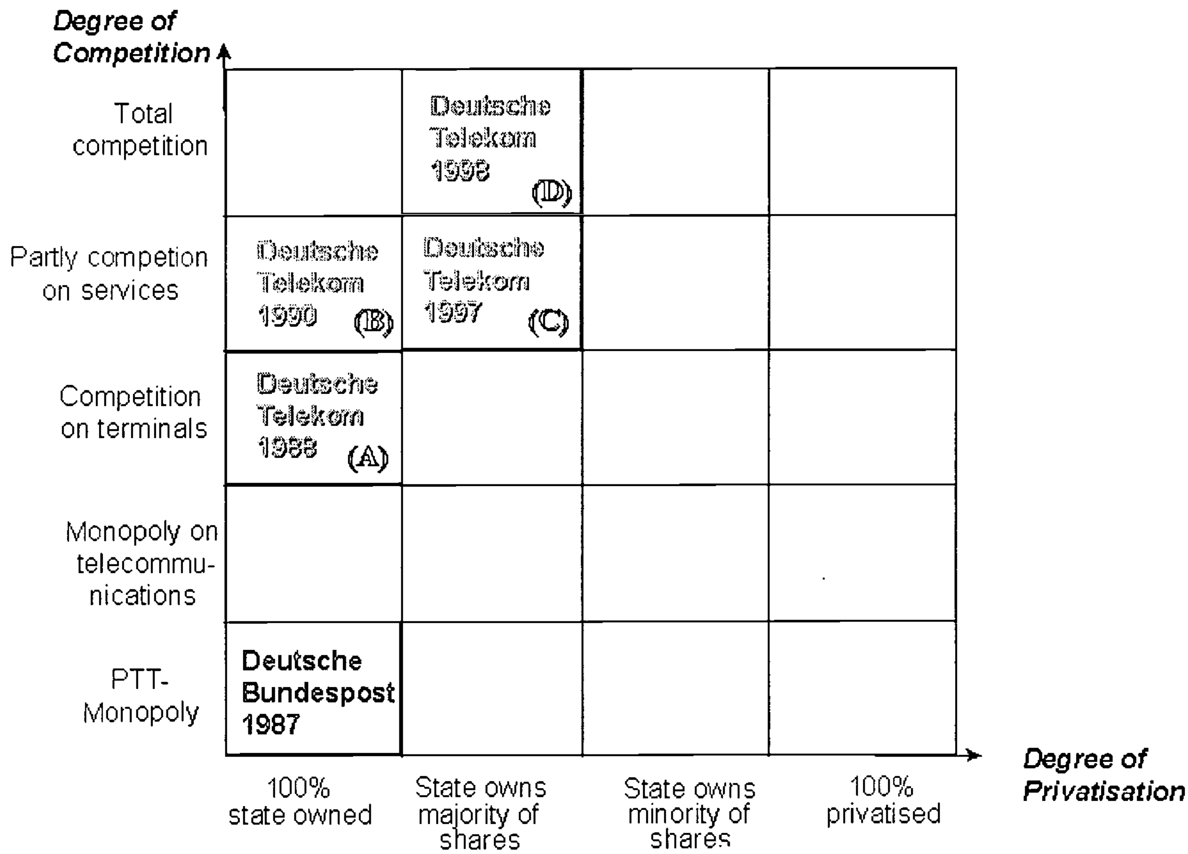


Figure 3: Deutsche Telekom's transition

This can be seen as quite a normal time frame for the transformation of any PTT in the western world. One reason for the long duration is obviously politically based; restructuring of the telecommunication sector depends on the political will of the government and on other political forces.

Though eleven years may appear be a rather long time, it was just long enough for Deutsche Telekom to prepare for competition and privatisation.

1. *Pricing Policy*

Competition is probably the most important driver of tariff reforms. Operators have to be able to compete effectively on prices. Dependence on high tariffs in one area (for example international calls or long distance calls) in order to finance other areas will not work under competition. The high-price area will be attacked by competitors.

Being put into competition immediately without taking any precautions would probably be a shock that many operators will not be able to survive. Having been dependent on high prices in one area of the tariff schedule, quick adaptions would collapse the whole system. Tariff re-balancing has to be done carefully, understood well and planned to the long term.

Comparing a private competitive company with a state-owned monopolist will usually show the following picture:

- Installation fees of a private competitive company are relatively low
- Local monthly fees are relatively high
- Local call charges are higher
- Domestic long-distance charges are lower
- International charges are lower

That's the general trend. The first six years during this decade showed that generally fixed charges rose and usage charges declined.

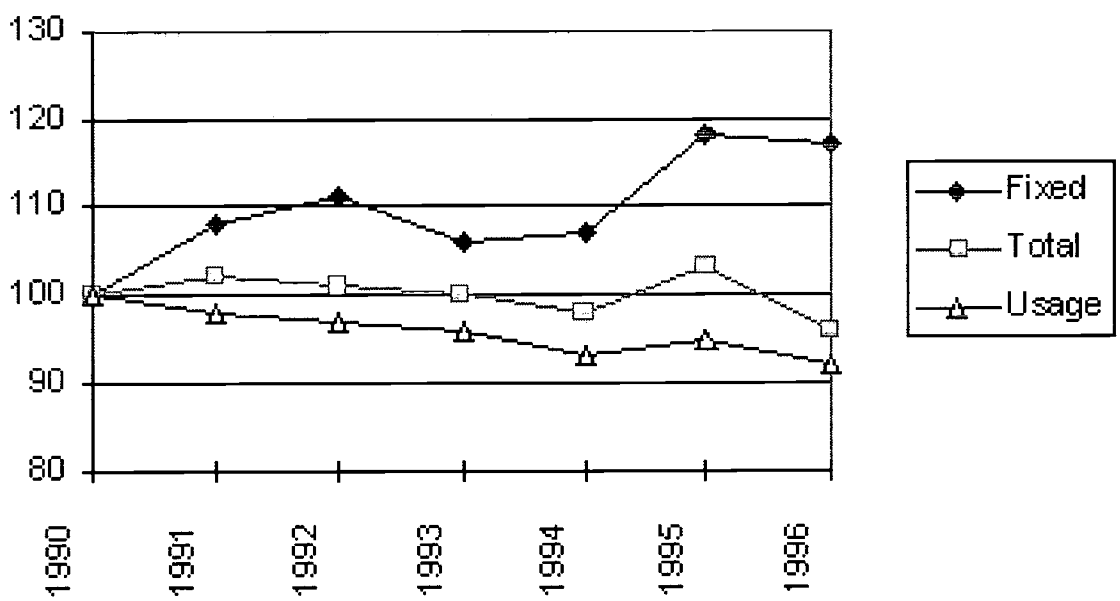


Figure 4: Tariff Development in OECD Countries

Though it's a general trend, it does not necessarily mean that each change in pricing on the way to competition and privatisation follows this particular pattern. Rather it depends on the starting point and on the specific regulatory framework.

Deutsche Telekom for example could afford to raise installation charges as there is still almost a *de facto* monopolistic structure in the access line market in Germany.

Tariff-Rebalancing at Deutsche Telekom (in Deutschmarks)			
	1990	1996	1998
Installation	65	100.87	100.87
Monthly rentals	27	24.82	24.82
regional peak (3 min.)	0.23	0.84	0.85
International peak (3 min.)	2.3	1.8	1.69

Figure 5: Incumbent's Tariff Development in Germany

Though the regulator allows full competition in all areas, real competition only takes place in the long distance market. More than a hundred fixed-line operators obtained a licence in Germany, most of them do not have their own network but operate based on extremely cheap interconnection prices and/or via long-distance leased lines and unbundled access to the local loop.

The regulatory framework in Germany is radical, which means friendly to the new operators. The possibility of operating a telco company without its own network by using the Deutsche Telekom's infrastructure leads to hard price rebates of usage fees. Some operators offer up to 50% discounts on long distance calls.

The residential and SME markets are especially attracted by these special offers. In the first half year after the introduction of competition about 11% of Deutsche Telekom's revenues went to the new operators.

Within a few months of competition one can distinguish clearly who is successful in the market and who isn't. The rule of success in the mass market is just *"keep it simple to the customer"*: Those operators that offered long-distance telephony without any contract, just by dialing a prefix number made about three quarters of all new operators' revenues. The customers got their bills via Deutsche Telekom (Third-Party-Billing).

The German example shows that especially those customers who are very price sensitive are an attractive target group for new "discount operators". Though liberalisation was radical, Deutsche Telekom was well prepared, as re-balancing of tariffs had begun early and it had started from a realistic base.

Coming back to the liberalization-model, we'd like to demonstrate the challenges for SOEs in Asia or the Middle East, that are quite far away from this mode of competition.

Taking an example from a different part of the world, the Arabian Gulf, we find a situation that is completely different from that of Western European countries. In this area local calls are not usage charged, whereas international calls are relatively high, the whole tariff system is far from being cost-based.

The problem with these operators is that their total turnover depends on one cash-cow: international telephony that makes in some cases about 65% of the operators revenues.

Immediate competition in international telephony would collapse the companies concerned. As local calls are free, competitors could have free access to the customer. Given the potential fall-out this scenario is not likely to happen.

Managers of operators in this situation generally understand that prices for international calls have to be lowered, and experience shows that this does not necessarily lead to revenues losses, dependent on price-elasticity. The experience of Q-Tel, was that reducing rates on average by 30% leads to an increase of 25% in traffic.

But still, the problem will not be solved by just lowering international tariffs. The dependence on one cash-cow will remain. Introducing local call charges, an economically wise exercise, is often a politically touchy issue and difficult to explain to the customers. Their perception is not based on cost based pricing but on the present situation and on the deviation from it. Any negative change will result in negative reactions, but over the long-term there is no alternative. The major issue is how to convince the customer. Tariff re-balancing also means making tariff structures more understandable. It requires information and education as well.

From the above discussion we can see that prices and products are highly inter-linked, that is changing price-relations has a deep impact on the makeup of the product portfolio. In some cases products are nothing but a specific pricing policy. Telcos which have been in competition for a long time tend to invent price-based product packages such as "friends-and-family".

In the case of the Arabian Gulf States, tariff re-balancing is a must, but still a difficult political issue and additionally not sufficient to make the SOEs in these states competitive in the international arena. This is because the countries are comparatively small and most of the population (over 80% in some cases) is concentrated in one city. Furthermore there is a large expatriate labour force, who account for over 90% of the international call revenues. As such national call revenues will never be sufficient in order to create a well-balanced portfolio, as there are no domestic long distance call revenues.

Joint ventures or strategic alliances between these carriers could be a step into the right direction; thus telecommunications business will get more importance in this region.

Even this rough view of pricing policy shows how difficult it would be to introduce competition in these countries and how deeply corporate decisions are inter-linked.

2. *Organisational Issues*

The pricing example showed how difficult and time-costing the way towards privatisation and competition is. But pricing is only one issue. Obviously changes in the organisational area are necessary as well.

Let's begin with the two extremes again. The SOE has usually a bureaucratic and not a customer oriented structure. It is mainly driven from the technical side, whereas the private competitive operator divides its company into business units that are extremely flexible and market driven.

Monopolists often have a functional structure and a governmental culture: departments are not related to products or customer segments but to internal requirements, or have been formed for internal political reasons. Changing these organisational circumstances means completely changing the culture of the entire organisation, of the departments, and of each employee. It cannot be expected that employees who have been embedded in a bureaucratic and governmental structure will have the skills and capabilities to service customers and products within a short time frame. Also in this field of organisational restructuring, changes take time and hurdles of resistance have to be overcome.

Let's take the German example again. In 1988, when Deutsche Telekom was separated out of the former PTT (Deutsche Bundespost), it had a product oriented structure: departments were divided into voice services, data services and overhead functions (technical, marketing and administrative). Responsibility for customer segments was not existing. Pushing basic products into the market was the focus of the company.

Competition, introduced in 1990 in certain areas (data and mobile services) was the major driver of structural change. As new competitors emerged focussing on attractive customer groups, a customer oriented structure was a necessary answer for Deutsche Telekom. In 1993 profit centres concentrating on residential customers, corporate customers and key accounts were introduced. The mobile business was separated in a new subsidiary, DeTeMobil.

In addition to the restructuring at the headquarter level, regional offices were restructured as well. Being "more close to the customer" was the maxim of all these efforts. Experience showed that restructuring is something that cannot be done quickly; rather it is a long lasting process that requires adaptation in many other areas of the organisation. Being quick is not the major precondition for a success story; it is more important to know the direction of organisational change and allow for human resources development and adaptations in all areas.

The general trend in reorganisation on the road to privatisation and competition is the following one: SOEs have usually started with a functional structure; the restructuring then usually goes towards a product oriented structure in a first phase and a customer-oriented structure in a second phase. International business units are the next step. Comparing a SOE that has recently been faced with competition - Deutsche Telekom - with one that is still in a monopolistic situation - Q-TEL, the SOE in the Arabian Gulf State of Qatar - shows that the company in competition has already gone through several structural reforms, whereas the monopolist is still at the beginning of its journey. Yet, the direction of both appears to be the same.

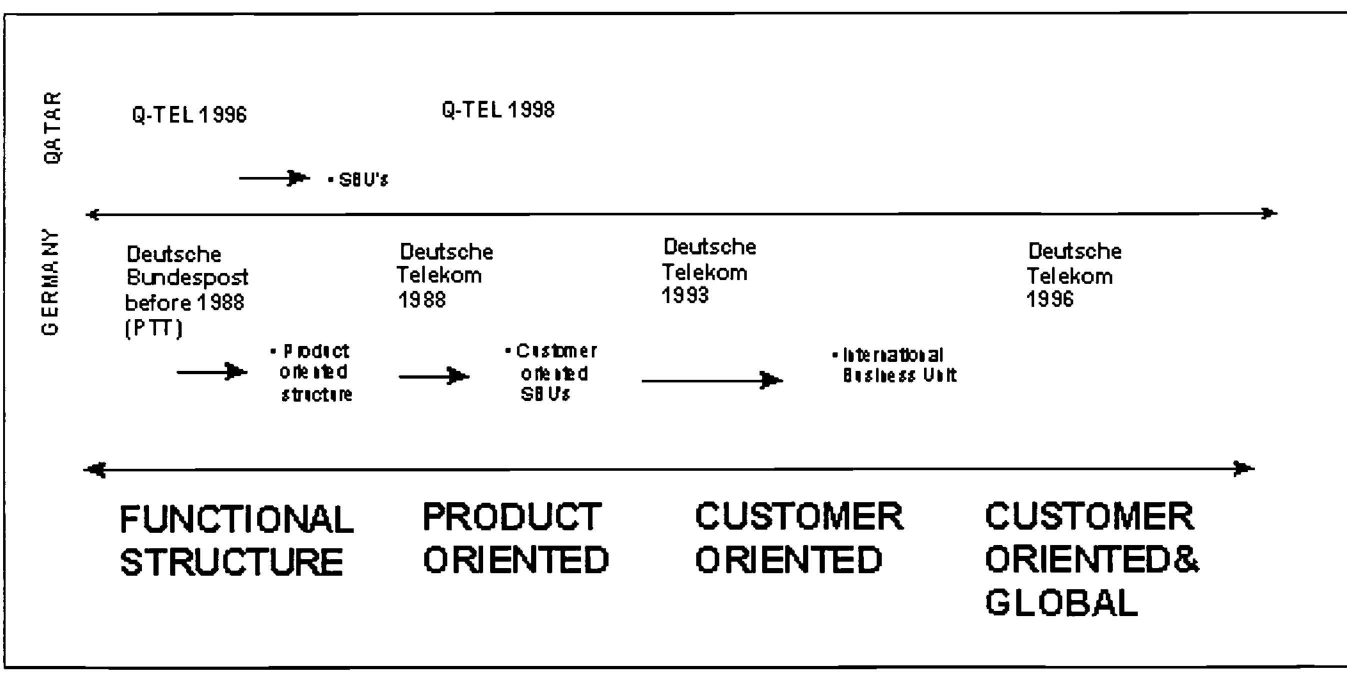


Figure 6: Organisational Development in Two Different Countries

Reorganisation usually leads to improvements in productivity as well. Competition with its pressure on costs on the one hand, and privatisation with the shareholders' intention to maximize the profit of their shares on the other hand, requires a streamlined organisation. In fact, the German example illustrates this in that productivity has risen intensively during the last five years: The total number of employees has declined, whereas the number of telecommunication main lines has risen.

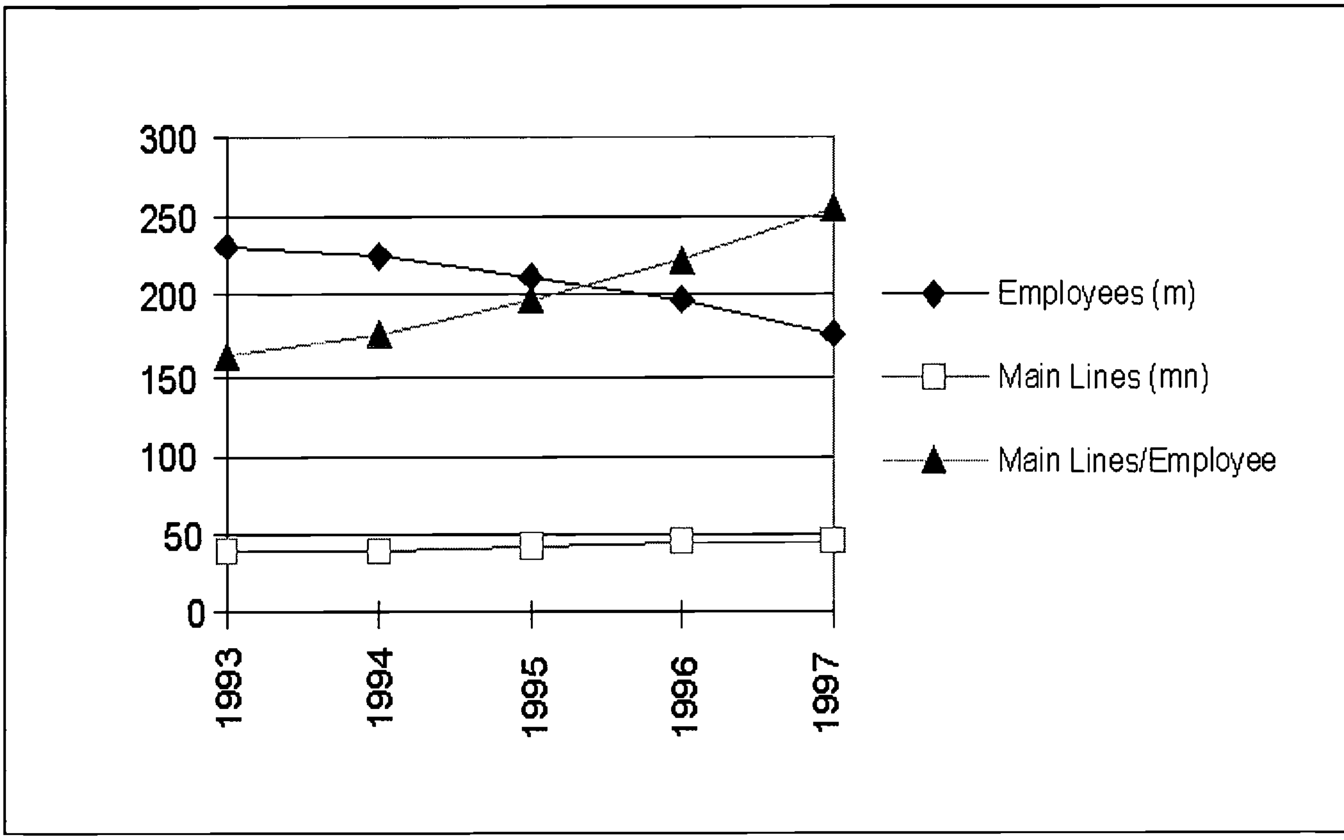


Figure 7: Productivity Development of Deutsche Telekom

3. *International Policy*

Telecommunications is more and more becoming a global business. About ten years ago almost none of the biggest telecom operators in the world had any significant international activities. During the monopolistic times telcos were only active on their home markets. Nowadays there is no telecom operator in the western world that is not integrated into some form of either international alliances or joint ventures. As revenues and gross margins decline due to competition on the home markets, other sources have to be discovered.

Getting international is another milestone on the way to privatisation and competition. Let's take the German example again: An initial step on the way to globalisation was the foundation of the Global One in 1995, a joint venture between Sprint of USA , France Telecom and Deutsche Telekom, that strengthened the company's position in the global telecommunications market.

Since then three different types of international activities have emerged:

1. Purchase of shares of existing operators:

    - In December 1995, Deutsche Telekom and Ameritec jointly acquired a majority interest in MATAV, the Hungarian incumbent

    - In April 1995 Deutsche Telekom bought a 25% share in SATELINDO, Indonesia's GSM operator with additional licenses for international telephony and satellite communication

    - In October 1996 Deutsche Telekom acquired a 22% share in Technology Resources Berhad (TRI), which ownes the leading mobile operator in Malaysia with additional licenses for national and international fixed line telephony and value added serviceS

    - Deutsche Telekom has a 10,42% share in Islacom, which is both a mobile operator and a regional fixed line operator in the Philippines

    - Deutsche Telekom has a 10% share in SPRINT

2. Foundation of new joint venture companies together with a national infrastructure (electricity) company:

    - In November 1997 Deutsche Telekom, together with France Telekom and the Italian energy monopolist ENEL, founded a full service telecom operator in Italy, named WIND.

3. Foundation of new joint venture companies without a national partner:

    - Deutsche Telekom (50%) and France Telecom (50%) founded a fixed line operator "Multilink" in Switzerland in 1998

So far a final assessment cannot be given in order to explain which kind of international activity is likely to be the most successful. But experience shows that it is very difficult to build up new joint venture companies together with foreign partners.

For example, it took more than one year between the shareholder- agreement and the launch of the Italian joint venture WIND. If time is a key success factor in this area, the first solution (purchasing of shares) is likely to have advantages in comparison to the others.

As it happens most of Deutsche Telekom 's international activities fall under the first category.

Also in this section we'd like to take an example of an operator that has not gone very far on the road to privatisation and competition. Q-TEL, the Telecom operator in Qatar does not have international activities that are comparable to those of Deutsche Telekom of course. But still, one international activity has emerged so far: Q-TEL is one of the major and founding shareholder in the mobile satellite services operator, THURAYA. This joint-venture company has a coverage over an area of 1.8 billion inhabitants, mostly in regions with a low teledensity covering the Middle East and Asia. Q-Tel has also invested in another mobile satellite services Operator I-CO. This clearly indicates its intention to follow the trend which is common to recently privatised telecommunications operators.

V. IMPLICATIONS FOR SOEs

What is the message of our explanations? We have tried to show that there is a global trend in telecommunications - the privatisation and competition trend. SOEs on their way towards liberalisation have to follow some common principles. We have shown using three examples that prices have to be re-balanced, organisations have to be restructured and international markets to be entered either through joint ventures or strategic alliances or equity acquisition.

The more liberalised a SOE's market is, the more developed will be its corporate policy on these specific areas.

It is quite obvious that the way towards competition and liberalisation is extremely difficult as several projects have to be conducted in parallel, and many of these projects lead to enormous resistance on both sides - the customers and the employees.

Resistance is often based on a lack of understanding the necessity of the actions. Therefore communication is one of the basic elements that helps to improve the probability of success. As changes are radical, everyone who is involved should be well informed about the reasons and the consequences of any action. Managers have to be communicators.

Communication is one precondition of success, another important issue is planning. Though we showed only a rough insight into three specific areas, in reality many more areas have to be transformed in parallel. Competition requires new products, new company image, clearly defined customer segments, new career development opportunities and many other things more.

Organisational change towards competition and privatisation requires a complex package of projects that have to be well organized and co-ordinated. Mis-management will let the privatisation and liberalisation process fizzle.

We believe that it is not a good idea to wait until the regulatory framework changes. It is much better to make an early start to corporate development in the direction we have shown and to plan all the necessary steps. A high-level master plan will help to manage and co-ordinate all the individual projects, in order that each step goes into the right direction.

Moving towards competition requires market/customer oriented changes to take place whereas moving towards privatisation requires process changes to take place. Our findings are that a combination of the two changes has to take place simultaneously if the SOE is to be successful in the new industry environment. The degree of which process has more dominance will depend on the government's intentions or timetable for allowing competition and the speed at which privatisation is to be achieved.

VI. REFERENCES

1. Economist Intelligence, *Country Reports,* Unit, 1998

2. Deutsche Telekom *Annual Reports* 1995 –1998

3. ITU, *World Telecommunications Development Report,* ITU, Geneva 1998 and 1995.

4. Q-Tel *Annual Reports* 1995 - 1998

5. WTO, *Basic Telecommunications Agreement,* WTO, Geneva, 1995.

Return to Top View Full-screen

The Information Policy Maze

Dianne Northfield and John Burke

Centre for International Research

on Communication and Information Technologies, Australia

ABSTRACT

Nations across the world are joining the race to 'be online'. In doing so, they are confronted by issues and stakes which are global in character. While broad objectives are similar – to reap political, social and economic benefits – nations diverge over decisions on which path or directions to take. As the title of this paper reflects, the development, implementation and outcomes of national information and communication policies presents a maze of issues, options and unexpected turns for all stakeholders involved. This paper compares national information strategies and competition and regulatory environments. It identifies issues which remain unresolved and areas of continuing controversy between different stakeholders, while yielding some common lessons for nations reviewing their policies.

This paper derives from a project conducted jointly by the Centre for International Research on Communication and Information Technologies (CIRCIT), RMIT University Australia, and the Program on Information Resources Policy (PIRP), Harvard University, United States. Since June 1996 the project has drawn on the experience of active participants from government, industry, academic and community sectors across the world. We have focused on the Australian and United States environments, with reference to other countries where relevant. In particular, developments in the United Kingdom, Canada, the European Union, and Japan have been examined. Other issues examined as part of this project relate to: the boundaries and opportunities of industry self-regulation; access regimes; and information and communication services industry development.

View Full Text

The Information Policy Maze

I. INTRODUCTION

A wave of change, possibly permanent ongoing change, has hit the world's national information systems – destroying their isolation. Global trends, including market liberalisation, technological developments, so called convergence and the growing interdependence of the world economy, are forcing nations to reconsider information policies and strategies. Key issues relate to the objectives of national strategies and the nature, management and expected outcomes of competition policies. Appropriate roles for government, the communications industry, business sectors and community stakeholders are also under constant examination.

Nations are responding to issues in information and communication services (ICS) development in unique ways, conditioned by different national priorities and economic, political, social and cultural circumstances. Country size, population and geography, and different levels of infrastructure and service development are also influencing the adoption of different strategies. No one 'model' is therefore transferable from one country to another, nor is it clear that traditional policy approaches will be adequate or appropriate in the emerging environment. Despite differences in approach however, nations are essentially dealing with a similar set of issues. Reviewing national experiences therefore provides some guidance and signposts through the policy development maze.

II. APPROACHES TO NAVIGATING THE MAZE -- NATIONAL INFORMATION AND COMMUNICATION SERVICES STRATEGIES

In the 1990s many developed and developing nations have articulated a 'vision' for economic and social development based on the deployment and use of ICS. However, national strategies remain largely unrealised, and as original projections and expectations have been revised, questioning of the role and value of visionary statements has increased. Despite this, many stakeholders see the existence of a statement of national purpose and the identification of leaders, as important ingredients in galvanising national approaches and providing at least a basis of guidance for different stakeholder activities.

The level of detail in these statements varies. Broad principles are articulated in the United States (US), Canadian and Australian cases. In Europe, there is a focus on pilot projects and specific applications developments, while the setting of target dates and investment projections is seen in the statements of a number of countries in East Asia. National approaches also vary in the extent to which infrastructure and/or services development and competition are supported. For example, infrastructure competition, leading to competition in services is the cornerstone of the United Kingdom's (UK) policy. The focus in the US is more on competition in services, while in Singapore, the promotion of competition in either infrastructure of services is not a centrepiece of policy.

Linkages between ICS policies and broader national policies also vary significantly. In the US, communications policy is explicitly tied with social policy objectives, matched with programs targeting deployment and use of ICS in the community and in educational and health settings. In the UK, communications policy is directly tied to regional development objectives. Japan's approach is based on communications development as a key element in redressing national economic downturn and supporting local ICS industry development. In Canada, communications policy explicitly targets local content development and the maintenance of cultural integrity. Singapore's model is based on long-term strategic planning and government direction and involvement. In Australia, the link between communications policies and broader national policies and strategies has been more nebulous, a situation which has attracted growing criticism.

In the late 1990s, revisions to national strategies have seen a global directional change with many nations focusing on the Internet and the promotion of service and application developments. For example, the 1993 US National Information Infrastructure (NII) statement envisaged nationwide broadband networks and services which would be widely available. By 1998 the focus has shifted to the Internet as the backbone of the US's future communications infrastructure. Japan too has moved from an emphasis on infrastructure competition to Internet use and the development of multimedia applications. Australia's focus is on the Internet and the promotion of electronic commerce.

The stated priorities of different nations are summarised in the following table.

Table 1: Key Ingredients of National Information and Communication Services Strategies

Country	Stated Priorities	Comments
Australia Information Economy Online Services Strategy	Online services development and use economy wide. Electronic commerce. Government use of ICS. Emphasis on industry self-regulation.	Dual infrastructure development to 1997. Focus from 1 July 1997 on service provider competition. Coordination of policies through National Office for the Information Economy established in 1997. One third of national carrier privatised in 1997.

United States Information Superhighway	Services and applications development. Specific principles relate to universal service and connection of health and educational institutions.	Shift from a vision of national interconnected broadband networks, to a focus on the Internet as backbone network. Largely market driven, some government funding particularly of research and development (R&D).
Canada Information Highway	Modernise existing infrastructure. Emphasis on promoting Canadian culture, content and access. Internet as central backbone. Recognition of importance of benchmarking.	Primarily market driven approach, with significant government facilitation of R&D. Information highway development explicitly linked with introduction of competition across ICS sectors.
European Union Information Society	Network interoperability and infrastructure development across Europe. Examination of social implications of ICS. Focus on pilot projects and promotion of collaborative, cross-border research programs.	Introduction of competition to ICS markets represents core policy approach. Promotion of cross-border R&D.
United Kingdom Information Society	Infrastructure competition. Strong link between ICS development and economic, particularly regional, development.	Long standing model of infrastructure competition. Cable infrastructure forms basis of nationwide broadband network development.
France	Infrastructure development based on fibre optic rollout. Redress low cable penetration and infrastructure limitations which impede service deployment.	Significant government direction. France Telecom key role in fibre cable roll out and conduct of broadband trials.

Singapore Intelligent Island	Infrastructure to enable service and applications developments. Attraction of transnational value-added activities onshore. Focus on target projects and trials. Agenda includes target dates for fibre optic network developments and investment projections.	Strong government role based on long-term planning and Singapore Telecom as a key player. Introduction of competition not central. Service developments focus on government applications.
Japan Informatization of society Info-communications infrastructure	Infrastructure development via introduction of competition. Aims to redress economic downturn, reduce urban concentration, and reenergise local ICS industry. Focus on broadband rollout, government funding of R&D and trials.	Policy agenda has centred on restructuring of Nippon Telephone and Telegraph throughout the 1990s. Late 1990s, emphasis on infrastructure development shifts to focus on Internet and multimedia service developments.
Korea Informatization	Infrastructure development based on two networks - public and private. Strategy includes target dates for network developments and funding projections.	Agenda influenced by strong business interests and different bureaucratic agendas. Late 1990s focus shifts to Internet as backbone of network development.
Malaysia Information-rich society	ICS policies part of broader modernisation program. Centrepiece - Multimedia Supercorridor infrastructure development as a platform for applications developments.	High profile agenda with strong Prime Ministerial support, attracting significant global attention.

Source: CIRCIT at RMIT and Program on Information and Resources Policy, 1998.

III. CHALLENGES IN IMPLEMENTING NATIONAL STRATEGIES

Adjustments and revisions of national strategies have been influenced by many factors which have affected most nations in varying degrees. Most countries are dealing with conflicts in seeking to achieve multiple policy objectives – political, economic, social and cultural. A related issue is balancing trade-offs between sector specific, national and international policies and programs.

Jurisdictional conflicts between the priorities and strategies of federal and state governments are witnessed in the US and Canada, while competing bureaucratic agendas, as seen in Japan and Korea, are also influencing the achievement of national strategies. Though not directly relevant to nations such as Australia where communications policy rests with the federal government, the attempts of these countries to develop a more unified and coordinated national approach to ICS development, deployment and use are informative. This is so in that Australia, like many nations, retains responsibilities for different aspects of ICS development across multiple departments and agencies at federal and state government levels. On the other hand, the potential conflict between centralised government control of ICS development and the widespread use of a diversity of ICS presents itself in countries including Singapore and Germany where issues of content control and censorship are central.

All nations are dealing with issues in relation to the regulatory treatment of different ICS markets, players and services. Rapid technological developments and so called convergence have led to questioning of the relevance and effectiveness of asymmetrical regulation, often a central strategy of promoting competition. Alternatively, when is competition healthy enough to warrant a move to symmetrical regulation?

Further 'common' issues influencing the achievement of national strategies include:

- Uneven network development and a lack of interoperability within nations, as in the US, and across different countries, as seen in Europe
- Impediments to new service developments created by inadequate underlying infrastructure as experienced in France
- A lack of workable approaches for achieving an effective basis for collaborative and cooperative activities within and between the public and private sectors
- Inadequate sources of funding for infrastructure and service developments
- Unpredictable and largely unmeasured demand with a lack of appropriate data on national and global levels
- Unclear indicators of success' and assessment of outcomes in relation to economic, political, social and cultural objectives and referenced against different stakeholder expectations.

IV. ATTEMPTS TO PROGRESS THROUGH THE MAZE -- THE ROLE OF COMPETITION POLICIES AND REGULATIONS

Partly in response to such challenges, and following global liberalisation trends and pressures to open markets to foreign entrants and trade, a growing number of nations have embraced competition to apply to information and communication industries since the mid-1980s. In many cases, the development or extension of complex regulatory structures and arrangements has accompanied the introduction of competition.

There has been a trend of embracing generic competition policies and associated regulation to apply across economic sectors. Regulators in many countries are instead relying on generic competition policy, fair trading principles and ownership regulation to administer competition policies. However, there remains considerable diversity in the extent to which competition regimes apply to different economic sectors, to public and private sector organisations, and in relation to the level and nature of exemptions which apply. Moreover, individual legislation or industry specific provisions, including elements of competition policy, continue to apply to different ICS sectors in most countries.

Asymmetrical regulatory treatment of different ICS sectors and players is prevalent globally, with individual legislation or industry specific provisions, applying to different sectors in most nations. With the growing 'convergence' of technologies, markets and industry players, the relevance and effectiveness of asymmetrical regulation (often a central strategy for promoting competition) are being questioned.

In 1996, the Australian Productivity Commission presented a useful summary of different national approaches to the enforcement of competition policy, noting that:

> *"Australia, the EU and Japan focus their enforcement efforts on the conduct of firms whereas the US and South Korea are more concerned about industry structure...Australia, Canada and the US have adopted a strict approach to all price agreements whereas the EU, Japan, South Korea and Taiwan tend to allow more exemptions for such agreements. There are also differences among countries in how they consider the use of market power. Countries in the Asian region have the weakest enforcement among the jurisdictions examined in this report. Exemptions, especially for cartels, are relatively common in Japan, South Korea and Taiwan. The Asian countries also have weaker enforcement where foreign trade is concerned as both import and export cartels are permitted in many of these countries...Countries also differ in their willingness to pursue extraterritorial cases."*

Predominant amongst regulatory mechanisms supporting the development of competition and the curtailment of abuses of monopoly power have been:

- ***Regulation of vertical and horizontal agreements between firms*** through formal prohibitions or restrictions on: price fixing; resale price maintenance; exclusive dealing; refusal to deal; and tying arrangements
- ***Control of mergers and acquisitions/ownership regulation***, based on tests of

player dominance or substantial lessening of competition. In many countries provisions are included for the different treatment of foreign entities. In determining the impact of merger activities, regulators will generally consider the existing industry structure, the local-foreign mix, the degree of import competition, barriers to entry, implications for pricing, market concentration, and the extent of available substitutes

- ***Tests of misuse of market power***, based on tools to define relevant markets and to measure substantial degrees of market power and misuse of power
- ***Regulation of the horizontal and/or vertical integration activities of individual firms*** through tools such as restrictions on market entry and lines of business ownership regulation.

Vertical and horizontal integration in and of themselves are not necessarily deleterious to competition. However, concerns arise when such activity combines with market dominance. On the one hand, vertical integration can lead to economies of scale and scope with the potential to provide beneficial economic and social outcomes. Alternatively, it can provide a mechanism for dominant players to stifle competition by raising barriers to entry through means such as access bottlenecks and the application of inequitable pricing structures.

The key for regulators is determining where vertical integration promotes or impedes the development of effective competition:

> *"There is a need to ensure that the special characteristics* of telecommunication *infrastructure and service provision are adequately reflected in the 'rules of the game' which govern future investment trajectories...regulation will continue to be needed in order to ensure that competition does not 'tip' the balance between benefits and disbenefits in favour of the latter for any of the interested parties. The priority is to establish which tools of regulation are required to optimize...efficiencies..."*

The development of Pay TV services in Australia, where the content and carriage of cable services were exclusively held by the two general carriers until June 1997, provides an example of government policy supporting a degree of vertical integration for a transitional period. This was been justified on the basis of: promoting infrastructure and services development; maintaining incentives for incumbent investment; allowing the second licensed general carrier to establish sustainable market presence; and promoting access to broadband cable networks. Limited channel capacity, pre-digitalisation, was also an important determinant of the regulator, the Australian Telecommunication Authority's (AUSTEL) support of a Pay Television duopoly to 1997.

In the emerging ICS environment, decisions to intervene or forbear are highly problematic and will arguably occupy significant regulatory time and resources and will require a high level of regulatory expertise in relation to ICS industry structures and issues:

"Unlike in the past, where market power was typically vested in the exclusive control over facilities and monopoly provision of services, market power in the new framework is more likely to be based (on) market dominance through vertical and horizontal integration across facilities, services and content. Such market power may be supported by proprietary software and protocols needed to operate the network and services...These forms of market power may be much more difficult to control than traditional monopolies and the instruments of regulation are not well suited to cope with the issue."

V. A SUMMARY OF NATIONAL COMPETITION MODELS

National approaches to introducing competition to ICS sectors are summarised below.

1. *Australia*

A transitional model seeking to extend competition policies across economic sectors and public and private organisations. The focus is on influencing efficient firm behaviour and on reducing barriers to market entry. The *1997 Telecommunications Act* is designed to open the market to 'full competition'. The Australian Competition and Consumer Commission has been vested with broad investigatory and enforcement powers in dealing with anti-competitive conduct issues. There is also a preference for industry based dispute resolution where possible, avoiding recourse to judicial proceedings. Industry specific regulations continue to apply to the communications sector, under the responsibility of the Australian Communications Authority. One third of Australia's national carrier, Telstra, was privatised in 1997.

2. *New Zealand*

Application of generic competition policies across economic sectors, including telecommunications, and non-discriminatory treatment of public and private sector organisations. Limited provisions for industry developed principles apply, and there is not a comprehensive statutory regime in relation to access to essential facilities. This has led to reliance on judicial mechanisms which have been instrumental in influencing the level and nature of competition which has developed.

3. *United States*

Pursuit of an ideological commitment to the introduction of competition has been accompanied by an increasingly complex and comprehensive regulatory regime. Stringent anti-trust laws have shaped a highly prohibitive and prescriptive model, with few exemptions from the purvey of competition regulation. The focus of regulation has been to influence the development of competition through structural industry change, exemplified in the forced divestiture of AT&T. In this context, legal rather than legislative decisions have had a large influence on the shape of the competitive environment. Industry specific regulations continue to apply to the communications sector.

4. *Canada*

The development of competition has historically been driven by judicial response to actions brought by private organisations and by the initiatives of provincial and regional governments. There are limited formal exemptions from competition regulation, although regulators have exercised a significant degree of forbearance in relation to cartels and vertical integration activities, as evidenced in the treatment of Northern Telecom. Restrictions on foreign market entrants are rigidly enforced. Industry specific policies and regulation in relation to ICS have been maintained and Canada has adopted a transitional approach to the introduction of competition

5. *European Union*

Competition policies and regulatory mechanisms focus on Europe-wide harmonisation of economic policies and regulation. Regulations target the conduct of firms rather than forcing structural industry change. The European Commission (EC) has relied on providing guidance to member states, using the 'threat' of its enforcement powers to pressure European nations to liberalise markets. Broad exemptions apply in the interests of Europe-wide cooperation and collaboration.

6. *Germany*

Introduction of competition across economic sectors, including ICS, is the key approach. Government direction and involvement in economic development has been long-standing. Other priorities have been the modernisation of the East German communications infrastructure and the privatisation of Deutsch Telecom. Since 1996 responsibility for multimedia regulation has been divided between Federal and State government regulators.

7. *United Kingdom*

Regulatory powers are spread across the Monopolies and Mergers Commission (MMC), the Director General of Fair Trading, the Secretary of State for Trade and Industry, and individual utility regulators. MMC powers are limited in that it cannot initiate investigations. The Office of Telecommunications (OFTEL) powers are limited in terms of enforcement. The focus of competition policies has been on influencing firm behaviour. The primary tool of promoting competition in telecommunication has been carrier licence modifications. Rather than relying on legislative change, OFTEL is moving to develop a more consultative approach, to provide extensive guidelines to industry on how it will treat anti-competitive behaviour, and to increase its enforcement powers.

8. *Japan*

A focus on the development of limited and controlled competition. The enforcement of anti-competitive legislation is less stringent as evidenced in exemptions relating to cartels. Restrictive provisions apply to foreign market entrants. Telecommunications specific regulation has been maintained with the regulated introduction of competition to telecommunications linked explicitly to broader industrial development policies.

VI. CONCLUSIONS

The countries examined here have managed the introduction of competition to ICS in different ways. Common elements of these approaches are however identifiable. These include:

- A desire to reduce the role of government, both in terms of prescriptive policies and levels of public funding, in the development of ICS competition and in relation to industry development
- Greater examination of appropriate roles for government, industry and the community in ICS liberalisation and industry development
- A move to embrace generic competition policies applicable across economic sectors and to public and private organisations without discrimination
- Recognition of a continued role for regulation in controlling anti-competitive behaviour in ICS markets, notably through mechanisms of:
  - Regulation of vertical and horizontal agreements between firms;
  - Control of mergers and acquisitions/ownership regulation;
  - Tests of misuse of market power; and
  - Regulation of horizontal and/or vertical integration activities of individual firms;
  - A growing shift to case-by-case assessment of anti-competitive behaviour.

The implementation of competition policies globally has been accompanied by regulatory adjustment and complexity. Under these conditions ICS industries have been dramatically transformed, and in the process, this has influenced further regulatory change. This situation of ongoing change is likely to be with us for the foreseeable future.

Policy makers, regulators and industry players alike are confronted by a series of issues and questions with limited precedents to guide decision-making processes, creating the need for stakeholders to engage in attempts to perform 'balancing acts' across a range of issues. These include efforts to: integrate policies promoting competition in ICS with broader economic reform agendas; and to develop mechanisms to balance, and accommodate for, trade-offs between promoting competition in ICS and the pursuit of other political, social and economic objectives, including universal service and industry development.

High on the agenda of many nations is the examination of the appropriateness of maintaining asymmetrical regulatory arrangements applying to ICS sectors, including the extent to which (and why) principles of competitive parity and neutrality will be applied, recognising the cross-impacts of treating industry players differently. Balancing incentives and obligations on industry players which support the development of 'effective' competition, efficiency, innovation, and the achievement of benefits to end-users is a further challenge.

Whether nations are adjusting existing regimes or implementing new 'models', global experience indicates the value of seeking to clarify national objectives for ICS and their interrelatedness. Identification of overlaps and cross-impacts of different policies and programs should also benefit from efforts to differentiate and accommodate individual stakeholder positions and expectations. Meanwhile, nations are also recognising the importance of ongoing monitoring of both policy processes and outcomes.

This project has aimed to identify, prioritise and examine a range of global issues in relation to ICS policy and industry development. It has focussed on examining the basis and outcomes of decisions made relating to:

- The development, role and relevance of national ICS strategies
- The design and implementation of competition policies
- The appropriate extent of the role of regulators, and of regulatory intervention per se
- The role and scope of industry self-regulation bodies and process across ICS sectors
- Arrangements for interconnection and access to networks, facilities and services across old and new carriers, service providers, content developers and end users; and
- ICS industry development, particularly in relation to investment and innovation programs.

Nations have responded differently to these issues, and no one approach therefore represents a model to the rest of the world. Moreover, it not clear that traditional approaches are extendable to the changing ICS landscape. New issues are emerging, compounding the old, and policy and industry responses are likely to be neither immediate nor comprehensive. Despite differences in ideologies, aims, and approaches however, individual nations are essentially dealing with a similar set of issues, stakeholders and stakes, which are global in character. Examination of national experiences in dealing with issues in ICS development and use provides important lessons for nations examining the results of their approaches and a guide for nations reviewing their policies.

VII. REFERENCES

1. Bauer, J.M. and Wilsey, M.F. 1996, 'National and Supra-National Regulation of Cybernetworks and Telecommunications Carriers', Paper presented to Cybercomm II, C.I.T.I New York, 27 September. http://www.ctr.columbia.edu.vii/papers/citi.htm

2. Information Highway Advisory Council, 1997, *Preparing Canada for a Digital World: Final Report of the Information Highway Advisory Council*, Industry Canada, August.

3. Commission of European Communities (CEC). 1997, *Green Paper in the Convergence of the Telecommunications, Media and Information Technology Sectors, and the Implications for Regulation Towards an Information Society Approach*, COM (97) 623, Brussels, 3 December.

4. Information Policy Advisory Council (IPAC). 1997, *A National Policy Framework for Structural Adjustment within the new "Commonwealth of Information",* July.

5. Johnston, D and Turk, E. 1997, 'Access, Canadian Content and Competitiveness: The Three Pillars of Canadian Internet Policy', Paper presented to Kennedy School of Government Conference - The Impact of the Internet on Communications Policy, 3-5 December. http://ksgwww.harvard.edu/iip/iicompol/Papers/Johnston.html

6. Mansell, R. and A. Crede. 1996, 'The Role of Regulation in a Service Provider Driven Telecommunications Industry', *Communications and Strategies*, IDATE, France, Issue 21, First Quarter.

7. Marsden, C. 1997, 'Convergence or Coexistence? Television and Telecommunications Policies Diverge in the Convergence Debate,' Work in Progress, 1997 (3), *The Journal of Information, Law and Technology*. 31 October. http://elj.warwick.ac.uk/jilt/wip/97_3mars/

8. Productivity Commission. 1996, *International Cooperation on Competition Policy. An Australian Perspective*, Report 96/15, September, Australian Government Publishing Service, Canberra.

9. Spectrum Strategy Consultants. 1997, *Moving into the Information Society*, Report prepared for Department of Trade and Industry, United Kingdom. http://www.isi.gov.uk

10. Spies, A. and Wrede, J.F. 1997, 'The New German Telecommunications Act,' *The Michigan Telecommunications and Technology Law Review*, 27 October

11. Sunshine, P. and Roth, M. 1980, *Administrative Procedural Policy: Rule Making or Adjudication in dealing with Technology*, Program on Information Resources Policy, Harvard University, Incidental paper I-80-3, November.

12. Weisman, D.L. and Maingyuan, Zhang. 1997, 'Opportunities vs Incentives to Discriminate in the US Telecommunications Industry,' *Telecommunications Policy*, Vol 21, No.4, pp.309-316.

13. West, J. Dedrick, J. and Kraemer, K.L. 1996, 'Back to the Future: Japan's NII Plans', Paper presented to Kennedy School of Government, Symposium on National and International Initiatives for Information Infrastructure, Harvard University, 24-26 January.

14. Williamson, M. 1997 'Address by Hon Maurice Williamson, Minister for Communications', TUANZ AGM Conference, 5 March. http://www.executive.govt.nz/minister/williamson/mws0503.htm

15. Wilson, E. J. 1996, 'Comparing National Information Superhighways: What, Why, Where and How', Paper presented to John F. Kennedy School of Government Conference - National and International Initiatives for Information Infrastructures, 25-27 January. http:ksgwww.harvard.edu/iip/GIIconf/wilpap.html

Return to Top View Full-screen

New Governments throughout Asia Refocus Telecommunications Policy: The Quest to Overcome "Information Apartheid"

Charles Dodgson

Telenews Asia, Australia

ABSTRACT

My paper will present a brief overview of the new telecom policy directions that can be expected from three governments: China, India and Indonesia. The paper will compare the differing approaches to juggling the need to increase basic telephone connectivity and, at the same time, pursue a goal of greater high bandwidth connectivity. Government officials from each country point out that there are two equally important objectives in their telecom policy: one, to increase access to a dial tone; two, to insure that the information gap between the developed world and the developing world is not expanded too greatly.

View Full Text

New governments throughout Asia refocus telecommunications policy: The quest to overcome "information apartheid"

I. INTRODUCTION

Three of the world's four most populous countries, China, India and Indonesia, changed their political leadership during the first half of 1998. These three joined virtually every Asian country in changing its leadership during 1997/8 as the financial crisis began to have a major impact on policy directions. One of the first moves of each new administration was to restructure the departments that determine telecommunication policy.

In each of China, India and Indonesia, the new administrations made unequivocal statements that access to telecommunications is a priority for their country's national development plans. The three countries represent over 50 percent of the world's population, yet have less than five percent of the world's telephones. Over half of the combined population of China, India and Indonesia have never spoken on a telephone.

Government officials from each country point out that there are two equally important objectives in their telecom policy: one, to increase access to a dial tone; two, to insure that the information gap between the developed world and the developing world is not expanded too greatly.

My paper will present a brief overview of the new telecom policy directions that can be expected from three governments. The paper will compare the differing approaches to juggling the need to increase basic telephone connectivity and, at the same time, pursue a goal of greater high bandwidth connectivity.

II. INCREASING ACCESS TO A DIALTONE

Increasing access to a dial tone means making sure that every village has at least one public phone, and reducing the waiting time for urban connections. Village telephone projects are crucial on humanitarian grounds when a village can often be days away from public health or other social facilities. Over 80 percent of the 2.5 billion people living in India, China and Indonesia live in villages.

I once worked on an Australian government aid project in a village not more than 50 kilometres from Calcutta. The nearest road was 20 kilometres away and this could only be reached by punting a small boat for some eight hours. If there was any kind of outside help needed in that village it would be at least 10 hours before anyone in the outside world could even be contacted. Then there was another 10 hours to reach the village. There are one million villages like this in India alone and less than ten percent have access to a telephone.

Telephones on demand in cities are equally crucial in developing the basic economic infrastructure of these nations. Can you imagine trying to run any sort of business without access to a telephone?

As the developed world begins to redefine the concept of universal access to include universal access to multimedia services providing access to services such as the Internet, the developing world struggles to keep up its basic fixed line rollout objectives. China's impressive installation record of 15 million lines a year means that the country is only installing one new line for one new Chinese baby added to China's population every year.

An Indonesian telecom official once described to me that the focus of the developed world on new telecommunications applications that increase content access means that an "Information Apartheid" system is developing between his country and the western world. The official said that those who can access the Internet can participate in a new commercial world, but those that can not are even more disadvantaged than ever because they now have a new hurdle. Not only can they not communicate, they also can not access the data by which the developed world is building a new commercial reality.

The Indonesian official was answering my question about the priority of spending $US1 billion on the Nusantara 21 project, to create a high capacity ATM ring around Indonesia, when the country's economy was descending into financial ruin. According to the official, Indonesia has no choice but to pursue such projects. Thai officials have also given me this same reasoning: that despite the ever increasing costs of high end telecommunication projects, it is the pursuit of these projects that will deliver Thailand's economic salvation.

I will briefly describe how the deregulation policies of China, India and Indonesia is aimed towards minimising information apartheid.

III. CHINA'S MINISTRY OF INFORMATION INDUSTRY

- In March 1998, China's new premier, Zhu Rongji, abolished the Ministry of Posts and Telecommunications (MPT) and replaced it with the Ministry of Information Industry (MII), a super-ministry with responsibility over broadcasting, and all telecom regulation, policy and administration of the three carriers, China Telecom, China Unicom and Great Wall. Significantly, Zhu said that a priority for the MII is to prepare China for entry into the World Trade Organisation.

  Although the MII was formed in March, an administrative structure for its 13 departments did not emerge until early November. At the time of writing, there was still no official announcement as to the form of the MII's new administration.

  The delay is seen as significant. Primarily because it indicates that the State Council has not been happy with moves by the former MPT to sideline officials from the former Ministries of Electronics Industry (MEI), and Radio, Film and Television (MRFT) within the MII. All three ministries were combined into the MII when Zhu Rongji took over China's premiership from Li Peng.

  An editorial in the *South China Morning Post* said at the time of the MII formation that its structure and staffing will provide an all important indication of the central authorities' commitment to market liberalisation, and determine whether foreign investors can secure industry approval for their deals.

  Without a telecommunication law, decisions within the telecom sector are too often subject to the personal prejudices of individual administrators. I have heard repeated accounts of telecommunication regulations being interpreted on an ad hoc basis by local administrators. Commentators say that it is an awareness, by the cental authorities, for the need to establish a more efficient organisation that recognises the need to adopt a uniform approach to an industry in which technologies are rapidly converging, that is driving a reform agenda.

  Aside from the eventual structure of the MII, a further indicator of the direction of change will be the Telecom Law. As with the MII restructuring plans, the State Council apparently has rejected drafts of the Telecom Law on the grounds that its provisions favour the former MPT over other ministries.

  Sources say that promulgation of the national law may be delayed until after 2000 because of power struggles within the new MII structure. It has even been suggested former MPT staff are using delaying tactics, as the absence of a national law allows the MII to maintain discretionary control.

  The Telecom Law will likely include a restatement of the ban on direct foreign investment in ownership, operations and management of networks, and regulation of the standard of telecom equipment and design.

It is unlikely to contain any specific reference to the contents of interconnection agreements, including interconnection obligations between the incumbent operator, China Telecom and other operators, or address tariff structures.

In keeping with the mainland regulatory "tradition", it is most likely the Telecom Law will address general issues and refer to the MII as the primary regulatory and administrative body, responsible for implementing regulations on specific issues, such as interconnection to the main network or equipment standards. Specific regulations probably will be promulgated, as they have in the past, as issues arise and when the authorities deem them important enough to regulate.

This concern is now perhaps even more crucial with the effects of Asian economic crisis and Japan's recession starting to impact on credit availability in China. Direct foreign investment in China has fallen by up to 20 percent over the course of 1998.

It is difficult to ascertain the effect of a credit fall off China. China installs about 20 million new fixed lines a year. The cellular market doubled during 1997 to 13.6 million subscribers, it passed 16 million at the end of April and is expected to reach about 22 million by the end of 1998. All of this has been achieved largely from internal sources. China Telecom's revenues last year were a reported $US23.8 billion.

Yet with falling interconnection fees and expensive rural areas to connect, and a fall off in available foreign capital the State Council must be considering whether or not it is time to bring in foreign capital to help.

But for all the massive growth, the concentration of telephone services in China remains low. At the end of 1997 China had 111 million telephone subscribers, a total penetration of less than 10 percent. That figure, however, masks large differences between country and city. While 40 percent of Chinese villages still do not have access to a phone, urban areas, particularly eastern coastal cities, have penetration rates approaching 30 percent, led by Shanghai and Beijing.

In 1993 the State Council sanctioned the formation of a second carrier, Lian Tong (China Unicom), to increase line rollout targets. Although the law banning foreign participation in infrastructure installation or operation was not repealed, foreign telecommunication companies were able to invest in the China Unicom through a backdoor process called zhong-zhong-wei (chinese-chinese-foreign, or CCF) joint ventures. Forty foreign-based carriers - most notably US-based Sprint, France

Telecom and Deutsche Telekom - invested some $US1.4 billion in small chinese companies which, in turn, formed joint ventures with regional China Unicom branches. However, executives from companies which invested in China Unicom have all complained that they failed to realise profits because the MII-owned China Telecom avoided interconnection arrangements.

In over five years China Unicom has only been able to install one fixed-line network, in Tianjin with less than 30,000 subscribers, and some 18 GSM networks with approximately one million subscribers. In September 1998 the State Council said that CCFs were illegal and that the investments foreigners had made in China Unicom would be repaid. It is still unclear how this will effect China Unicom's operations. However, China Unicom did get some postive news during November with the issue of a MII licence for a nationwide GSM services.

Although it would seem that the State Council move erodes confidence in the intentions of the Chinese government to open its services market to foreign participation; a more informed analysis suggests that the move is a means to insulate China from the worst effects of the Asian financial crisis.

One of the points of debate about the currency crisis in Southeast Asia has been the possible follow-on effect the plunge in regional currencies and stock market values will have on the region's mega markets of China and India with their partially convertible currencies.

On the one hand, analysts argue that a fall in the regional currencies will adversely effect the big markets because they will have to compete against cheaper products. A devaluation in the Chinese currency, for example, is therefore seen as inevitable and this will have a disastrous follow-on effect on the country's banking system which has huge debts, propping up inefficient state-run enterprises. Although the premier, Zhu Rongji, has said that he wants to accelerate reforms of state enterprises, the problems appear intractable.

The same problems which, in hindsight, bedevilled Southeast Asia's economic miracle are identical in China, only magnified. In the words of an *Economist* editorial: "State-run companies and their cronies have, until, recently had a stranglehold on credit supply by China's state banks. As in Thailand, Malaysia and Indonesia, far too much borrowed money has been pumped into speculative property development that will never see a return". Chinese banks had some $US145 billion in accumulated bad debts at the end of 1996, a figure equivalent to 20 percent of total loans.

A counter argument suggests that China will in fact prosper from the financial woes of the region. This argument suggests that the growth which underpinned Southeast Asia's economic boom over the last decade was simply displaced Japanese and Nanyang chinese (Taiwanese, Hong Kong and western-domiciled chinese) capital which was moved into the region looking for cheap labour. When that labour became more expensive the capital looked elsewhere and has increasingly found India and China. And China and India represent far more sophisticated markets which have the capacity to absorb, transform and utilise that capital laterally throughout their economies far more effectively than Southeast Asia.

This argument continues that Malaysia's prime minister, Dr Mahathir, was the only regional leader to appreciate this long term capital movement and this explains both his enthusiasm for the mutimedia supercorridor, and his exasperation when the meltdown came at a point before he had locked foreign capital into more capital intensive industries.

Indian financial institutions have demonstrated an awareness of this trend with their move to insure that overly ambitiously telecom companies are not able to plan beyond their means and face the liquidity crunch which we now witness in Southeast Asia and South Korea. But in China the picture is less clear because of the relative lack of transparency in its financial system.

A Ministry of Information Industry source told the author that the prevailing view within the MII is that Asia's crisis is China's opportunity. The MII official said that China's telecom sector is still a "domestic-demand-pull market" where the most important feature remains that demand exceeds supply and China's telecom growth has yet to reach the point where domestic telecom demand will shrink. In comparison to Thailand, for example, in which demand for telephones has diminished with the financial turndown, despite a still low teledensity of some 10 telephones per 100. China has some 111 million lines for a similar teledensity as Thailand - but has shown no signs of reaching a plateau in demand.

Another factor in China's favour is the relatively low level of foreign investment in its telecom sector. Only some 15 percent of China's telecom investment has come from abroad and the MII largely funds its own rollout programmes. Despite calling for a massive $US75 billion in investment in the five years to 2000, the MII does not rely on foreign capital and is therefore not subject to the vagaries of international capital movement.

Yet another significant factor is the growth of China's equipment manufacturing industry. For example, only 40 percent of digital exchanges were produced in China in 1995. During 1996 it increased to 78 percent and to 92 percent by 1997.

This sort of increasingly independence from foreign equipment manufacturers is replicated throughout the industry. The market is one of the most closed for operators but also is the most competitive for equipment manufacturers. The size of the potential sales means Beijing can get the best deals out of suppliers, playing company against company.

IV. INDIA AIMS TO USE ITS STRENGTH IN IT FOR TELECOMS DEVELOPMENT

India's Prime Minister, AB Vajpayee, also restructured India's communications administration when he came to power in April. Vajpayee appointed a minister to oversee a new super ministry with responsibility over broadcasting, telecommunications and information technology.

When the appointed minister, Sushima Swaraj, resigned in October to become the chief minister of Delhi, Vajpayee chose to retain the position. Although some observers in Delhi criticise Vajpayee for apparently leaving the communications portfolio vacant, others believe Vajpayee will use the opportunity, and his position as prime minister, to push through reforms in the telecom sector in which he has taken a personal interest. One of Vajpayee's first actions as Prime Minister was setting up the National Taskforce on Information Technology (NTIT) to investigate taking advantage of India's prominent role in software development and developing a methodology to quickly develop India's telecom sector.

The NTIT handed the government its recommendations in July and Vajpayee said that the government would move to adopt all 108 recommendations. The most crucial recommendations called for a repeal of the 1885 Telegraph Law and a consolidation of the communications sector so that there was no distinction between the telecommunications and information technology sectors. Two NTIT recommendations have already been implemented: the full opening of India's satellite sector to foreign participation and the deregulation of India's Internet business.

A NTIT member said that Vajpayee was well aware that India's potential as a leading IT power was being compromised by beaucratic infighting in the telecommunications sector and that the solution lay in initiating reforms that were not subject to infighting between the Department of Telecommunications, the Telecommunications Regulatory Authority of India, other government agencies and private telcos.

The taskforce has recommended that India should draw on its existing strengths in the IT industry and use these strengths to position India as a world IT&T superpower through an open telecommunications infrastructure. Currently some 15 percent of the world's corporate software is written in India and this percentage grows yearly. Some commentators have predicted that India has the human resources and opportunity to become the regional centre for content and application development and an alternative Internet hub to the US if the process of telecommunication deregulation is handled correctly.

A taskforce member told the author said that the government has finally recognised that telecommunications and the IT industry in India are inextricably linked and that India's IT success will not continue unless the telecom sector is reformed. The aim is to make India competitive and attractive to foreign investment and the basis already exists in India's IT industry.

V. INDONESIA, THE GREAT OPPORTUNITY UNRAVELS

The events surrounding the replacement of President Soeharto with President Habibie has underlined the risks of doing business in a culture of crony capitalism.

When such a system comes under stress then the very factors which drove its success are its biggest risk factors and the system can unravel with spectacular rapidity. This appears to be happening in Indonesia at the moment.

Less than 12 months ago Indonesia was seen as one of the region's best prospects for telecommunications business. With a population of over 200 million, and an annual economic growth rate of around 10 percent, foreign telecommunication companies were falling over themselves to enter the market.

With the fall of President Soeharto evidence is emerging as to how the Indonesian government smoothed the way for foreigners to invest in the telecom sector and the high returns which could be expected.

One month before Soeharto's fall the author participated in a discussion with senior executives from two foreign telecommunication companies, at a Jakarta embassy, about the merits of doing business in Indonesia. One executive took the view that deals were easier to come to in Indonesia than any other country in the region because of the unofficial manner in which beaucratic avenues were smoothed. In contrast to India, in which his company needed to make its way through multiple government departments in order to change particulars of his contract, he argued that in Indonesia he was able to change minor points with a minimum of fuss.

An executive from a competing company challenged this perspective and said that the first executive retained a typically western-colonial attitude towards doing business in Asia: return a short term profit and ignore long term development pictures. This second executive argued that it was better not to enter a market, and forgo short-term returns on three or five year business plans, if market entry resulted in the company becoming too closely associated with an amoral political regime. Few political regimes outlive the lifespan of a company's longterm business plan, he said, adding that most telecommunication executives fall in to the trap of being toadies to an accomodating regime without considering the long term damage they may be causing their company. He made the telling prediction that because few foreign companies had bothered to establish long term credentials in the Indonesian market, most would eventually leave having sustained a loss.

This was a telling prediction with valued-added service companies deserting the Indonesian market and amendments to the Kerja Sama Operasi (KSO) agreements -between PT Telkom and five foreign carriers to install fixed-line telephony services in five nominated regions of Indonesia - showing a marked downturn in profits from fixed line installation.

The KSO agreements coincided with the October 1995 international share offering in Telkom. The government instituted five large-scale regional joint venture projects or KSOs, which aim to connect 78 percent of the population by 1999. Telkom, which is maintaining control of the networks in greater Jakarta and East Java, will install the remaining three million lines. At the time of the announcement, industry sources were sceptical that Telkom has the capacity to meet such a target and recent events have borne out this view. The terms of participation have been set up to be beneficial to Telkom.

No KSO operator installed its target in the first or second year of operations. With costs of imported equipment escalating, and the capital base of Indonesian companies dwindling as their foreign debt becomes more difficult to service, it would appear as if line installation targets have become illusionary.

Return to Top   View Full-screen

An Analysis of the Australian PCS Auction(s)

Reg Coutts and Seregey Nesterov

University of Adelaide, Australia

ABSTRACT

During May-April 1998 the Australian Communications Authority(ACA) conducted spectrum auctions in Australia of both 20 MHz at 800MHz(ie the "AMPS" band) spectrum and 45MHz at 1800MHz(ie part of the 75MHz "GSM1800 band). It raised some A$350million for the Government and saw the allocation of some 65MHz of spectrum over 19 geographic regions in Australia. The auctions were done electronically using the multiple round ascending auction methodology as used in the United States for the PCS auctions held in 1995. In September 1998, the ACA auctioned the unsold lots using an English Outcry auction. The proposed paper will analyse the effectiveness in this auction methodology in allocating spectrum to both incumbents and potential new players into the Australian marketplace. The paper will consider in particular the impact of the auction rules on the process and effectiveness in achieving the desired outcomes for both players and the regulator. CTIN

The Centre for Telecommunications Information Networking (CTIN) was established in mid 1993, under the Directorship of Professor Reg Coutts and leads the research and educational activities in Telecommunications at the University of Adelaide. It has built on existing technical strengths in Telecommunications such as the Telstra sponsored Teletraffic Research Centre (TRC) and has built links with other disciplines within the University such as Economics, Commerce and Management. In addition, CTIN works closely with other groups around Australia to meet client's needs.

View Full Text

An Analysis of the Australian PCS Auction(s)

1. Introduction

Market based mechanisms to efficiently allocate spectrum is beginning to feature strongly in spectrum management in Australia. The Radiocommunications Act 1992 permits the allocation of spectrum licenses using price-based market mechanisms. Creating spectrum property rights, relying on defining spectrum access in three dimensions: time (ownership duration), geographical area, and spectrum bandwidth, can be traced back to Ronald Coase in the 1950's. With the theory well documented and the practice confirmed with application to the US PCS auctions, the ACA selected the simultaneous ascending bid process to initially allocate spectrum to open up spectrum for new players in telecommunications as well as provide additional spectrum for the current three mobile operators.

A discussion of the ACA's development of a property-like spectrum access right is beyond the scope of this paper, but it is sufficient to say that it centres on the creation of a commodity in spectrum space, with commodity units of space defined in the dimensions of time, area and frequency bandwidth. The auction system is intended to allow market conditions to allocate these commodity units, or arbitrary aggregations of these units, in the preferred configuration of clients, and to support its own attempts to create an "open market" for spectrum licensing through the creation of a unique model of spectrum property rights. This will allow market conditions to ultimately determine spectrum use as well as to determine spectrum users.

In 1998 the Australian Communication Authority (ACA) conducted a spectrum auction in 21 geographical areas in Australia for 22 spectrum bands of varying bandwidth within both the 800 MHz and 1.8 GHz frequency ranges, using the ascending bid multiple round auction process. The PCS auction took place over 89 rounds beginning on the 20th April 1998 and concluding on the 25th of May 1998. Reaction to the PCS auction by the ACA process was described as an "outstanding success". Total revenue (including penalty payments) from this first allocation of spectrum licences totalled **$350,190,135**. At the first round there were nine participants including; Telstra, Optus, Vodafone, AAPT and a number of other companies representing Australian and overseas investors. However, by the completion of the auction only seven remained. Within the competition policy limits imposed by the Australian Government, the participants were free to bid for most of the 227 lots of varying bandwidth located within the total of the 21 areas. Bidding required the use of ACA supplied software, a computer terminal and modem access to the ACA but all information was available to the public on the Internet. The remaining lots were subsequently auctioned by English Outcry auction on the 15th September.

While a broader discussion of the PCS auctions is available, this paper will focus on several specific results of the auction for discussion in this paper.

2. The PCS Auctions in Australia

Convinced by the superiority of the simultaneous ascending auction process, the ACA, Australia's spectrum management regulator decided to use this method of auctioning to allocate spectrum licences in two separate frequency bands simultaneously.

The auction of spectrum licences occurred over 89 rounds between April 20th and May 25th 1998. The auction realised a revenue of about AUD$350 million dollars for the allocation of 227 lots within 21 geographical areas as indicated in Figure 3.1. Bandwidth of the lots (each identified by a lot number and lot rating) varied in size from 2.5MHz in the 1.8 GHz band and 5 MHz in the 800 MHz band.

Not all the spectrum was sold during the auction in April/May. The remaining spectrum was auctioned on the 14th September using an English outcry auction held in Canberra and saw all but one lot sold raising another $30.6 million and the entry of One.Tel into the list of new entrants. It is understood they intend to rollout a GSM1800 network in the capital cities.

This section describes the spectrum offered for allocation in the PCS spectrum auction. It describes the spectrum parcels that were available, and the areas in which they were available. Each combination of band and area was regarded as a spectrum allocation lot, that is, a lot that was open to bidding in the auction. There were 227 lots on offer in this auction, and applicants were able to bid on any lot or any combination of lots up to their own pre-declared limit (their eligibility), which had to be within the limits determined by the Minister.

1. ***Spectrum Market to be Auctioned***

The spectrum to be auctioned was:

•2 ´ 20 MHz from 825-845/870-890 MHz in metropolitan areas;

•2 ´ 5 MHz from 825-830/870-875 MHz in regional and outback areas;

•2 ´ 10 MHz from 835-845/880-890 MHz in regional and outback areas;

•2 ´ 45 MHz from 1710-1755/1805-1850 MHz in metropolitan areas; and

•2 ´ 15 MHz from 1710-1725/1805-1820 MHz in regional areas.

For the purposes of the auction, the ACA divided Australia into 21 areas determined by considering population distribution, communities of common interest, geography and ability to shield radio signals, and existing radio site usage.

These areas are classified as one of three types of areas, either:

• metropolitan (Brisbane, Sydney, Melbourne, Adelaide and Perth);

• regional (Canberra, Darwin and Hobart, and populated rural areas of Australia);

• outback (these include all remote areas).

The population of each area has been set by the ACA based on an estimate derived from census data collection from 1992. These population figures are provided for the purposes of the auction only.

2. ***Spectrum Parcels for the Allocation***

The radio frequency bands on offer were allocated as spectrum lots which may be aggregated through the allocation process to form spectrum licences.

In the 800 MHz band, the ACA allocated 4 parcels, each of 2 X 5 MHz in metropolitan areas (a total of 2 X 20 MHz), and 3 parcels, each of 2 X 5 MHz in regional and outback areas (a total of 2 X 15 MHz).

In the 1.8 GHz bands, the ACA allocated the spectrum in 18 parcels of 2 X 2.5 MHz in metropolitan areas (a total of 2 X 45 MHz) and 6 parcels of 2 X 2.5 MHz in regional areas (a total of 2 X 15 MHz). The Minister has not made a declaration for the re-allocation of spectrum in the 1.8 GHz bands in outback areas.

3. ***Spectrum Allocation Lots***

The ACA used a simultaneous ascending bid auction system to allocate the spectrum. The system employed spectrum allocation lots (or "lots"). Lots are like "building blocks" of spectrum. The auction process allocated lots to the applicants who, in economic terms, value them most highly. The lots were then aggregated after the auction to form spectrum licences.

Each combination of *allocation area* and *spectrum parcel* was regarded as a *spectrum allocation lot*. Each lot was numbered sequentially and had a "name" which combines the area name and the band number (e.g. "Sydney-21").

Each lot had a *lot rating* which was a measure of its population coverage and bandwidth. Lot ratings were calculated by multiplying the population of the area of the lot by the bandwidth of one half of the frequency pair constituting the lot (in MHz) and dividing by 100. Lot ratings are rounded down to the nearest whole number. Lot ratings are important to the auction system because they provided a basis for applying activity rules which prevented the auction from stalling.

4. ***PCS Auction Rules***

In a simultaneous ascending auction, all bidders are able to bid on all elements of their preferred aggregations at the *same time*. All the lots on offer are auctioned simultaneously, rather than in sequence. Bidders can bid on any lot, or any combination of lots, up to their own pre-declared limit. This limit is expressed as eligibility; a representation of the amount of bandwidth and population coverage the bidder ultimately hopes to win. Bidding is conducted over multiple rounds and the auction closes when there are no new bids on any of the lots in a round in the final stage of the auction.

A key feature of the auction was the application of *activity rules* that encouraged active participation and ensured that the process did not stall. If a bidder had failed to meet their activity requirements, the amount of spectrum that they were eligible to bid on would have been reduced. Bidders could not bid on lots in such a way that their bidding activity would exceed their eligibility.

Applicants also paid an *eligibility payment* set by the ACA to register for the allocation process. This eligibility payment is refundable at the end of the auction if there was any surplus after the deduction of bid withdrawal penalties, and after credit to the balance of the bid price (ie. Winning bids plus bid withdrawal penalties minus the eligibility payment).

Each round of the auction comprised:

• a bidding period when bidders made their bids and any automatic rebids, or withdrew some or all of their current high bids so that they could redeploy their eligibility to pursue different bidding strategies;

• a short period of time for the ACA to calculate the results and make them available for download, and for bidders to consider the results before the next round commenced.

Due to the very large number of permutations of bidder preferences in an auction which offers 227 lots, this auction was run on a computer, and people submitted?bids electronically. Bidders submitted their bids using a computer and modem, transmitting bids over the public telephone network or the Internet. Bids were encrypted for security and data integrity.

5. *Bidders*

Initially there were nine officially registered applicants, which can be divided into three groups

Table 2.1 - Applicants for the PCS MHz Auction

Applicant	Initial Eligibility
Telstra	4180970
Optus	1975490
Vodafone	1556120
Hutchison	1433590
AAPT	2407380
OzEmail	3147600
OzPhone	2536330
Catapult	18410

Global Mobility	1257875

Telstra was the strongest incumbent attempting to get maximum spectrum in both bands.

Vodafone was interested in spectrum at 1.8GHz to meet future capacity and as a platform for new services in the cities.

Optus was also interested in spectrum at 1.8 GHz to meet future capacity and as a platform for new services in the cities.

OzEmail a leading Internet service provider, also had some interest in the potential for wireless delivery and bid in the early phases of the auction at 800MHz before withdrawing when the prices had escalated above their valuation.

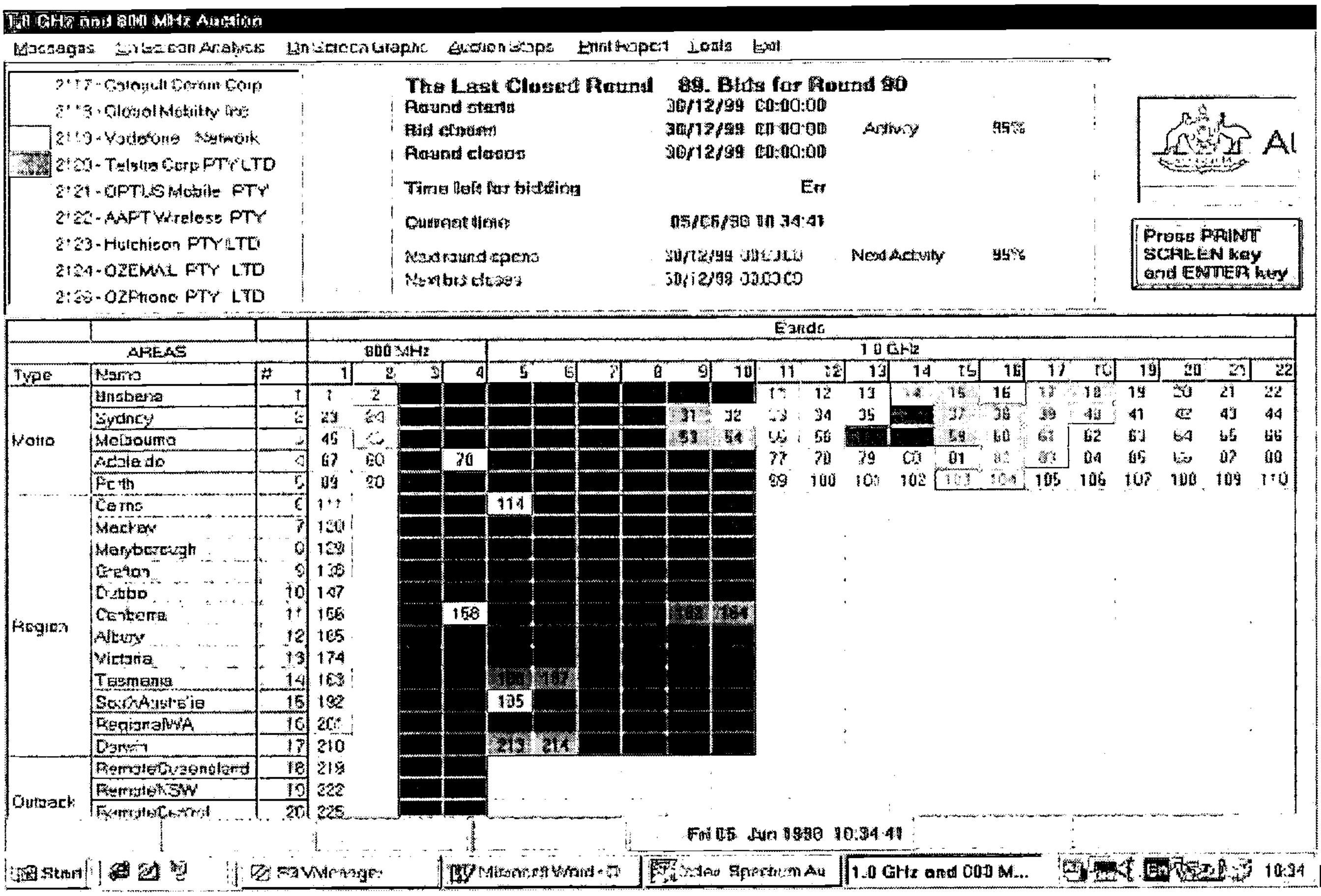
Global Mobility was and still is a mystery company, and we have no reliable source of detailed information about the company, but it is known that Global Mobility Networks Inc are based in the United States of America. Industry rumour was that Global Mobility was involved in putting together license applications working for interests associated with TDMA technology, including apparently a major US telecommunications and a major world equipment supplier. They did not actually participate in the PCS auction process, however they deposited an initial payment and were eligible to bid for licenses.

OzPhone was created to bid in the Australian spectrum auction and originally it was believed that Spectrum Networks, National Australia Bank and Lendlease, in association with Qualcomm comprised the consortium. However, Qualcomm has secured the granted licences and has stated that they are the sole owner of OzPhone stock. OzPhone's initial eligibility was sufficient to acquire at least 15MHz in the metropolitan areas and 10MHz of spectrum in all other areas. The current company is called Leap Wireless.

Catapult is a Silicon Valley based company specialising in the delivery of test systems for digital wireless and satellite products, such as GSM, SS7 and Intelligent Networks. Catapult's initial eligibility was sufficient to acquire 5MHz of spectrum in a small regional area, like Cairns.

3.

4. Values Achieved for Spectrum from the Auction?



Placing an actual dollar value on spectrum licences depends on business case valuation by respective bidders and depeds on many factors. The Australian Telecommunications market is undergoing a great deal of change and uncertainty associated with the industry deregulation, post 1997, as well as the final Government decision(s) around "AMPS closure". The need to allocate spectrum efficiently amongst potential operators, with sound regulatory and competitive auction and deployment rules will have a profound impact on spectrum price.

In Fig 3.1 shows the final winners of the spectrum auction as of May 1998 where there were a number of lots had be auctioned later as mentioned earlier. Clearly Telstra was the major purchaser of spectrum contributes nearly half of the total amount raised at the auction.

Fig 3.1 – Final Winners at the Auction at Round 89

The Australian PCS Auction was not complete in a final sense as there were unsold lots in some areas which were subsequently sold. For example, one 5 MHz lot [800 MHz band] in Melbourne has been withdrawn at the nearly $16 million level. In the 1.8 GHz band, spectrum is still available in Sydney, Melbourne, Brisbane, Adelaide, and Perth. As was subsequently found, the most valuable unsold lot in Melbourne was sold at a "dropped price" – $14 million dollars and all other unsold lots except for Remote Central-1 were sold at below average lot prices and the ACA raised another $30.6 million dollars. The total revenue was $381 million dollars for all the PCS spectrum sold.

Table 3.1 summarises average spectrum value $/Pop/MHz for each region and band.

Table 3.1 - Assessment of Relative values of the Spectrum Lots

Area	Area #	Population	Area Type	Spectrum (MHz)	Dollar value	Spectrum (MHz)	Dollar value	1.8 GHz $/Pop/MHz	800 MHz $/Pop/MHz
Brisbane	1	1735500	M	20	$28,400,000	45	$14,829,500	0.21	0.82
Sydney	2	4265500	M	20	$96,080,000	45	$69,289,000	0.41	1.13
Melbourne	3	3246700	M	20	$48,840,000	45	$50,606,000	0.39	1.0
Adelaide	4	1094900	M	20	$4,938,500	45	$3,831,900	0.1	0.30
Perth	5	1189100	M	20	$5,109,200	45	$4,160,800	0.1	0.21
Cairns	6	368200	R	15	$884,600	20	$754,400	0.10	0.16
Mackay	7	305100	R	15	$701,500	20	$457,620	0.07	0.15
Maryborough	8	769100	R	15	$2,153,200	20	$1,153,200	0.07	0.19
Grafton	9	395000	R	15	$1,066,500	20	$592,500	0.08	0.18
Dubbo	10	273900	R	15	$765,800	20	$410,820	0.07	0.19
Canberra	11	505200	R	15	$1,014,200	20	$808,200	0.08	0.20
Albury	12	477800	R	15	$1,336,800	20	$716,400	0.07	0.19
Victoria	13	719900	R	15	$2,014,400	20	$1,079,400	0.07	0.19
Tasmania	14	482500	R	15	$1,113,000	20	$965,800	0.10	0.15
South Australia	15	308600	R	15	$770,900	20	$617,260	0.10	0.17
Regional West	16	201800	R	15	$403,200	20	$322,880	0.08	0.13
Darwin	17	107600	R	15	$225,960	20	$232,370	0.11	0.14
Remote QLD	18	124400	O	15	$124,400	0			0.07
Remote NSW	19	152700	O	15	$244,320	0			0.11
Remote Central	20	127600	O	15	$127,600	0			0.07
Remote West	21	289000	O	15	$289,000	0			0.07

In summary the Sydney and Melbourne markets generated nearly 80% of the auction revenue in the 1.8 GHz band and 74% at the 800MHz ; Sydney alone generated nearly 50% of the auction revenue. Metro areas generated more than 93% of the auction revenue in both bands. Table 3.1 illustrates revenue and average $/Pop/MHz for each band and area. The higher prices for the 800MHz lots is discussed later.

For a comparison of the value of spectrum realised from the auction compared with the revenues raised by the administrative process, the estimate is based on the previous administrative apparatus licence fees over 15 years, allowing for interest (7%). It would be enough to compare the final results only. As described in a previous paper [Nelson, 1996] the GSM license price for 1 MHz of spectrum nationally per year is $740,000(average). The total amount of spectrum sold in metro areas was 65 MHz (20 MHz in 800 MHz band and 45 MHz in 1.8GHz), so altogether this spectrum would have generated in the first year: $789,500 x 65 = A$51.3 Million. Based on the assumption of unchanging license fees, the NPV over 15 years with a 7% interest rate is $467 million which is 25% higher than that paid ($350 million including withdraw penalties) at the auction.

However, the straightforward approach of projecting GSM spectrum value onto sold PCS spectrum has some limitations. We would not expect that incumbent operators Telstra, Vodafone and Optus would need to buy as much spectrum at the PCS auction as it was additional to their previous allocation. Ideally they would like to apply for spectrum in 5 or 10 MHz blocks over time to meet demand. On the another hand incumbents were forced to buy extra spectrum in advance because the auction was the best time to purchase and to limit the potential of greater competition. In terms of revenue generated per extra spectrum, all incumbents have a clear advantage over the newcomers, because of economies of scale based on their existing network infrastructure.

A new entrant's spectrum value estimation depends on their market estimates and costs of network deployment. However the average price they have paid for spectrum in Australia is comparable with or less than, the US figures depending on market and band intensity. Valuation may also reflect short term benefit estimates of traffic the spectrum may carry (and associated revenue), or a strategic assessment of the impact spectrum acquisition may have on a float, or future technology developments.

There are a number of factors which should be taken into account when considering spectrum value:

- much less than a full 65 MHz was available *nationally*. In regional areas there was at most 30 MHz available which would reduce the money which would have been expected to have been raised administratively
- Comparing the 1.8 GHz band with the 800 MHz band, one should include a discount due to the different propogation characteristics, with 1.8 MHz being inferior and requiring many more base stations.
- The spectrum, particularly the 1.8 GHz band, was bieng sold heavily encumbered which would significantly reduce its utility in the short term. Again a discount factor would be needed.

Therefore we believe that all parties involved in the PCS auction, both ACA and applicants, should be happy with the auction results, because applicants have obtained spectrum at a very competitive price and a 20% ACA discount which is quite fair given the market uncertainty over a 15 year period and given that the licence is likely to be reauctioned at the end of the 15 years.

1. Analysis of Value Escalation

It is very important for the bidder to know the real demand on lots in the particular area with respect to the number of lots for sale. With knowledge of real demand the bidder can adjust its spectrum requirements to prevent price escalation. The starting assumption for analysis in this section is that the rate of value escalation of the lots is related to the difference between supply and demand. The increase in the lot value with successive rounds is shown in Fig 4.1 which shows the minimum, maximum and average lot value over the 18 lots for 1.8GHz band.

Let us assume that we have N available lots in the area and real demand is M lots. If M is equal or less then N then we have a trivial situation, i.e. a lack of competition. However, when M exceeds N there is a lot shortage, K equals M-N. So, each bidder should reconsider their demand and accordingly reduce spectrum requirements, otherwise the auction process leads to a continuous price escalation. A secondary driver of demand is the variance in lot value across the band so that players, even without a lot shortage, would bid for lower value lots but run a risk of a withdrawal penalty.

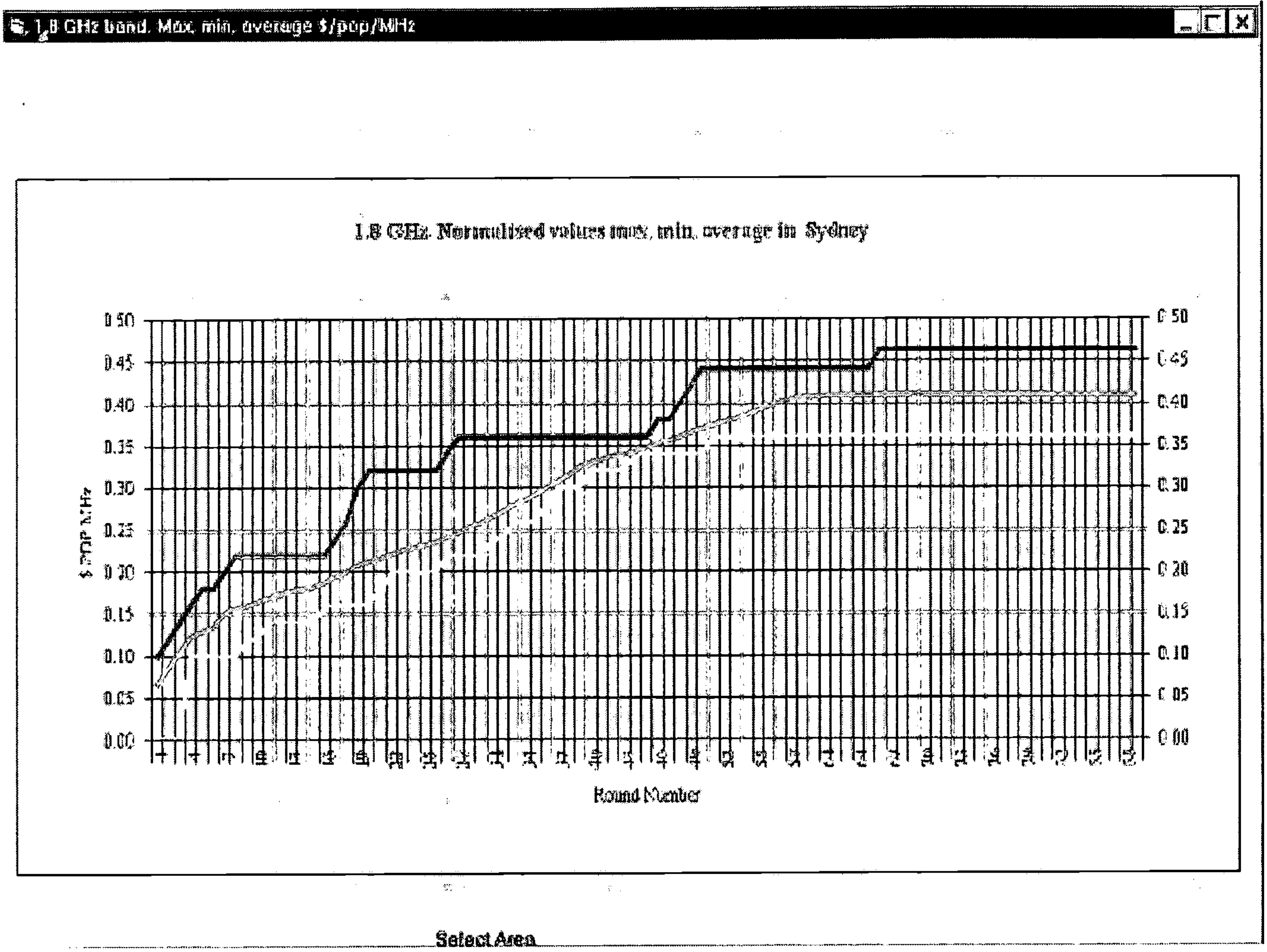


Fig 4.1 Escalation of Lot Value in Sydney

To support lot shortage analysis the CTIN software tool generates a sloped incremental graph for each area. Axis X is a round number and axis Y is the average lot increment value for the round in cents/Pop/MHz

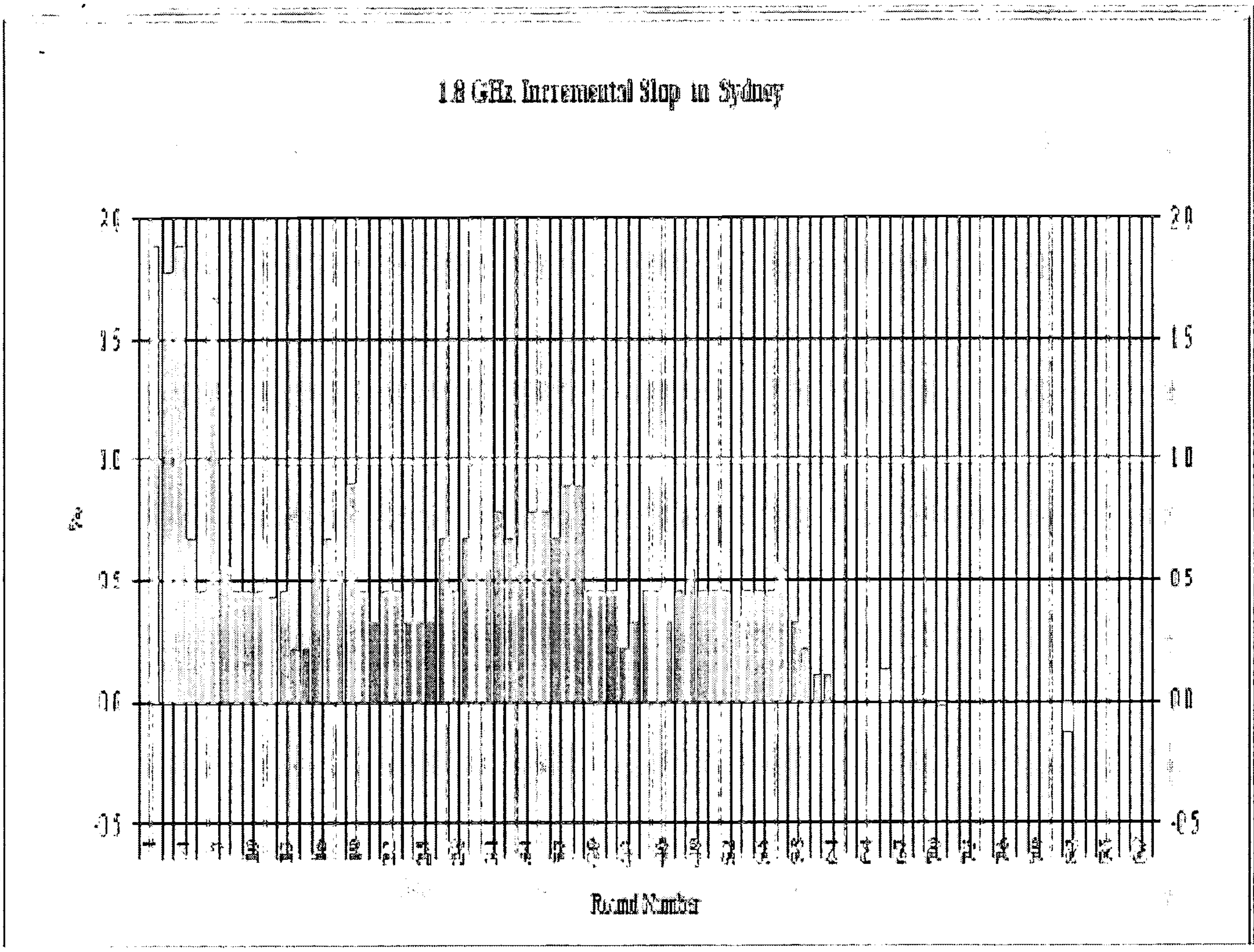


Fig 4.2 Incremental Slope in Sydney

Fig 4.2 shows the effect of lot shortage up to round 60 which resulted in an escalation of value. However, from round 60 there was no escalation of value meaning there was no lot shortage at all! In this round, one of the players (AAPT), a major bidder earlier going for 6 lots, stopped bidding in this band. The magnitude of the slope can be projected to another graph presenting theoretical lot incremental values depending on the lot shortage. This theoretical curve for Sydney and Melbourne has been calculated with the assumption that all applicants followed a minimum bid strategy and bid rationally for these theoretical curves as discussed further below.

Lot shortage could be caused by two reasons: (1) actual shortage when the applicants required more spectrum and (2) ''eligibility maintaining'' shortage when applicants bid in this area to maintain their eligibility. Thus the rules of the auction which forced bidders to bid to retain their level of eligibility does "appear" as competition particularly in this auction where there were two completely different bands auctioned simultaneously. This effect can also be seen from rounds 29 to 42 where another player (OzPhone), which was not bidding in the 1.8GHz band up to round 29, started bidding here to retain eligibility. It is assumed that they wanted to disguise their true bidding objectives in the 800MHz band until round 42 when it had decided to re-enter bidding. These 13 rounds saw an increased value escalation and certainly contributed to faster escalation of the spectrum prices. .

Figure 4.2 demonstrates that in rounds 1-10 (training period) the bidding was inconsistent as players who were in some cases quite inexperienced in the auction game and were in "learning mode". In rounds 10 - 30 real competition existed and the lot shortage was estimated as five lots. In rounds 30 – 38 there was an increased lot shortage because OzPhone started to bid in the 1.8 GHz band, joining the competition for a short period of time as mentioned earlier. In rounds 39-56 the lot shortage returned to five lots again. From round 56 to the end of the auction there was no lot shortage and no escalation of value. This was because AAPT dropped their spectrum demand in the 1.8 GHz band, and the remaining three players could acquire enough spectrum.

Several conclusions can be drawn from this analysis:

- The rate of escalation of lot value from round to round can be estimated from the number of lots in contention, which is the difference between the lots for supply and the total demand of the players in a region.
- Auctioning two different bands simultaneously leads to higher prices due to cross band bidding. The structure of this auction involving auctioning two distinct bands simultaneously means bidders, to retain eligibility disguise their true bidding objectives in a particular band, usually by a cross bid in the other band "artificially" increasing the number of lots in contention which escalates the lot value.
- The ultimate demand for 1.8GHz spectrum was less than supply (45MHz on auction) in all the cities as indicated by the number of unsold lots. However, the auction structure of auctioning both bands created competition for lots which increased vales above their starting value ($0.1). This proposition certainly holds for Adelaide and Perth where a number of lots received no bids. It is less clear that it holds in Sydney, Melbourne and Brisbane where the existence of unsold lots might relate to eligibility problems towards the end of the auction. However, demand at 800MHz exceeded supply and this was seen by much higher prices achieved and the fewer number of unsold lots (with the exception of the major lot in Melbourne).
- Recognition by players of the above escalation effects in bidding strategies could have reduced prices paid. Two of the "true" bidders (Telstra and Vodafone) appeared to recognise this escalation effect of cross band bidding and temporarily reduced the number of lots they demanded. However, this was insufficient to stop value escalation and required one of the other two bidders to realise what was happening. It is suggested by the authors that if one of these bidders could have also reduced their demand temporarily, this would have prevented escalation until the strategic intentions of the bidder(s) bidding in both bands had been clarified. This would have required them to also cross band bid to retain eligibility (e.g. Vodafone in fact did this)

The disparity in prices between lots in the 1.8GHz and 800 MHz bands reflects number of factors including the difference in propagation parameters, which impacts on the network infrastructure costs. These factors are:

- Supply factors: Carrier frequency: the higher frequency of 1.8GHz would normally be expected to be cheaper per MHz and one would expect the 5MHz lots to be at least twice the value of the 2.5GHz lots. This would explain a factor of 4 difference alone.
- Demand factors: 800MHz spectrum attracted greater competition in the cities as can be seen so there will be price escalation where this competition occurs.

5. Conclusions

There is now both a strong theoretical background and practical experience to support the multiple round simultaneous ascending auction process as, the most efficient method of allocating spectrum rights where there are multiple interdependent lots to be allocated. The experience with the Australian PCS auctions and the process supports this conclusion for allocation. However, the remaining problem is the process of deciding which bands should be auctioned, how much spectrum and what pre-auction intervention in the rules on players is required. For example, the only significant new spectrum licences have emerged in the bands where the three incumbents were prevented from bidding. This suggest that similar restrictions should apply in future auctions.

In the case of the PCS auction the most of the bidders were able to achieve their desired licence aggregation, whether nationwide or confined to one particular area with the exception of AAPT, Hutchison and OzPhone regarding 800MHz who will likely be involved in post-auction trading. Price variability was evident in a number of areas, particularly in the larger markets of Sydney and Melbourne, and was predominant in both bands. Some areas however experienced little or no price variability between bands, for example, in Darwin.

- While there are many alternative definitions for "efficiency" where some options are: ?The time taken to complete the process ?The complexity of the allocation process ?The avoidance of appeals against decisions administratively allocating spectrum?The degree of certainty for players desiring to acquire spectrum? ?Economic efficiency in placing a market value on the spectrum?

The following conclusions assume the time taken as the measure and cannot assume at this stage that there will be no legal delays.

Some of the specific conclusions to be drawn from this auction are:

i. The simultaneous auctioning of two separate bands leads to cross band bidding to disguise bidding objectives and so in part defeats the intention of the eligibility/minimum bid rules of the auction process. It does however, increase the bidding activity and potentially increase prices. Although both bands were for "equivalent use" for mobile/PCS, they were quite different from a business/technology perspective.
ii. The existence of fixed links in the 1.8GHz band in different lots did not impact the bidding strategies of players to any degree and all 18 bands were seen as equivalent. Even the technical desirability of achieving maximum efficiency through having concatenated bands does not seem to have been paramount. However, it remains to be seen whether there will be any trading between successful bidders in the 1.8 GHz band
iii. The restriction on Telstra at 800MHz to only be able to bid in bands 3 and 4 also helped to disguise bidding strategies and is a likely contributor to pushing up the prices in bands 3 and 4 paid by Telstra.
iv. The auction was very efficient in the allocation of a large amount of spectrum across Australia. However, when the total elapsed time is considered including the time to finalise the rules before the auction, the overall efficiency is more debatable.
v. The values for spectrum paid through this auction process was of a similar order to that being paid for the spectrum under the administrative process.

We believe that the government's objectives: independent spectrum allocation and the promotion of new infrastructure competition were achieved. However apart from Catapult acquiring 2 of the 162 licences at 1800MHz, no new operators acquired 1800 MHz licences at the auction in May. At 800MHz Telstra is dominant, holding 40 of 62 licences allocated, with 3 new licensees sharing the remaining 22 licences. And Telstra has now announced its clear intentions to overlay a digital (CDMA) network on its analogue AMPS infrastructure.

In conclusion, the PCS spectrum auction process was both effective from the point of view of the Government in allocating spectrum and a success for the industry in seeing both incumbents and new players receiving sufficient spectrum for their respective business needs.

6. References

Coutts, R. (1993) "***Spectrum Management in the Digital Age: Problems and Perspectives***" CIRCIT Seminar, Melbourne, November 23, 1993.

Coase, R. H. (1959) " ***The Federal Communications Commission***" J. Law Econ., Oct 1959, 2, 1-40.

Coase, R.H., Meckling, W., & Minasian, J. R. (1963) "***Problems of Radio Frequency Allocation***" unpublished study, Rand Corporation, May 1963.

Nelson, S. Rogers, D & Coutts, R. (1996) "***Wireless Personal Communications: An Australian Perspective***" Centre For Telecommunications and Information Networking -- Discussion Paper. June 1996.

Australian Communication Authority(ACA) (1998) ***"Spectrum Licence Allocation 800 MHz and 1.8 GHz Bands. APPLICANT INFORMATION PACKAGE."***

Stephen Nelson (1997) "***An Analysis of the Australian 500MHz Auction***", Communications Research Forum 1997, Canberra, 2-3 October 1997.

Coutts, R. Nesterov, S(1998) "An Analysis of the Australian PCS Auction", CTIN Public Domain Report, September 1998, http//www.ctin.adelaide.edu.au

Return to Top View Full-screen

Internet Connectivity: Commercial Expansion, Open Competition and Vertical Integration

Bernadette Jew, Rob Nicholls and Michael Reede

Gilbert & Tobin, Australia

ABSTRACT

Not Available

View Full Text

GILBERT TOBIN

LAWYERS

Internet Connectivity: Open Competition in the Face of Commercial Expansion

1 Introduction

The Internet could be considered a carrier's worst nightmare or, perhaps, a dream come true. It poses a potential competitive threat for every provider of telephony, broadcasting and data communications services, since it is substitutable for all existing media. At the same time, Internet-related businesses are substantial customers of existing telephony, broadcasting and data companies.

The shift from circuit-switched to packet-switched networks requires a new approach to interconnection - not just because the Internet is fundamentally different from other communications technologies, but because it presents new cost structures and revenue opportunities. For example, the Internet exploits every weakness of the traditional telephony carrier: motivating end users to stay logged on all day, and tying up a carrier's fixed assets without yielding incremental revenues; and substituting e-mail for potential long-distance voice traffic that would otherwise pay for the carrier's fixed costs of infrastructure. From a revenue perspective, however, the Internet not only creates alternate distribution channels for pre-existing content but, more importantly, it permits the delivery of new and hybrid forms of content – with the divergent values attributed to various kinds of content presenting yet another challenge to the traditional interconnection model.

The maturing of the Internet and the dynamics of Internet interconnection are quite different to the dynamics encountered in other industries that have been established according to normal commercial structures. The culture and structure that defined the Internet's early development are still major influences on the industry. Many of the current contentious issues relating to Internet interconnection arise out of principles and solutions which were acceptable for a nascent structure supporting non-commercial applications, but which are no longer appropriate in a mature commercial industry.

Internet interconnection is currently in a state of turmoil throughout the world. Internet backbone providers are no longer prepared to remain bound by Internet interconnection arrangements which fail to take adequate account of associated infrastructure costs – costs which are growing exponentially with the increased demand for bandwidth-hungry applications. At the same time, aggrieved Internet service providers (ISPs) have now come to expect free access to the Internet backbone, and are claiming that the refusal of Internet backbone providers to make available settlement-free peering to ISPs on an ongoing basis is "discriminatory".

As a consequence, the rules for Internet interconnection are still in the process of being worked out – and in this uncertain environment, Internet interconnection is an inherently risky business. The new technology presents its own interconnection complexities, with multiple layers of virtual networks built one over the other - so that an operator at any layer of the infrastructure will have its costs determined by the prices charged by the virtual network below it, while its prices, in turn, will determine the cost structure of the layer above. Furthermore, while commercial principles would suggest that money should flow towards those operators which produce value, this does not always happen in practice (a hangover of the historical expectation that Internet access should be free for all). The uncertainties of the environment are aggravated by the fact that there is currently no consensus on the issue of how to attribute "value" to the various elements of Internet interconnection.

The industry is still working through the basic, and yet daunting, task of determining the optimal set of Internet interconnection arrangements. As this development unfolds, regulatory authorities are faced with the question of whether an unregulated market can provide a "socially optimal" level of interconnectivity at an acceptable cost – and if not, what forms of regulation are required? An additional element in the equation is the burgeoning growth of vertical integration and vertical partnerships, which create further potential for regulatory intervention in an industry which has experienced spectacular growth and innovation to date without the constraints of regulation.

While carriers have been busily working out how to re-dimension their Public Switched Telephone Networks (**PSTN**), Internet protocol telephony has grown to the extent that it looks likely to replace the PSTN in many situations. Accordingly, Internet interconnection presents one of the major challenges for the telecommunications industry over the next ten years - and the industry's response to that challenge will be crucial to its future competitiveness and growth.

2 The need for interconnection

At the heart of all networks is interconnection - the ability of one entity to connect to other entities. This is particularly so in relation to the Internet, where interconnection is the glue that holds the "network of networks" together. The objective of global connectivity has not always been a feature of the Internet – initially, the sole purpose was the sharing of remote computer resources among as many sites as possible. Global connectivity only became a possibility as ever-increasing numbers of individual networks connected to the Internet. However, we have now reached the stage where each end user connected to the Internet has the expectation of global connectivity to all other end users connected to the Internet.

There are many alternative interconnection arrangements in the layered structure of the Internet that can result in full connectivity among end users – encompassing a mix of direct connections, transit traffic, public exchanges, private exchanges, "multi-homing" and international connectivity. Full connectivity does not require all networks to establish business relationships with one another, but rather that the matrix of interconnections throughout the industry enable all end-users to reach one other through seamless connectivity among the millions of routers, services and users.

The optimal degree of interconnection can only be achieved if those interconnection arrangements do in fact reflect the actual costs associated with interconnection. Interconnection charges which bear no relationship to the actual costs associated with interconnection will inevitably create distortions in the market, with potential risks ranging from heightened barriers to entry (and the lessening of competition) to the undermining of incentives for investment in infrastructure.

This paper canvasses the practical, economic and regulatory factors to be taken into account as the Internet industry works towards identifying and achieving that optimal degree of interconnection.

3 background to current Internet debate

It is essential to view the Internet interconnection debate in the context of the evolution of the Internet - from an academic, non-commercial facility to a commercial tool characterized by exponential growth. The Internet was not designed with commerce in mind, but simply began to assume a commercial role once commercial organizations recognized the enormous benefits that it could deliver:

- The growth of the Internet was originally driven by the goal of Internet engineers to make the network function as widely and as quickly as possible, with the limited objective of sharing remote computer resources among as many sites as possible.
- Before the Internet "went commercial", it merely presented an opportunity to sell leased lines to academic institutions. Applications by end-users were largely non-commercial, and were more in the nature of gadgetry than the part-lifestyle, part-commercial applications that characterize it today.
- As the Internet became more widely available and used by companies and individuals, the prime opportunity for carriers became the provision of bandwidth, with little indication of the commercial explosion that was to follow.

3.1 Commercialization of the Internet: changes in usage, utilization and infrastructure requirements

It was not until about 1993 that the Internet began to move from the non-commercial model towards the Internet model that we know today. The number of users grew exponentially as more and more people started to notice the attractiveness of what looked like, if not a free lunch, then something close to it. This was accompanied by dramatic increases in capacity utilization levels due to the type and volume of data accessed (reflecting the increasing demand for bandwidth hungry applications), as well as an increase in the average capacity requirements of customers (who were simply spending far more time on the Internet). Furthermore, the World Wide Web created a split between the end users (who import data) and content companies such as Web hosting firms (who are data exporters), resulting in major traffic imbalances.

As a result, the costs of Internet backbone providers increased, and are continuing to do so, not only due to the need for upgrading capacity, but also as a result of the shortening of capital investment cycles in network upgrades - from 24 months to periods approaching 6 months. Internet backbone providers are now facing the need to find ways of increasing their infrastructure, while at the same time their more profitable base of private networks is beginning to erode as the corporate world exploits the cost advantages inherent in hybrid Internet applications such as intranets.

3.2 Current interconnection "problems" once provided the perfect solution

The failure of many Internet interconnection arrangements to take adequate account of infrastructure costs is therefore a reflection of the historical perception that the Internet is "free". It is also a reflection of the fact that Internet usage, utilization patterns and infrastructure demands were quite different during the early stages of Internet development. In the early days, Internet backbone providers and ISPs generally swapped traffic freely – since early Internet applications like file transfer protocol led to more or less symmetrical traffic amongst them. The capital costs of infrastructure were comparatively moderate, with there being an adequate amount of "slack" in the average usage of each bit pipe. Furthermore, no-one was trying to make a profit.

In addition, routing practices which are problematic today were perfectly acceptable in the past. For example, the technique known as "shortest exit routing" (sometimes described as the game of "hot potato") was perfectly appropriate when traffic flows were comparatively low, but creates problems in the current environment:

- Shortest exit routing means that data goes onto the receiver's network at the earliest point. This approach saves the sender ISPs the costs associated with bandwidth, since they are able to reduce the bandwidth costs associated with hauling data to the point closest to the customer, and instead pass that burden to the Internet backbone provider at the earliest point. This practice may even involve an ISP linking one of its own subscribers to another of its subscribers via a backbone provider, rather than directly via its own links.
- Shortest exit routing works to the advantage of an ISP where it connects with a

backbone provider on an SKA peering basis and traffic flows are asymmetrical (with the ISP sending more traffic than it receives). Because the ISP is not required to pay for traffic sent via the backbone network, it has every incentive to offload data onto the Internet backbone at the earliest possible point – without being required to carry an equivalent volume of the Internet backbone provider's traffic via its own network.

- By comparison, the dynamics are quite different where an ISP connects to the backbone provider under a settlements arrangement, as the ISP has an incentive to retain data on its own network for as long as possible where the costs associated with off-loading that traffic onto the Internet backbone provider's network are higher in comparison.
- When networks were all roughly the same size, the game of "hot potato" was treated as a simple reality of Internet provision. However, traffic flows and volumes have changed over time so that there is now both a traffic and cost imbalance between networks that supply connectivity to content sites (and are net exporters of data) and those networks with many subscribers that request the data (which flows over their own provider's network). These imbalances have now reached such a scale that shortest exit routing is no longer appropriate. It imposes severe capacity demands and burdens on the performance capabilities of Internet backbone providers, having a significant effect on the ability of backbone providers to recover the costs of their investment in infrastructure.

In summary, it is not so long ago that many of today's "problems" provided a viable solution within the limited parameters of the non-commercial Internet – with the added attraction of being easy to implement. However, usage of the Internet has subsequently altered so drastically that such practices are no longer sustainable in a commercial environment. As a result, we are now on a collision course between the spiraling bandwidth consumption of users, and the expectation on the part of ISPs of an entitlement to free Internet interconnection.

4 the distinguishing features of the Internet

In any consideration of Internet interconnection, it is essential to identify the distinguishing aspects of the Internet – given that many of the assumptions and business models that have been applied to traditional telecommunications interconnection arrangements will fail to deliver viable commercial results on the Internet.

4.1 Absence of end-to-end circuits

As noted at the outset, the Internet is based on packet-switching, with there being no dedicated connection – the data is broken up into packets which may be delivered via totally different routes over the Internet, and reassembled at their ultimate destination. There is no limit as to the number of networks which a packet of data may transit before it reaches its destination. This is in stark contrast to the traditional telephony networks, which switch or assign a dedicated end-to-end circuit for every call – and are able to charge on the basis of minute-by-minute and circuit-by-circuit.

4.2 US-centric industry

Another key feature of the Internet is that it is US-centric. This is partly a reflection of the fact that the Internet initially started as a national US network, and partly because the US is the source of the world's most popular Internet content, and the pre-eminent cultural influence as globalization becomes a reality. Today, half of the Internet's users and 58% of all content hosts are based in the United States. While this situation will inevitably change over time, non-US backbone providers are currently exhibiting some impatience with the costs entailed in acquiring substantial international capacity to and from the US. Non-US networks were initially happy to pay for both ends of the transoceanic circuits required to connect to US backbones, but now claim that this practice requires them to effectively subsidize US Internet users (to the extent that US users are using those same links to access content outside of the US). Allegations of discrimination have been referred to the International Telecommunications Union, amongst other international bodies.

4.3 Layered nature of the Internet industry

In the context of interconnection, a key feature of the Internet is the layered nature of the Internet industry - with the "backbone cloud" comprising a series of Internet backbone networks which provide the base layer of the infrastructure. The layer in which an entity operates within the industry will inevitably determine that entity's position within the Internet food chain. The lower down in the chain, the more an entity will find that those above can raise prices or do other things that will affect its cost of operation.

The layers of the Internet industry can be described generically as follows:

- An Internet backbone is generally a national backbone (or in the US, it may one of the four super-regional backbones, Cable & Wireless, Sprint, UUNET or AGIS, which between them account for at least two-thirds of the backbone connections in the country). Each Internet backbone is an over-arching network to which multiple national and regional networks connect, and which generally does not service directly any local networks or end users.
- There will often be a series of networks "hanging off" each Internet backbone (ie: connected to the backbone by way of fiber optic cable). These networks are generally operated by large ISPs utilizing the Internet backbone infrastructure constructed by the telecommunications carriers. These large ISPs are able to interconnect with each other and direct traffic between their respective networks, with traffic only being directed over an Internet backbone where it is necessary to access another Internet backbone or any network linked to another Internet backbone. While these large ISPs have a national presence, they are not treated as full peers to the Internet backbone providers.
- The large ISPs provide Internet access in turn to the regional ISPs (which construct regional networks through leased lines).
- The regional ISPs provide Internet access in turn to those ISPs which have no

investment in leased lines, and which simply resell Internet access direct to the end user.
- Online service providers also utilize this infrastructure for the purpose of supplying value-added services. They do not derive revenues by reselling network transmission services, but rather by offering proprietary content and specialized commerce, selling advertisements, and providing users with the ease-of-use which comes from special software interfaces and customer hot-lines.

At the retail level, Internet access is supplied as a bundled service in the form of online services together with such other additional services as:

- Internet connectivity services, including support of various connections to customers (PSTN, ISDN, E1, Microwave etc);
- online functional products including, in particular, email functions, browser software and other software products;
- cache for the temporary holding of accessed web pages; and
- technical support and billing functions.

The industry is not settled on what constitutes a full Internet backbone provider, as compared with a large ISP and other layers or classes. This is a consequence of the fact that the dynamics of the industry are continually changing as networks mature at a rapid rate. Furthermore, Internet backbone providers can, and frequently do, choose to acquire the skills needed to offer Internet provider services, thus becoming ISPs themselves. However, for the purposes of this paper, the reference to an Internet backbone provider indicates an entity in its capacity as the supplier of Internet infrastructure at the backbone layer of the industry.

4.4 Importance of the backbone layer

All industry participants are beholden to the Internet backbone providers – it is by virtue of the quality and scale of their infrastructure that all other interconnecting parties prosper. By way of example, if Carrier A (a small regional ISP) interconnects with Carrier B (a large ISP) which in turn relies on the infrastructure provided by Carrier C (a backbone provider), the upper limit of Carrier A's service quality will be determined by the quality of Carrier C's infrastructure. Thus the backbone provider determines the quality of carriage services ultimately delivered to end users. Indeed, it is the quality of infrastructure that has attracted ISPs to interconnect in droves with Qwest in the USA.

Because of the significance of the backbone layer, the continuing growth and innovation of the Internet industry is dependant on the age-old dilemma of achieving the appropriate balance between:

- encouraging competition at the backbone layer in order to provide the impetus for backbone providers to deliver innovative and price-competitive Internet services, and so

- facilitating greater connectivity and increased competition at the ISP layer; and
- retaining incentives for ongoing investment in the Internet backbone infrastructure, which is crucial to the ability of the industry to meet the exponential increase in demand for bandwidth-hungry applications.

4.5 Relevance of industry layers to interconnection

The layer in which an entity operates is also relevant to the issue of an entity's ability to interconnect with other networks, ie: the criteria for interconnection turn on the extent to which a network is able to provide equivalent network services on a reciprocal basis to another network. A network operating somewhere down the chain is unlikely to be able to provide services of equivalent value to an entity operating at the backbone layer.

Wanting to have some degree of direct control over their own fate, many ISPs have tried to connect at the Internet backbone layer of the Internet hierarchy. This is one of the reasons why there has been such a heated response to the recent moves by five of the largest backbone providers in the United States to move away from public exchange points to a series of private interconnects (and so place themselves in a new hierarchy above the 40 to 50 ISPs at the public exchanges). ISPs are concerned about the additional costs incurred as a result of the shift away from SKA peering to settlements interconnection arrangements. They also resent the fact that such a move results in their rejection from the backbone layer of the industry, so that they are delegated to the status of "customer" - a full-fledged downstream reseller of the Internet backbone provider - with possible flow-on effects in their interconnection arrangements with other Internet backbone providers.

5 a collision course: peering v Internet explosion

There will inevitably be tensions between the economic incentives driving the various industry participants in their interconnection dealings. For example, an Internet backbone provider will be looking for a return on investment in bandwidth and other network infrastructure. By comparison, ISPs will instead be seeking to minimize their incremental costs of transmission by utilizing the infrastructure provided at the Internet backbone layer to best advantage.

5.1 SKA peering or no-settlement peering – the status quo

Up until recently, interconnection on the basis of SKA peering or no-settlement peering was the accepted status quo arrangement for Internet interconnection - largely due to the non-commercial and homogenous genesis of the Internet. While the term "peering" is sometimes used generically to refer to Internet interconnection, the term refers more correctly to an interconnection arrangement with no financial settlement whereby:

- no money exchanges hands regardless of the volume of traffic or level of connectivity exchanged among providers - in contrast to the voice telephony business, which

- provides a well-established system of settlements;
- traffic is effectively exchanged under a barter arrangement – each network agrees not to bill the other network on the understanding that the value of the network services which the other network is willing to supply equates to the amount which that network would otherwise have billed;
- while different bits of the message are likely to travel by different routes, the only cash payments are from the end-user to the ISP (usually in the form of a fixed monthly fee) and from a particular ISP to the nearest high capacity backbone node (normally in the form of a capacity rental payment); and
- because each network collects and retains all fees derived from its downstream subscribers and customers, this model is also referred to as a "sender keep all" or a "bill and keep" arrangement.

5.2 SKA peering – simply a billing arrangement

However, while peering is simply intended to provide a means of simplifying the billing administration in circumstances where networks are providing equivalent services on a reciprocal basis, peering has in many instances been adopted blindly – either because of precedent, technological difficulties in implementing any kind of alternative billing and payment arrangements, or possibly due to regulatory intervention (as has been the case in Australia). As a consequence, peering has come to be seen as an end in itself and to drive the economic imperatives, rather than simply providing an administrative outcome for a certain kind of interconnection arrangement.

5.3 SKA peering – the need for equivalence

Peering only makes sense only where the costs and benefits of allowing reciprocally "free" access are equal. An SKA peering interconnection arrangement contemplates that the "peers" will be of roughly the same size—recalling the traditional sense of the word. Brock has argued that there are two conditions necessary for SKA peering to be viable. These are:

- that the traffic flows should be roughly balanced between interconnecting networks; and
- that the cost of terminating traffic should be low in relation to the costs of measuring and billing for traffic.

In practice, the criteria applied have in many instances been far broader than Brock suggests. The notion of "similar size" has been determined not only by traffic flows and backbone capacity but also by numbers of customers, the services and content able to be accessed via a particular network, the geographic reach of connectivity, and various other factors which networks have chosen to recognize as a basis for the free exchange of traffic.

5.4 Consequences of blindly adopting SKA peering

Inevitably there will be some subjectivity in the decision by an Internet backbone provider as to whether or not to peer with another entity. For example, greater geographic coverage may be a determining factor which results in one network being prepared to value the benefits derived from interconnection with another network as being equivalent. Similarly, an ISP with a very large client population within a limited geographic locality may provide significant value to another network.

Fundamental economic problems have arisen as a result of the adoption of peering interconnection arrangements between networks which have disparate capital investment and which offer disparate value to each other. Where SKA peering has been adopted between networks which are not "peers" in the true sense of the word:

- it has resulted in costs being incurred by the Internet backbone provider, since the smaller player which is not investing in building national or international infrastructure inevitably derives greater benefit;
- ISPs with no investment in the building of national infrastructures and which are unable to offer equivalent value to backbone providers have come to rely on an "entitlement" to peering – thus ensuring that their traffic is transported across the global Internet at no cost other than the coordination costs to arrange interconnection agreements; and
- it has meant that Internet backbone providers are not always fairly compensated even if the amount of traffic exchanged is equal – given that Internet backbone providers are forced to carry traffic further along their networks than the ISP (due to ISPs using the shortest exit routing or "hot potato" routing referred to in paragraph 3.2 above).

5.5 Impact of SKA peering on long term investment in infrastructure

As with mobile communications, this skewed model of connectivity has allowed the network to develop rapidly. However SKA peering provides no real platform for organic growth: revenues are required in order to finance the large network upgrades and increased capacity from which all networks derive benefit - be they direct downstream ISPs, customers or peers. Firms that have committed to major infrastructure investments have little to gain from interconnecting with smaller networks unless they are adequately compensated for the network services provided.

ISPs who seek peering arrangements with large backbone providers may benefit in the short term, since it enables them to avoid any settlement charges. However, when peering provides a disincentive for the backbone provider to build infrastructure, and ISPs are relying on that infrastructure for their Internet access, then the long-term benefits to ISPs and their customers are put at risk – the quality of network services will inevitably suffer if there are no incentives in place for the backbone provider to continually upgrade and expand its infrastructure.

As argued by Farnon & Huddle, continued growth of the Internet depends on the development of an alternative to the SKA peering model. Companies which have committed to major infrastructure investment are increasingly reluctant to interconnect with smaller networks because of the inevitable inefficiencies and burdens on their backbone performance arising from the SKA peering arrangements.

5.6 Analogy with traditional telecommunications interconnection principles

The principle that a network offering Internet backbone infrastructure should be entitled to charge a higher price for interconnection than an ISP, reflecting the value of network services offered, is no different to that adopted in traditional telephony interconnection arrangements. In telecommunications we have seen the use of reciprocal arrangements in respect of terminating calls in order to eliminate differences between internal and cross-network prices and to mitigate the advantages of monopoly. However, the relative network size is still taken into account in determining the structure of component prices. A relatively larger network still charges more than a smaller one for outgoing calls under such a reciprocal arrangement, due in part to the fact that origination fees increase as the originating network gets larger - because a large network, given its size advantage, commands a higher percentage of the revenue from outgoing calls.

6 Us developments: break away from peering

Approximately three years ago the big five Internet backbone providers in the United States established criteria for SKA peering. Since then, between 15 and 20 national ISPs have met the criteria – far more than ever imagined possible. This has placed a strain on the peering relationships between US networks, particularly as the traffic of the large Internet backbone providers has become considerably larger than that of their counterparts or "peers".

In the face of the emerging collision course between peering and the ongoing requirement for expansion in infrastructure, some US Internet backbone providers took the drastic step in 1997 of refusing to renew many of their previous peering arrangements. They transitioned their peering arrangements away from the large public exchange points in favor of setting up direct interconnections with other networks – allowing improved levels of service in the technical aspects of interconnection.

As a result of these developments, peering grew more prevalent as between ISPs themselves (both nationally and on a regional basis), and was boosted by the creation of more local network access points – a logical outcome of the incentives which ISPs now face in developing new efficiencies, since they can no longer rely on free access to the Internet.

6.1 Chain of events

AGIS was the first Internet backbone provider to unilaterally terminate peering arrangements in 1996. MCI subsequently terminated its connection to the Central Internet Exchange (CIX) in February 1997, ending peering to several ISPs. In the meantime, Sprint began a policy by which its peers would have to pay in declining amounts, according to the number of exchange points where they conducted peering.

However, the case which received the most attention was that of UUNET, a subsidiary of Worldcom (and perhaps the largest Internet backbone provider in the world), which declined to renew peering agreements with a number of ISPs as from May 1997. UUNET stated that it would no longer accept peering requests from other networks whose infrastructures would not allow the exchange of similar traffic levels. In essence UUNET believed that shortest exit routing was requiring it to provide national and international data transport, as well as connectivity and support services, to companies that could not provide similar services in return.

UUNET even went so far as to tell the Federal Networking Council that it would no longer continue to offer the government "charity" connections and that government networks which had been getting cost free peering would now have to pay for the privilege of their connectivity.

UUNET's move was based on recognizing the true nature of the relationship between UUNET and its customers. In one instance, the public shake-up resulted in the dismissal of a network executive, David Holub, then-president of Whole Earth Networks Inc. Holub subsequently posted a public message on the North American Network Operators Group (NANOG) e-mail discussion list arguing that UUNET's refusal to peer was anti-competitive and possibly illegal. Holub argued that Internet interconnection is analogous to telecommunications carrier interconnection, and that access should be regulated on the grounds that "universal reachability" of networks is in the public interest - and that this regulation should extend to mandating public disclosure and regulatory approval of terms.

Holub presented a solution for state public utility commissions (PUCs) to regulate Internet peering arrangements, and require disclosure to prevent discriminatory practices. PUCs are allowed to regulate interconnection agreements among interexchange carriers and local exchange carriers under section 251 of the *Telecommunications Act* 1996 in cases when the market players cannot come to an accord. However, while Holub would like to argue that the *Telecommunications Act* applies on the basis that Internet interconnection is analogous to telecommunications carrier interconnection, it is generally accepted that Internet backbone providers and ISPs are not classified as common carriers under the Act when they provide Internet services using the packet transmission service of a common carrier affiliate - such offerings constitute "information services" under the *Telecommunications Act*.

In addition to the disputes between Internet backbone providers and ISPs, a further battle has emerged between the backbone providers and major content providers (web farms). Essentially, the web farms have sought to argue that because they provide content which is in high demand, they are entitled to interconnection on a peering basis with the Internet backbone providers.

7 Alternative models to peering – financial settlements interconnection arrangements

It is now becoming common practice for Internet backbone providers to implement a financial settlement system with ISPs that accounts for the use of each other's facilities for "transiting" traffic. A number of alternative settlements models are now emerging, along with more traditional telecommunications interconnection regimes. Such arrangements require that the parties determine a fair and reasonable charge for interconnection – as compared with SKA peering which simply mandates interconnection for free, often without recognition of the underlying value of the network services provided by each party. Furthermore, settlements arrangements provide far greater flexibility, facilitating asymmetrical payment arrangements where appropriate in order to reflect the comparative value offered by each of the interconnecting networks.

The flexibility inherent in such fee-based interconnection arrangements enables Internet backbone providers to enter into interconnection arrangements without losing the ability to be fairly compensated for their infrastructure costs and ongoing network expansion. Accordingly, such interconnection arrangements have the potential to promote a greater level of interconnection in the long term than would otherwise be the case – and to deliver an optimal level of Internet connectivity.

In effect, we are moving towards a tiered pricing structure encompassing the full range from retail one-way charges to symmetrical settlement charges to asymmetrical settlement arrangements to peering.

7.1 Practical implementation

In practice, many of the downstream ISPs acquiring connectivity on a settlements basis do not pay based on their actual usage, bit by bit, but based on a usage profile. This is because the costs and practical difficulties associated with metering every data flow simply outweigh the benefits – particularly given concerns that the use of technology required to measure exact usage could adversely impact on the speed and quality of the Internet service delivered. However, this usage profile should be distinguished from the alternative "accounting rate" approach which is not cost-based and is inevitably arbitrary, bearing little relationship to traffic levels and the level of network services provided. The latter approach simply serves to aggravate the business instability which is already prevalent in Internet interconnection arrangements.

There is also considerable diversity in the various settlements arrangements implemented, due to added complexities arising from the fact that there is no uniformity as to which way a settlement should go in the case of a traffic imbalance: ie: whether the parties should adopt a "sender pays" or a "receiver pays" approach.

8 risks associated with breaking away from peering

Interconnection is absolutely crucial to the operation of the Internet – more so than for any other network-based industry, given the absence of end-to-end circuits. The delivery of an item of data over the Internet depends on negotiating the successful delivery of each separate packet of data via a complex and potentially chaotic web of interconnections between networks. However, despite the enormous technical challenges posed by connectivity on the Internet and the potential for chaos, full global connectivity has now become a reality through seamless connectivity among millions of routers, services and users. Furthermore, it has been achieved in a largely unregulated environment.

Having overcome seemingly insurmountable technical obstacles to Internet interconnection, it is the age-old economic and regulatory problems which now pose the greatest threat to the expansion of connectivity on the Internet, as regulators are called upon to intervene in the myriad of disputes arising as a result of the break away from SKA peering interconnection arrangements.

8.1 Regulatory concerns

The shift away from peering has, not surprisingly, drawn cries of protest from affected ISPs which had previously operated very profitable businesses based on the arbitrage opportunities arising from:

- peering with Internet backbone providers in order to obtain Internet access for free; and
- like foreign exchange arbitrageurs, extracting revenues at the time of on-supplying access to the Internet to smaller ISPs.

However, notwithstanding the protest of ISPs, it is widely acknowledged that:

- interconnection arrangements have not adequately reflected the actual costs of interconnection in the past;
- the arbitrage opportunities presented by peering resulted in there being little incentive for ISPs to look for efficiencies in the aggregation of traffic or to deliver value-added products and services to their customers; and
- while ISPs resent being delegated to the status of customer, any network will inevitably be a customer of another network within the layered structure of the Internet, and so unable to control its fixed costs, unless it is a very large network with enormous capacity and is upgrading continuously (in which case it will qualify for peering with another very large network).

Having said this, there are still very real risks that the shift away from peering will attract the attention of regulators, with the following scenarios likely to ring alarm bells:

- The mere fact that Internet backbone providers are in a position to substantially increase the charges imposed for Internet access, with the accompanying power to withhold connectivity to a portion of the market, is of itself sufficient to raise concerns as to the possibility of a degree of market power being vested in Internet backbone providers.
- In the case of a vertically integrated backbone provider, the move away from peering can very easily be interpreted as an attempt to put a "financial squeeze" on the Internet backbone provider's competitors at the ISP layer of the industry.
- Concerns may arise as to possible collusion amongst the "club" of large Internet backbone providers, based on the assumption that there is no incentive for them to allow any emerging Internet backbone provider to enter the club. Such concerns do, however, indicate a lack of understanding of the commercial imperatives which are associated with peering. Any agreement to peer with an additional network of a comparatively similar size can only add to the value of the existing networks within the "club", since it provides those networks with increased connectivity and access to a greater range of network services – as compared with the desire to keep the smaller networks out of the club on the basis that they are perceived to "free ride" without providing any value to the existing networks within the club.
- Concerns may arise in relation to the imbalance in power between an Internet backbone provider and an ISP, such that the Internet backbone provider is in a position to absolutely refuse to recognize the (albeit lesser) value provided by the ISP, given that the ISP has a greater need for connectivity to the backbone provider than vice versa.
- Finally, even if a regulator is prepared to accept that a particular ISP does not bear a complementary cost in terms of network resources, the mere fact that the revoking of a peering arrangement could result in the affected ISP being hurt more than the Internet backbone provider is a disparity which could give rise for concern on the part of regulators.

8.2 Possible market power vested in Internet backbone providers

Regulators may wish to take a closer look if an Internet backbone provider becomes very large, given the concerns that this could ultimately result in a greater number of other Internet backbone providers and ISPs:

- becoming more beholden to that Internet backbone provider to carry their customers' traffic than that Internet backbone provider is by comparison to them; and
- being forced to accept Internet services on whatever terms that Internet backbone provider chooses to offer, or run the risk that a large proportion of their customers will not have connectivity to the customers of that Internet backbone provider. The result could be a loss of value in the services which they are supplying to customers, due to limitations in the connectivity which they are able to offer.

The potential outfall of the break away from peering is therefore likely to give rise to concern on the part of the regulators, since the competitiveness of the backbone layer of the Internet is crucial to the competitiveness of the entire Internet industry. A lack of competitiveness at the backbone layer would enable Internet backbone providers to charge above cost, with little incentive to invest in network expansion and upgrades, and would impact adversely on the price and quality of services delivered to end users.

Concerns have been expressed as to the control vested in large Internet backbone providers - particularly in the United States where the larger Internet backbone providers are going through a period of consolidation, both in terms of business rationalization and by merger. Internet backbone traffic is being concentrated into the hands of fewer and fewer organizations and, while the MCI-Worldcom merger focused on the issues of peering arrangements, it did not set any ground rules or guiding principles in this area.

However, the potential for a lack of competitiveness at the backbone layer is in fact far greater in those regions which are still in the start-up stages of infrastructure development. This is due to the propensity for incumbent telecommunications monopolies to refuse to recognize the value offered by new entrant backbone providers, and to use their market power to withhold interconnection to new entrant backbone providers on fair and reasonable terms.

8.3 Australian example: misuse of market power by incumbent monopoly provider

This exact scenario arose in Australia during 1997/98 with the incumbent telecommunications monopoly, Telstra Corporation, refusing to provide interconnection to the new entrant, Cable & Wireless Optus. This was despite the fact that:

- the new entrant had constructed a national ATM Internet backbone, with greater capacity and speed than that of the incumbent's Internet backbone;
- the new entrant had acquired substantial international capacity in its own right (a key element of any Internet backbone operation outside of the United States, particularly in Australia where at least 70% of all Internet traffic is international); and
- traffic levels between the networks were roughly equivalent.

The incumbent monopoly refused to enter into any form of interconnection agreement with the new entrant, insisting instead that the new entrant must become a customer of the incumbent in order to access content and customers via the incumbent's network. This entailed payment to the incumbent of $190 per gigabyte of data received, which was a bundled rate calculated to recoup the costs of both national and domestic traffic – despite the fact that the new entrant only sought access to the incumbent's domestic network. Furthermore, the incumbent refused to pay the new entrant on a reciprocal basis for access to content via the new entrant's network, despite the equivalent traffic flows between their networks.

A stand-off of some 15 months finally resulted in regulatory intervention in May 1998. However, the outcome of that regulatory intervention clearly illustrates the real dangers of the regulators "getting it wrong". The regulator mandated interconnection not only between the incumbent and the only alternative backbone provider in Australia, Cable & Wireless Optus – but also mandated that the incumbent must enter into interconnection agreements with two of the larger ISPs in Australia (which happened to be the only other entities which had lodged complaints with the regulator in respect of the incumbent's interconnection practices at that time). Neither of those ISPs had invested in the construction of their own infrastructure, and instead provided Internet services utilizing the infrastructure supplied by the Internet backbone providers. However, they managed to convince the regulator that they had equivalent status as Internet backbone providers, largely based on the fact that they had nodes in each of Australia's capital cities.

The arbitrary nature of the Australian regulator's decision is highlighted by the fact that there were, and still are, other ISPs operating in Australia with larger operations than those ISPs designated by the regulator as being entitled to interconnection at the backbone level. Ironically, one of the ISPs named by the regulator had not even acquired its own international capacity - despite the fact that international capacity is a key requirement in the supply of Internet services in Australia, since 70% of all Internet traffic in Australia is international. Instead, the ISP relied on the supply of international capacity by the Internet backbone providers, thus reinforcing its true status as a customer of the Internet backbone providers.

The Australian regulator has not disclosed the criteria which it applied in reaching this decision, thus adding to the considerable uncertainties which the decision has created in respect of both:

- the relationships between Internet backbone providers and those ISPs which *were not* included in the regulator's order; and
- the ongoing relationships between the Internet backbone providers and those ISPs which *were* named in the regulator's order, given that the size and scope of operation of those named ISPs is constantly shifting in comparison with that of Internet backbone providers and other ISPs operating in Australia – so that the regulatory intervention runs the risk of entrenching the status of the named ISPs in an environment which is constantly changing and evolving month by month.

9 difficulties faced by regulators – assessing value of interconnection

Any regulatory intervention in the area of Internet interconnection is fraught with difficulties, the most obvious being those associated with understanding a fundamentally new technology. However, even greater difficulties arise due to the uncertainties associated with attributing value to the various components of Internet interconnection, namely:

- broadband capacity and the other network features and services;
- connectivity (ie: the scope of reachability to end users); and

- other value-added services (including content and other value-added applications).

A fair price for interconnection is all about determining the relative value offered by each network to the other. However, this evaluation involves a number of added complexities in relation to Internet interconnection.

Regulators are no longer dealing with relatively similar networks which offer comparable capacity and speed, as in the case of PSTN networks. The technology and capacity incorporated in Internet backbones varies substantially, and there will inevitably be considerable differences in the quality of the network services, features and benefits offered by the respective networks – particularly in relation to the carriage of multi-media content.

Given the failure on the part of Internet backbone providers to take adequate account of the economics of Internet interconnection in the past, the principles for attributing value to various components of Internet interconnection are still being developed. The criteria applied in the past have been largely subjective (and may continue to be subjective for so long as Internet interconnection remains deregulated). For example, the notion of "similar size" in a network has been determined by traffic flows, numbers of customers, backbone capacity, the geographic reach of connectivity, the services and content that can be accessed via a particular network, and other factors which the networks have been prepared to recognize as a basis for the free exchange of traffic:

- greater geographic coverage might be the determining factor which resulted in one network being prepared to value the benefits derived from interconnection with another as being equivalent;
- a network might perceive that the significant content hosted by another network had the potential to add value to its own network to the extent that, while infrastructure investment was not equivalent, the overall value provided by each network to the other was nevertheless equivalent; and
- similarly, an ISP with a very large client population within a limited geographic locality might be considered to provide significant value to another network.

The uncertainties associated with the value attributable to each component of interconnection are aggravated by the lack of transparency in Internet interconnection agreements between networks. To date, little has been disclosed or, in fact, understood about the business model assumptions underlying and motivating interconnection arrangements. The only time when there has been any public discussion as to the dynamics involved and the business case assumptions underlying Internet interconnection agreements has been when disputes have arisen – so that inevitably there is only limited expertise, particularly amongst regulators, in evaluating the stakes involved in such a dispute.

Unfortunately, there is no industry consensus on these issues – and nor is there likely to be consensus in the near future. Any view adopted in relation to the values attributable to the various components of interconnection will inevitably be driven by the economic incentives of the particular industry participants. ISPs without investment in infrastructure will inevitably seek to bundle the components of interconnection and argue that each component should be accorded equal value in the interconnection equation. For example, an ISP which is able to offer connectivity to a large customer base, or access to highly popular content, will seek to argue that this equates to the value offered by another network with substantial investment in backbone infrastructure.

9.1 Value associated with connectivity

ISPs argue that connectivity (without routing and transport) should be settlement free. When a customer of one ISP communicates with a customer of another ISP or backbone provider, both customers benefit. Each customer pays for use of the network to which it is connected. The operators of both networks are paid by their customers, and there should be no further need for them to settle.

ISPs have sought to link the issue of connectivity with the price payable for access to the Internet, claiming that the removal of peering arrangements serves to impede the overall connectivity on the Internet and is therefore anti-competitive. However:

- while each ISP is able to offer increased connectivity to an Internet backbone (in the form of connectivity to the ISP's own customers), this does not of itself entitle an ISP to peering – there must be recognition of the disparate value between the network resources provided by the Internet backbone provider and the increased connectivity offered by the ISP;
- if the limited marketing expenditure required to develop a customer base is accepted as being sufficient to provide an entity with free access to a national Internet backbone, this will act as a serious deterrent for ongoing investment in infrastructure in the long term;
- the refusal to provide peering to certain ISPs does not prevent them from obtaining connectivity – it simply requires that they interconnect at a different point in the chain and pay the appropriate price for that connectivity. It is open to an ISP to negotiate such connectivity either:
- on a one-to-one basis - as a customer of the Internet backbone provider or another ISP, or via a settlements interconnection arrangement which reflects the disparate values between the networks; or
- on a many-to-one basis - by aggregating or peering its network resources with those of a group of similarly sized networks to create a single larger network with increased bargaining power, which is then in a position to jointly interconnect with the Internet backbone provider or a comparatively larger ISP; and
- the ease with which ISPs can aggregate their resources by interconnecting with other "peers" (whether on a regional or a national basis) is unique to the Internet, and results in the technology itself imposing its own constraints on any potential market power of

- Internet backbone providers - including in relation to their ability to withhold connectivity.

9.2 Value associated with content

Turning to the value of content, a dispute has arisen in the United States between major content providers (web farms) and major backbone providers in relation to the value attributable to content in interconnection arrangements – as illustrated by the highly publicized dispute between Exodus Communications Inc. (a publicly held company with net assets of nearly US$60 million) and GTE Internetworking. Exodus is a national web farm hosting such valuable content sites as USA Today and GeoCities, and had entered into a short-term peering agreement with GTE Internetworking. GTE Internetworking announced on 9 July 1998 that it would not be renewing that peering contract.

GTE Internetworking's strategy was based on the fact that peering no longer works in the case where an Internet backbone provider is faced with asymmetrical traffic flows from a web farm:

- Peering is based on the assumption of some form of symmetry – not in the exact number of bytes exchanged in each direction, but by an order of magnitude. Peering contemplates that both networks will strive to present equal value to each other. Furthermore, it is based on the assumption that both sender and receiver pay an equal share for traffic. The asymmetrical traffic flows destroy the assumption on which the Internet has so far been built, namely that both sender and receiver must contribute to support traffic costs. In this case, Exodus sent many times more bits to GTE Internetworking than were sent the other way, and these asymmetrical traffic flows imposed a heavy burden on the performance capabilities of GTE Internetworking's network.
- The burden on the backbone provider is aggravated when hot potato routing means that the content is immediately passed onto the backbone provider's network – resulting essentially in a "receiver pays" pricing model for the Internet. The only solution to this scenario is "best exit routing" (which involves imposing responsibility on the web farm to carry the traffic flow to an exit point closest to the location of the Internet backbone provider's customers, going some way towards restoring the symmetry which is destroyed by the web traffic) and settlement based peering.

In response, Exodus sought to argue that since it was a highly desired content provider, it was entitled to interconnection on a peering basis with large global backbones such as GTE Internetworking - despite a major imbalance in the traffic flows between the networks (estimated to be something in the order of sixteen to one). In effect, this amounted to a claim that Exodus should receive free interconnection because it provided content that GTE Internetworking customers would want to access.

If Exodus were to succeed in its claim, it would suggest that access to content either has surmounted, or is on the verge of surmounting, the need for equivalence of networks and symmetry in the exchange of backbone traffic. However:

- no consensus has been reached that web hosting companies need to be interconnected to the Internet for free – to remain a peer of everyone forever without being required to pay anyone for an inevitable cost of business, ie: that portion of upstream bandwidth consumed by the data exported;
- such an approach would lead to a "receiver pays" model, which would have major implications for the Internet industry - including the inevitable risks of multi-media spamming and the associated costs which that would entail for end users.

9.3 Implications for the regulators

As noted above, there is no industry consensus on the issue of attributing value to the various components of interconnection – and nor is there likely to be consensus in the near future, given that the issue will inevitably be driven by the particular economic motives of the various industry participants.

While decisions relating to interconnection within the commercial environment may in fact be reached on a subjective basis, any regulatory intervention must tread lightly. It must also be premised on a sound analysis of the value attributable to the various components of interconnection in any particular dispute. Failure to undertake such analysis will inevitably result in arbitrary decisions on the part of regulators, as they struggle to steer a path between the emotive and self-interested claims of the various industry players.

Internet backbone providers are not yet treated as common carriers, and universal Internet access has not yet become a public policy objective like universal telecommunications service. However, despite the fact that the telecommunications industry is subjected to a regulated access regime (while the Internet is not), the telecommunications industry is still subject to the constraints of pricing principles which ensure that the access price is set at somewhere between:

- the total service long-run incremental cost (TSLRIC) of providing the service; and
- a price which reflects the opportunity costs (ie: what is forgone by employing resources in their current use rather than the most valuable alternative use).

However, at least in Australia, the recent decision by the regulator suggests that these basic access principles have been thrown out the window in the deregulated environment of Internet interconnection. As a consequence of the decision not only to mandate interconnection between Internet backbone providers, but also to accede to the demands of the two ISPs who knocked on the regulator's door demanding free access to the Internet:

- Internet interconnection in Australia is now clouded by total uncertainty, due to the distortions created in arbitrarily deeming two of the ISPs (but not others of equivalent or greater size) to be peers of the Internet backbone operators;
- activities at the wholesale layer of the Internet carriage services market in Australia have been severely curtailed, with a consequent loss of the efficiencies associated with the aggregation of traffic which one would normally expect to see at the wholesale layer – so that backbone providers are forced to focus their attention on the potential revenues to be derived at the retail layer of the industry;
- the incentives for investment in infrastructure in Australia are seriously undermined; and
- Internet backbone providers are forced to rely on the bundling of Internet carriage services with value-added Internet services and unrelated commercial services in order to derive a return on their infrastructure investment.

The conduct of the Australian regulator in deeming two of the larger ISPs to have equivalent status to the Internet backbone providers represents a sledge-hammer approach to regulatory intervention at a time when the Internet industry in that country is still at a very immature stage – so that even "light handed" regulation is inherently risky. Furthermore, it conflicts starkly with the international trend towards recognizing the underlying costs of interconnection.

9.4 Dilemma between promotion of competition and retaining incentives for investment in infrastructure

The recent disputes in relation to Internet interconnection bring to the fore a major dilemma for regulators, ie: balancing the promotion of competition against the maintenance of long term incentives for investment in infrastructure. Any policy decision in this regard must take account of the particular characteristics of Internet infrastructure – which are very different to those exhibited in the telecommunications industry:

- The establishment and incremental costs of ISPs are comparatively minimal when compared with those of Internet backbone providers. ISPs must purchase a terminal service, a modem pool, ISDN network terminating equipment and routers, as well as dial-up lines to the telephone network. Clearly increases in the volume of customers will result in incremental costs relating to increases in computer memory, disk space and the number of incoming lines. The ISP's link to the Internet may also need to be upgraded from time to time.
- Some of the larger ISPs may also choose to acquire leased fiber capacity, in which case they will incur some upfront or fixed costs, with discount incentives enticing them to enter long term contracts. The extent of the sunk or fixed costs depends on the typical contract length, which is in the range of three to five years.
- Once the ISP has made the basic investment (and the acquisition of leased fiber capacity is not essential), there are numerous means available to an ISP to develop a national or regional network, utilizing not only the fiber capacity supplied by the Internet backbone provider but also routers and switches - which enable the instant

- establishment of virtual private networks for a fraction of the cost of constructing the required Internet backbone infrastructure.
- Accordingly, while the growth of the Internet ultimately depends on the capacity of the fiber in the ground, an ISP may be able to exhibit all the characteristics of a regional or national network without a comparable investment.
- When considering the application of traditional telecommunications access principles to the Internet, the ISP's costs are in fact minimal when compared with those of a telecommunications reseller which faces the costs associated with acquiring access to the local loop before it can commence business.

Accordingly, the discrepancies in the level of capital investment required to operate as an Internet backbone provider, as compared with an ISP, will impact adversely on the ability of the backbone provider to compete against the ISP if the ISP is able to obtain access to the Internet backbone without bearing an appropriate share of the costs associated with that access.

10 Where to from here? the emerging significance of content

It is generally accepted that an ISP with large volumes of valuable content is not automatically entitled to SKA peering with an Internet backbone provider, ie: the value of the content is not commensurate with the capital investment required to establish backbone infrastructure. However, the fact remains that an ISP which provides exclusive access to popular content is a more attractive proposition to the consumer than one which merely provides access to the Internet generally - particularly in a growing global marketplace where generic, culture-proof popular content increases in popularity to the extent that Internet usage expands across different countries and cultures. Furthermore, in the negotiation of an alternative interconnection arrangement involving settlement or billing, access to the consumer via popular content is the ISP's leverage in claiming a right of set-off against the interconnection payments owing to a backbone provider.

10.1 The rise of online portals

The trend towards recognizing the value of content is most clearly evidenced in the rise in popularity of ISPs portals, where ISPs bundle their carriage function with the provision of popular content. Following the extraordinary success of America Online, many ISPs have begun to provide exclusive access to content through strategic alliances with content providers. Thus in the USA, Disney has invested in Infoseek, and NBC has bought Snap, CNet's online directory service. In Australia, Microsoft has aligned with:

- Channel 9, Australia's largest and most popular television broadcaster; and
- Telstra Big Pond, the largest ISP in Australia,

to provide a portal to which Big Pond customers can obtain free access.

The bundling of these brands and the services they offer represents considerable value for the customer. In return, the ISP and its content providers retain a loyal base of customers. Because such customers are less prone to churn, this reduces the required level of ongoing promotional expenditure.

For the backbone provider, this translates into increased traffic flows of a stable and constant nature – together with consequent increased revenues under the settlement arrangement. Exclusive content provides even greater benefits to the backbone provider in the form of increased traffic flows. If customers choose to use only one portal to access all of their content, the Internet backbone provider will gain - at the expense of those ISPs relying on the lottery of the traditional Internet consumer model.

10.2 Using advertising content to fund access to the Internet

Even outside of the realm of traditional media such as Disney and NBC, it is clear that content is becoming a more valuable commodity on the Internet as the industry turns to advertising to fund the delivery of content to the end-user at low or nil subscription rates. Value-added services such as the roaming email services run by Yahoo, Alta Vista and Hotmail are examples of the utility of content to secure access to the customer at a low-cost to the ISPs – showing that customers will flock to a free service and, once there, will put up with prominent advertising on their screens. This is a competitive advantage over the traditional user-pays model, where a charge for each and every log-in can represent a significant disincentive to sign up as a subscriber. Furthermore, the real providers of the content – the advertisers – are happy to use ISPs to deliver the content because they realize the significant and still rapidly increasing exposure these services can provide.

In the long term, it is inevitable that the value associated with advertising will have some bearing on the interconnection rates negotiated as between networks, given the ability of advertising to decrease the costs of the end user, while at the same time funding the development of popular sites which attract increased traffic flows.

10.3 Content assists Internet backbone providers to differentiate their carriage services

Internet content can fluctuate wildly in terms of its usefulness and popularity, and hence its value. By comparison, the value of carriage remains relatively constant. Despite the efforts of Qwest and others to provide differentiation in service levels, carriage remains a commodity item with service levels being fairly constant across the industry. On this basis, the ability of an Internet backbone provider to connect with ISPs which host popular content will therefore have the potential to impact directly on the levels of traffic via that network – with consequent implications for the status of that backbone provider in interconnection negotiations with other networks.

10.4 Why content may not become king

As a consequence, one might expect that the golden rule of the cable industry, ie: "content is king", will be replicated in the Internet industry. However there are certain dynamics which have stalled the elevation of content as a driver in interconnection negotiations. With the prevalence of SKA peering throughout the industry until recently, this has served to actually decrease the value of content since:

- increased traffic flows do not result in any increase in the revenues derived by an Internet backbone provider; and
- in fact, increased traffic flows simply create a burden on the performance levels of the backbone provider's network,

so that in such circumstances it is not economically viable for the Internet backbone provider to attribute any value to the content held by the ISP. Content which is in high demand impacts negatively on the performance of the network, without any perceived benefits for the Internet backbone provider.

However, with the trend away from SKA peering and towards settlements-based interconnection arrangements, we will see opportunities for Internet backbone providers to derive increased revenues from popular content, thus ensuring that the value of content should become a relevant factor in the negotiation of any settlements based interconnection arrangements.

11 conclusion

It remains to be seen whether Internet backbones will be treated as telecommunications infrastructure, with accompanying obligations to provide fair and non-discriminatory terms to ISPs seeking interconnection – or whether Internet backbone providers will be able to pick and choose with whom they interconnect and on what terms.

However, commercial imperatives suggests that not all Internet backbone providers and ISPs will have direct and seamless interconnection with all others - primarily because commercial interests favor disconnection of ISPs unless and until they agree to interconnection arrangements involving transfer payments upstream, reflecting the underlying costs of the infrastructure provided by the backbone provider.

The recent disputes in relation to Internet interconnection bring to the fore a major dilemma for regulators, ie: the policy decision of whether competitiveness should be promoted at the expense of long term incentives for investment in infrastructure. In this regard, facilities-based competition has been the cornerstone of US, UK and OECD telecommunications competition policy and, arguably, is even more important in relation to the Internet where we are seeing an exponential growth in the demand for bandwidth. It is only through facilities-based competition that a sustainable and self-sufficient backbone layer will emerge and thrive, with consequent benefits for the entire Internet industry.

Return to Top View Full-screen

Antitrust Considerations of

Telecommunication Market in Korea

Kyoung Han Sohn

Aram International Law Office, Repulic of Korea

ABSTRACT

The introduction of telecommunication service in Korea spurred little response from the general public, however, today Korea is one of the top telecommunication markets in the world having one out of every four (4) Koreans uses some form of telecommunication service. Although cutthroat competition war among several companies in the telecommunication market exists today, a state of monopoly existed in the early stages of Korea's telecommunication market. However, beginning on December 30, 1983, the enactments of Telecommunication Basic Act ("TBaA") and Telecommunication Business Act (TBuA") gradually liberalized the telecommunication monopoly giving breath to competition.

View Full Text

Kyung-Han Sohn

Not Available

Return to Top   View Full-screen

KYOUNG-HAN SOHN

Attorney at Law, Aram International Law Offices, Republic of Korea

EDUCATION : Max-Planck-Institut, Munich (Research Fellow 1988) ; University of Pennsylvania Law School, Philadelphia (LL. M, 1985) ; Graduate School of Law, Seoul National University (Master of Law, 1983) ; Judicial Research and Training Institute, Supreme Court of Republic of Korea (1977-1979) ; College of Law, Seoul National University (LL. B, 1973)

PROFESSIONAL EXPERIENCE AND ACTIVITIES : Admitted: Korean Bar (1979) ; Korean Patent Bar (1981) ; New York Bar (1986). Partner, Aram International Law Offices, Seoul (1993-) ; Partner, Bae, Kim & Lee. P. C., Seoul (1988-1993) ; Member, Central International Law Firm, Seoul (1979-1988). Visiting Attorney: Vinson & Elkins, Houston and Washington, D.C. (1987). Pillsbury, Madison & Sutro, San Francisco and Washington, D.C. (1986). Vice-President, of Korean National Group, AIPPI (1990-1993, 1996-) and of Korean Patent Attorney Association (1988-1990). Executive Secretary, Korean International Trade Law Association (1990-). Director, LES Korea (1990-). Vice-Director, Korean Institute of Technology and the Law (1995-). Lecturer in Law : Seoul National University, College of Law, Graduate Program (1990) ; Arbitrator, Korean Commercial Arbitration Board (1989-).

ARTICLES AND PUBLCATIONS : Trademark and Product Protection in Korea (USTA Symposium, San Francisco, 1990) ; Protections and Current Trends in Intellectual Property and Proprietary Rights Law in Republic of Korea (Journal of proprietary Rights, U.S.A., 1991), Legal Aspects of the Evolution of the Korean Telecommunication Industry and Market (ABA Annual Meeting, San Francisco, 1992), Korean Law Chapter, Handbook on International Software Licensing (ed. by H. Ullrich & E. Koerner – Verlag Recht und Wirtschaft, Heidelberg, 1994) ; Overview of the Protection of Intellectual Property, and of the Related Laws and Practices, in the Republic of Korea (Swiss-Korean Business Council Conference, Journal, 1995) ; Protection of Information Technology in Korea (PTC, Honolulu, 1996) ; and others.

MEMBERSHIPS : Korean and Seoul Bar Associations (1979-) ; Korea Computer and Technology Law Section, and Others (1986-) ; AIPPI (1988-) ; International Trademark Association (1989-); Korea International Association (1990-) ; and others.

View Abstract

Fixed Network Market Opening:

Taiwan's Catch-up Plan for Telecom Liberalization

Lawrence S. Liu

Lee and Li, Attorneys-at-Law, Taiwan

ABSTRACT

In February 1996 Taiwan's Telecommunications Law ("Telecom Law") was amended. Along with the new Telecom Law came the promulgation of two other laws, the Chunghwa Telecom Corporation Law ("CHT Law") that corporatizes the state-run monopoly and the Law for Directorate General of Telecommunications ("DGT Law") that makes DGT only a regulator.

View Full Text

FIXED NETWORK MARKET OPENING:

TAIWAN'S CATCH-UP PLAN FOR TELECOM LIBERALIZATION

I. BACKGROUND

1. *1996 Reform*

In February 1996 Taiwan's Telecommunications Law ("Telecom Law") was amended. Along with the new Telecom Law came the promulgation of two other laws, the Chunghwa Telecom Corporation Law ("CHT Law") that corporatizes the state-run monopoly and the Law for Directorate General of Telecommunications ("DGT Law") that makes the DGT only a regulator.

All three laws manifest recent efforts by the Government of Taiwan to liberalize its telecom sector. These efforts have to be seen in the context of Taiwan's ambitions to increase its role in regional economic integration and become an Asia-Pacific Regional Operations Center and also as part of its pursuit of full WTO membership.

2. *Three-Stage Liberalization*

Following a three-stage plan for the opening of the telecom market, in November 1994 Taiwan opened the market for competition of second generation cordless telephone businesses. While this stage could be achieved without the passage of further legislation, the second and third stages still required a new legal framework as then established by the three aforementioned laws. The second stage of the market opening, completed in March 1997, aimed for liberalization of four additional segments of the wireless telecom market: cellular phone, paging, trunking radio and mobile data. The third and final stage would provide for competition in the wired/fixed line basic service market by July 2001 with liberalization beginning possibly at the end of 1999. This stage is also known as the fixed network market opening and is the focus of this paper.

II. THE TELECOM LAW AND FUTURE AMENDMENT

1. *Type Classification*

For regulatory purposes, the Telecom Law classifies the telecom industry into Type I and Type II operators/services. Type I encompasses facilities-based telecom services while Type II covers all services not included in Type I, and adopts a "negative listing" approach in determining the scope of Type II. "Facilities-based" means a service requires the installation of telecom facilities such as network transmission facilities between the original and receiving terminals, exchange facilities, and other accessory facilities. All basic fixed line telephone services, mobile services, and satellite communication services fall within Type I.

2. *Licensing and Foreign Ownership Limit*

Licensing requirements for Type I businesses are strict. Type I regulations are based on an oligopolistic model in which competition will be gradually introduced. Before a Type I business can begin operations, it must obtain from the MOTC a permit and license. This procedure requires the submission of many detailed and comprehensive documents stating the company's business plans. Furthermore, the basic tariff that Type I businesses set must be in accordance with the formula approved by the parliament, that is, the Legislative Yuan, and its implementation must be approved by the ministry, MOTC.

Article 12 of the Telecom Law limits the foreign investment in a Type I business to 20%. Moreover, a majority of the directors and supervisors of a Type I company has to be Taiwan nationals. An amendment will increase total direct and indirect foreign investment to 60%. It would also switch to a price capping regime. However, this amendment is not expected to be enacted before the tendering for the fixed network market opening of 1999 discussed below.

III. THE FIXNET MARKET OPENING TASK FORCE

1. *Nature and Schedule of the FMOTF*

The upcoming opening of the fixed network market in Taiwan is the work of the Fixnet Market Opening Task Force ("FMOTF"). The FMOTF is supposed to represent a continuing consultative process with the aim of formulating trends and policy-guidelines so as to have a common consensus formed by all concerned parties on the fixed network market opening.

The proceedings of the FMOTF officially began in January 1998 with preliminary consultations taking place as early as November 1997. The task force has been initiated and organized by the planning department of the DGT and supported by the MOTC. Final results of this task force in the form of three sets of position papers dealing with different aspects of the market opening had been scheduled for mid 1998. But output of the position papers has been delayed. In any event, formal regulations reflecting the positions of these papers are expected before the end of 1998.

2. *Why FMOTF?*

The idea for launching this consultative process sprang in part from dissatisfaction expressed by some involved parties over the liberalization of the wireless telecom market which took place in March 1997. The entire tendering process then was generally viewed as unnecessarily controversial. Thus, the DGT and the MOTC recognized that a significant improvement and more thorough preparation for the opening of the fixed network market had to be achieved.

Another circumstance that played a significant role in DGT's decision-making was that the fixed network market opening is generally regarded as being much more important than the opening of the wireless sector. This is due to the fact that the fixed network represents basic infrastructure necessary to supply local telephony.

Through the task force's consultative process, the DGT and the MOTC wanted to ensure a relatively smooth market opening by considering the views of major constituents of the expected fixed network market. In doing so the DGT followed a somewhat democratic approach complete with a voting procedure for the guidelines and resolutions as presented by the three position papers that come out of this process as the primary results. This approach, of course, follows recent trends in Taiwan politics towards more democratization. These position papers, however, are not legally binding on the DGT.

3. *Members of the FMOTF*

Members of the FMOTF are recruited from three different camps. First there are representatives of government agencies, namely the DGT, the NII, the Fair Trade Commission, the Consumer Protection Commission and others. The second type of members are representatives of the concerned industries, namely the incumbent CHT, six mobile operators, cable TV operators and also Internet Service Providers (ISPs). Academics and experts from related fields constitute the third type of task force members. In all, about 60 or 70 entities/individuals from government, industry and academia constituted the FMOTF.

In addition, a number of foreign observers were accepted into this task force to attend the meetings and contribute by presenting their own position papers on certain issues. However, in contrast to the formal members of the FMOTF, they are excluded from all voting. Thus, a questionable emphasis on local views and interests has been maintained.

4. *Progress of Subgroups*

The FMOTF members were divided into three subgroups, known as the Liberalization Strategy Group (Group 1), the Competition Policy Group (Group 2) and the Engineering Group (Group 3). Through regular meetings of these three subgroups and basically a string of debates and compromises, position papers were produced by each group for their specific field and voted on in plenary sessions involving all members of the FMOTF. Group 1 and Group 2 presented their position papers in July and August 1998, respectively, while the third position paper was still unfinished at that time. Nonetheless, the whole consultative process is expected to be completed soon so that the DGT could adopt regulations before the end of 1998 to facilitate tendering for the fixnet market opening in 1999.

IV. LIBERALIZATION STRATEGY GROUP (GROUP 1)

1. *Full Licenses*

To liberalize the fixed network market, the FMOTF has specified the types and number of licenses to be given to new entrants which will become competitors of CHT. The most comprehensive license to be given is the full-service license. The holder of a full-service license will be able to provide local, domestic toll and international telephone services for 25 years. Because CHT claims that it does not have enough physical capacity to share local telephone lines, the new full-service providers would have to dig up new roads and lay cable or use alternative technology to develop the "last mile" access. Because such social costs are high, Group 1 recommended that only two entrants shall be admitted.

2. *Other Licenses*

Another type of license is the domestic toll license. The holder of this license would be able to compete in the domestic toll market for island-wide communication needs for 20 years. Domestic toll service does not require as much the physical laying of new cables and hence its social cost is lower. Two licenses are to be given. A third type of license is the international license, which is given for a period of 20 years. Three licenses are to be given. As Group 1 noted, domestic toll and international calling rates in Taiwan are rather high in comparison to other countries. Hence, opening these markets to competition should enhance Taiwan's overall productivity. Group 1 made these distinctions to start the process of liberalization. It is well aware that these distinctions could become obsolete very soon because of technological convergence.

The last type of license to be given is for circuit leasing. This license allows entities in other network-based industries to lease their communication circuits, that is, alternative infrastructure, to holders of any of the three types of license mentioned above for 15 years. For instance, the dedicated communication lines used by Taipower (the state-owned electricity company) to help transmit electricity can be utilized by a telecom company as a telephone line. This license is intended to intensify competition by making available the supply of alternative infrastructure and thereby reducing social cost.

3. *Market Opening Schedule*

The FMOTF's Group I has proposed an ambitious timetable for liberalization. In stage one, many tasks must be completed by February 2000. In January 1999, the requirements for bidding for these various licenses will be publicly announced and circuit leasing to Type I business will be allowed. June 30, 1999 is the deadline for submission of bids for full-service, domestic toll, and international licenses. The winners of the full-service licenses will be announced on October 31, 1999. The winners of the domestic toll and international licenses will be announced on February 1, 2000. Also in February 2000, the winners of the circuit leasing licenses will be announced.

The reason full-service licenses are to be awarded prior to other licenses is that full-service license holders will be given more time to build local networks and to lay cables since building infrastructure takes a long time. Furthermore, the full-service licensees must provide basic local telephone services, which affect most consumers and hence are more politically sensitive. Once a company receives one license, it is disqualified from being awarded another license. For instance, a company awarded the full-service license is precluded from being awarded either the domestic toll or international license.

4. *Number of Licenses*

Why is the number of licenses to be issued 2-2-3? The number two for full-service licenses was finalized perhaps because one other full-service provider would make the market a duopoly. Politically, it is hard to justify only one other licensee given the current political trends in Taiwan of having multiple political parties and favoring pluralism. Furthermore, if the FMOTF had decided on just one additional licensee, and if that licensee's business failed, the policies of opening up the fixed network to competition would be unfulfilled. Hence, to make sure there will be at least one additional competitor, Group 1 recommended having two additional licensees, so that in addition to CHT, there would be two other formidable operators. The second licensee is therefore like an insurance policy, to make sure competition will survive. Why a total of seven licenses? Perhaps it is because now there are six mobile operators, and perhaps each wants to have a good chance at one license. Hence, they proposed seven. The number of licenses awarded, frankly speaking, is a product of compromise.

V. COMPETITION POLICY GROUP (GROUP 2)

Group 2 was concerned with competition policy within the fixed network liberalization context. Specifically, it advanced views on interconnection, universal service, telecom accounting and fair competition.

1. *Interconnection*

The basic idea with respect to interconnection is that an operator on any Type I network must be able to interconnect. There must be no discrimination against new entrants by an incumbent with respect to interconnection network capabilities, price, quality or service. Interconnection fees must be set in a transparent and reasonable manner based on commercial and technical requirements and will be reviewed on an annual basis.

A contentious issue with respect to interconnection fees is how it should be calculated. Group 2 advocated the use of the long run incremental cost method ("LRIC"), which is close to long run average variable cost for calculating unbundled network costs, plus a reasonable markup. Meanwhile, the incumbent CHT would like to base interconnection charges on fully allocated historical cost. Everyone has to pay for part of what the incumbent paid to construct the network even when it was inefficiently put in place. If based on LRIC, if a company runs the business better, its costs will be lowered and other companies' interconnection charges will decrease. Incumbents dislike using LRIC.

Group 2 also focuses on dispute resolution. The telecom provisions of most countries give parties to an interconnection agreement a time frame for negotiation. If negotiations fail, then the regulator has to step in and state a fair price the parties are bound by. This mandatory arbitration condition is necessary because of the fundamental asymmetry between incumbents, which have incentives to drag out the negotiation process as long as possible and new entrants, which are anxious to recoup investment expeditiously through early provision of service.

2. *Universal Service*

Group 2 is also charged to review the universal service principle. Universal service is a politically sensitive matter and generally governments endorse universal service. It is the details of calculating the avoidable costs that could be contentious. Also, CHT will share more of the burden because as the incumbent it offered service to all who applied for a telephone line.

The question then becomes how to compensate CHT for the universal service. These areas subject to universal service subsidies are called "uneconomic areas," generally remote areas. That compensation depends on the definition of "uneconomic areas." CHT of course, has an incentive to cover as many areas as possible under this designation while new entrants want to have as few as possible because they argue that universal service is unusual from a free market standpoint and that the market itself should be the ultimate allocator.

Although these problems are faced by many countries, in Taiwan they take on a more politicized form. It has to be kept in mind that although Group 2 stated many strong positions promoting fair competition, these are all recommendations. Without a statutory basis, future telecom participants can disregard these provisions since no authority can compel them to follow these provisions. Most importantly, these pro-competition criteria need to be embodied in further amendments to the Telecom Law. However, plans by the DGT to amend the 1996 Telecom Law do not yet call for a strong competition policy.

An important step for Group 2 towards promoting competition is making sure that actual costs are properly reflected in the fees. The CHT follows principles of government accounting, not commercially accepted GAAP principles. Their "tariff" is based on the rate of return, itself based on assets. Since CHT's assets are based on historical cost, CHT's assets are greatly undervalued. Thus, it is important to develop a set of accounting rules for the telecom business because it is difficult to know the true costs of a monopoly. A new entrant would be unwise to rely on cost figures of CHT.

3. *Strengthening Competition Rules*

Taiwan should follow the lead of countries like Germany and the U.S. and adopt the dual-track system with respect to antitrust regulations. In addition to antitrust regulations that apply to all businesses, the telecom law should also include antitrust or procompetition aspects. The latter is needed because Taiwan, like many other countries, started from a position of having a monopoly, and is trying to establish a more competitive environment. Thus, antitrust rules translated into telecom laws are necessary in the early stages because antitrust regulators may not be familiar with the telecom industry. Accordingly, the positions held by Group 2 on competition will need to have a statutory basis if they are to be enforced in the future.

Because the new entrants are likely to be big publicly-listed companies making significant investment, it is essential that fair competition standards are upheld, otherwise the public will suffer. Thus, strong competition is needed. Because of these considerations, as well as the need for entrants to be able to make enough profits to continue as businesses, Group 1 adopted an oligopoly model by allowing only 3 full-service telecom providers. However, it is necessary to monitor these three companies to ensure that they do not engage in activities to cartelize the market, which would result in overcharging consumers. Therefore, as recommended by Group 2, fixed network operators cannot engage in monopoly, collusion, technical boycott, cross-subsidization, or engage in other anti-competitive behavior. Furthermore, refusal to deal, discrimination, inappropriate business restrictions, and price or nonprice predation, are also to be prohibited.

Group 2's proposals have taken a strong stance on fostering competition. However, there is no statutory basis for these proposals. The present situation in Taiwan highlights the problems of the government operating CHT as a wholly-owned state enterprise on the one hand and regulating CHT on the other hand. There is an inherent conflict of interest because the government, through the MOTC, is on both sides of the transaction.

4. *Strengthening the Regulator*

When the DGT requires CHT to provide information concerning costs, CHT allegedly ignores the DGT. Compared to CHT, the DGT is an underling. Why is the regulator subservient in many ways to the state-owned telecom company? CHT has 36,000 employees in a powerful labor union, and it earns profits of NT$30 billion a year while the government as a whole is running a budget deficit. Vice ministers sit on the board of CHT and the current chairman of the board is a former DGT head. Also, CHT does not necessarily comply with DGT requests because the MOTC controls them both and CHT is generally more powerful than the DGT.

Due to the problems mentioned above, many groups have proposed that Taiwan create a new and independent regulatory agency, which is free from political control and meddling. The model Taiwan might use is the United States Federal Communications Commission. In the U.S. model, there are five commissioners, of whom no more than three can be of the same party. They serve for 5 years in staggered terms so each year a commissioner's term expires. Most importantly, the FCC is vested with rule-making, executive, and some judicial powers and is the highest governing authority over telecommunications. To adopt a model similar to the U.S., the DGT would have to become independent from the MOTC, so that it is directly responsible to the Executive Yuan, that is, the cabinet.

VI. ENGINEERING GROUP (GROUP 3)

Group 3 deals with engineering issues that are critical to the success of the liberalization program. Issues such as facilities sharing, the numbering plan and number allocation, equal access and provision of indirect access, number portability, quality of service, and coordination during construction and deployment of networks are being discussed. These engineering and technical issues are important to the mobility of customers in switching from one service provider to another and are essential to fostering competition and maintaining interoperability. Around forty proposals concerning these topics have been advanced by voting and non-voting members of the group. A final group position paper is expected in late 1998.

VII. CONCLUSIONS

The FMOTF represents Taiwan's catch-up plan for liberalizing further its telecommunications sector. Although the task force's consultative process and its recommendations represent a clear improvement of telecommunications policy-making, professionalism is sacrificed for democracy.

Indeed, the high political cost of market opening in a society as much focusing on democratization as Taiwan means that the process can be delayed and controversial. More importantly, Taiwan seems to embark upon the unavoidable path of gradual reform. It may always have to play this catch up game.

Despite various compromises, the three working groups of the FMOTF have adopted useful recommendations for adoption by the DGT. Meanwhile, the DGT's effort to amend the Telecommunications Law has to intensify. Of particular importance is strengthening competition. Transplanting antitrust rules is essential but has yet to happen. Whether the DGT should migrate towards the FCC model of the United States is another important issue. Timing for considering the advisability and feasibility of setting up an independent regulatory body is perfect, as the government is embarking on a "government re-engineering" program.

The fixed network market opening represents the most important program through which most of the foregoing issues will be debated. Despite much uncertainty that still surrounds the FMOTF's recommendations, 1999 certainly will be a busy year for Taiwan's telecommunications sector and those wishing to participate in its fixed network tendering.

Return to Top View Full-screen

Direct Broadcast TV in Taiwan - Whither Cable TV?

David McNeill

American Institue in Taiwan, Taiwan

ABSTRACT

Taiwan's multichannel television industry is a tremendously lucrative business, offering program providers and operators enormous revenue streams and delivering to consumers a highly sought-after service. Because of a range of market and regulatory factors, the television broadcast industry is on the cusp of a potentially tumultuous realignment. As proponents of Direct-to-Home broadcasting enter the market, the face of Taiwan's multichannel television market will change significantly and consumers will face new – and some would say welcome – choices.

View Full Text

Direct Broadcast TV in Taiwan - Whither Cable TV?

I. INTRODUCTION

Taiwan's multichannel television industry is a tremendously lucrative business, offering program providers and operators enormous revenue streams and delivering to consumers a highly sought-after service. Because of a range of market and regulatory factors, the television broadcast industry is on the cusp of a potentially tumultuous realignment. As proponents of Direct-to-Home broadcasting enter the market, the face of Taiwan's multichannel television market will change significantly and consumers will face new - and some would say welcome - choices.

II. TAIWAN'S CURRENT CABLE TELEVISION ENVIRONMENT

Prior to passage of the Television and Broadcasting Law in 1976, private television broadcasting was prohibited. Local television broadcasting - initiated in Taiwan in 1962 - was officially in the hands of the government. The three officially-sanctioned stations were controlled by the Provincial Government, the ruling KMT party and the Ministry of Defense - each dominating one-broadcast operator. By the late 1960s, the phenomenon of CATVs (Community Antenna Television) developed, which, eventually taken to its extreme, drastically altered the television broadcast landscape in Taiwan. Initially an unsanctioned outgrowth of the official broadcast channels, CATV took hold in rural areas and areas of poor reception. Enterprising viewers would construct a central antenna to gather television signals and relay them to neighboring homes via coaxial cable. Within a few years, CATVs broadened their services to include rebroadcasting of taped programs. Integrating newly acquired VCRs, these bootstrap operations commenced more sophisticated levels of service in the mid-late 80's. Armed with a single VCR and spindles of coaxial cable, entrepreneurs connected neighboring homes and multiple dwelling units (MDUs), offering videocassette movie entertainment for a small monthly fee. Soon these upstart businessmen branched out to connect entire neighborhoods, offering alternatives to the officially-approved program fare. Keeping up with advances in technology, when the telecommunications satellite AsiaSat 1 entered the Pacific Rim orbit in 1990, the nascent cable entrepreneurs kept pace by investing in satellite dishes, replacing their VCRs and upgrading into cable headends offering several dozen channels for a significantly higher monthly fee. In local parlance, the cable operators became known as the "fourth channel".

Though pervasive - as the still-remaining tangle of coaxial cable draped over most of Taipei's building structures clearly illustrates - the "fourth channel" was nonetheless illegal. Prior to the passage of the operative legislation in 1990, the authorities officially claimed to control the flow of all data transmissions throughout Taiwan. Thus the existence of any broadcast entity other than the three official stations were illegal. Furthermore, prior to legislation no framework existed to obtain a broadcast license.

Although Taiwan's entrepreneurial reputation is well known, illicit broadcasting was one cottage industry the authorities sought to eliminate. However, the authorities responded with a lack of vigor. Tasking the Government Information Office (GIO) with the responsibility of policing the flow of broadcast information, the authorities nonetheless dedicated scant resources to the objective. Designed to provide limited oversight to the existing three stations, the GIO's staff of fewer than ten employees were overwhelmed with the added responsibility of curbing the operations of approximately one thousand illegal operators. The nimble operators, usually possessing a small amount of equipment and reams of wire, disguised their operations and - if necessary - mounted their broadcast gear on mobile vans for broadcast via receivers concealed throughout neighborhood districts. From the operator's standpoint, the risks were minimal and the profits handsome.

Because the entry costs were so low, and the earning potential so great, the business quickly became competitive. On occasion operators expanded their markets by turning in rival operators to the authorities. Some operators were brazen enough to steal channels from competitors and rebroadcast at a discount. Eventually the business caught the attention and interest of local organized crime. It also caught the attention of the United States Trade Representative (USTR). Recognizing the copyright violation aspect of unlicensed broadcasts of U.S.-origin programming, in 1989 the USTR wielded its new Special 301 authority and placed Taiwan on its Priority Watch List. While not immediately subject to trade sanctions, Priority Watch list countries are nevertheless required to make progress toward equitable trade practices to avoid penalties. Not satisfied with its progress in several areas - including unlicensed TV broadcasting - USTR placed Taiwan on its Priority Foreign Country List in 1992. Priority designation ratchets up the pressure significantly, requiring the designee to resolve contentious practices within six months to avoid the imposition of trade sanctions calculated at the estimated value of losses to U.S. firms.

At this critical juncture, Taiwan's Legislative Yuan (LY) passed its initial Cable Television Law (Cable Law) in July 1993. While the law helped satisfy the requirements of the USTR and contributed to Taiwan's upgrade to Priority Watch status, it also began the era of cable TV regulation in Taiwan. To address the status of illegal cable operators, the Cable Law created the framework for then-operating operators to register with the authorities and apply for licenses. 618

companies duly registered. To obtain a license, registrants had to provide sophisticated operating and business plans, pledge significant capitalization and meet high technical operating standards requiring deployment of advanced hardware. Recognizing that most of the then-operating companies possessed little more than VCRs and low-level equipment, temporary nine-year licenses were made available requiring applicants to meet the rigorous standards within the allotted time. The Cable Law also provided for hefty fines and incarceration for illegal operations. This proved to be an effective deterrent.

Once the industry assumed its legitimate status, market forces began to change the competitive landscape significantly. The terms of the Cable Law divided the island into fifty-one districts and authorized five operators in each. Any one Taiwan investor was limited to a twenty percent holding in an operator and could invest in only one operator per district. Foreigners, meanwhile were limited to an approximate four percent holding in a single cable operator. By the March 1995 deadline, 204 companies submitted license proposals and 120 preliminary licenses have been issued. However, mergers and buyouts continue to winnow down the numbers such that, at present, Taipei - the best cable TV market in Taiwan - has only two merged operators in each of its five districts.

Two rival operators, Eastern Multimedia and United Communications, have taken the lead in consolidating the market. Eastern Multimedia, part of the Rebar Group whose holdings include building materials, hotels, retailing and media, holds a minority interest in 20 cable operators with 1.2 million subscribers throughout Taiwan, including in excess of seventy percent of the Taipei market. United Communications, a subsidiary of the Koo Group, a diversified company involved in banking, hotels, insurance and communications, holds interests in twenty-five cable operators with 2 million subscribers across the island. United also is a prominent program provider, producing its own programming fare and representing several major Taiwan and foreign programmers. Combined, the two groups control 88 percent of the Taipei market and have each aligned themselves with one of Taiwan's two dominant channel agents - Eastern Multimedia with TVTime and United Communications with Filmate. Because of the strength of these alliances and the array of programming choices they offer, it has become increasingly expensive to operate independently - and compete with these two powerhouses. Other operators - most of which were broadcasting with VCRs and illegally diverted channels not long ago - have found their subscription fees very expensive, and their revenues greatly diminished. This tends to encourage even greater consolidation as operators merge and sell out.

Meanwhile, consumer dissatisfaction over the quality of cable TV service has reached the crisis point. Despite comparatively low subscription fees - less than USD 15/month - consumers decry a perceived lack of value for their money.

According to AC Nielsen, between 1996 and 1998, total TV viewing has dropped from 55% to 43 % of the viewing day. Furthermore, consumers complain about inconsistency in service - that the operators constantly reshuffle their channel offerings and frequently drop channels without notice and without recourse. For example, during the past year, consumers have at least temporarily lost access to many popular channels such as Star TV, Sun Movie, ESPN, MSNBC, HBO, Disney and CNN. As well, tiered service is not available in Taiwan. Subscribers are forced to accept bundles of often-undesirable programming in order to obtain the few channels they seek.

Further, dynamics within the cable programming distribution arena threaten to reduce consumers' viewing options to an even greater degree. As noted above, the dominant MSOs are aligned with the island's most powerful program agents. At present, United and Eastern – invested and affiliated distribution agents represent 55 of the 68 major programs available in Taiwan - and cable distribution is becoming more collusive in nature. Eastern and United have recently let it be known that they are courting each other in an attempt to harmonize the market. They have announced their intention to unify creating an identical "genre" or "bouquet" of approximately fifty bundled channels to the island's operators on a take-it-or-leave-it basis. A certain, but as yet unspecified allocation will be reserved for different types of programming such as movies, sports, children's programming, etc. Considering the overwhelming dominance that Eastern and United have over both operations and distribution, both affiliated and independent operators will have little choice over whether to accept what the now-unified MSOs demand.

III. MARKET REGULATION

At present the cable TV industry operates with minimal government involvement. To date the GIO has been largely occupied with administering the provisions of the Cable Law which requires operators to build out their systems according to specific benchmarks and with eradicating renegade noncomplying operators. The GIO took its boldest step yet in facilitating an end to a brief blackout and narrowly averting a wholesale cable TV shutdown in December 1997. Facing a January expiration of their yearlong programming contracts, both Eastern Multimedia and United Communications threatened to boycott each others channels - historically carried by each as a quid pro quo in order to provide broad programming fare to subscribers. Testing uncharted waters in protecting consumer rights, the GIO wielded its influence and convinced both parties to negotiate and resolve their differences. However, this near miss further instilled the consumers' dissatisfaction with the local industry.

The Taiwan Fair Trade Commission (FTC) has also voiced its concern over the present state of Taiwan's cable TV, and has indicated that it is prepared to play a role in regulating certain aspects of the industry. However despite the FTC's authority to enforce Taiwan's Fair Trade Law – a law which bars the kind of collusive behavior currently at play in the distribution arena – the FTC has so far resisted strong pressure to intervene.

The state of Taiwan's cable TV market caught the attention of the United States Trade Representative's Office in late 1998. Concerned that the collusive activities of the MSOs would threaten market access for U.S. program providers, the USTR put forth the issue as major topic of negotiation in the last round of bilateral trade talks between the U.S. and Taiwan in November 1998.

Regulation of the industry is expected to intensify pursuant to amendments to the Cable TV Law presently before the LY. The prevailing amendment, first released by the Executive Yuan (EY) in December, 1997, would limit an MSO to no more than 1/3 of all subscribers island wide, would prohibit controlling more than ½ of the systems operators in a franchise area and would bar an MSO from controlling more than 1/3 of all systems operators island-wide. Also, the operator may not supply more than 1/3 of the available channels on its own system with its own programming. The franchise areas would be redrawn, providing for 26 regions, thus addressing criticism that the current areas are too small to be profitable. Further, allowable foreign investment would be increased to 50% in a single operator. Finally, as will be discussed in some detail later in this paper, the Amendment would authorize Cable TV operators to engage in telecommunications service operations - a means by which operators can participate in fixed-line telecom service.

Such is the present state of cable TV in Taiwan. Enter the direct broadcast satellite alternative.

Direct broadcast satellite (DBS) service (or direct-to-home service - distinguished by the U.S. Federal Communications Commission in terms of frequencies, allocation of orbital positions and interference coordination, yet generally referred to interchangeably within the industry) allows households to receive television programming directly from satellites through digitally compressed signals. This medium allows several programs to be broadcast from a single transponder, thus facilitating up to 200 channels from one orbital position in the sky. Using antennas now less than 18 inches in diameter, DBS offers consumers news and entertainment, premium channels, major league and college sports, pay-per-view movies and a variety of digital audio channels providing CD-quality sound.

DBS is currently offered via high power Ku-band broadcast services and medium power Ku-band and C-band services. The deployment of digital video compression drives the DBS technology. While different compression methodologies presently exist, the impetus for harmonizing the different systems has moved forward toward a global compression method referred to as MPEG2. Compression allows broadcast of digital signals by conventional satellite or fiber systems without requiring excessive bandwidth.

Presently DBS is one of the fastest growing satellite services. In the United States subscribers pay approximately $30-$35 in monthly fees and approximately $200 for equipment purchases. As of April 1998, 8.9 million U.S. households subscribed to one of the operating DBS services.

In Asia, DBS established a pattern of growth in certain markets, but government regulation in several countries, combined with the regional economic downturn has turned slowed the advance of DBS. At present, Japan is clearly the powerhouse for DBS. DBS is a well-known technology in Japan, with public broadcaster NHK having long offered an analog version with a restricted range of channels. There are currently approximately 10 million analog DBS subscribers and 2 million digital DBS subscribers in Japan served by SkyPerfecTV and DirecTV. Indonesia, Malaysia and the Philippines are presently niche markets subject to strong government control, however the demand appears viable. Meanwhile, China and India, in which programmers and satellite operators see great potential, are tightly restricted and offer limited present opportunities. India has banned DBS for the time being, and China prohibits individual ownership of satellite dishes, permitting DBS only in hotels and certain other restricted settings. Given the regulatory and financial impediments now operative in much of Asia, many DBS programmers are setting their sights elsewhere such as Latin America.

Because of distinctive characteristics, Taiwan is an exception. At present, Taiwan's economy remains robust, and the broad spectrum of experts ranging from local and foreign government analysts to bankers and manufacturers expect that this trend will continue. Taiwan operates a sound economy graced with enormous foreign exchange reserves valued at over $83 billion, a substantial trade surplus, relatively low debt levels and growth well in excess of inflation - predicted to approach 6% in 1998. While Taiwan's currency and stock market have fluctuated since mid-1997, Taiwan does not suffer from the structural inadequacies, lack of regulatory efficacy and "crony capitalism" that have crippled other regional economies. Because of restrictive banking policies, Taiwan banks limited their risky lending abroad and thus have little exposure in the region. Further, the lion's share of domestic borrowing has gone into increased manufacturing productivity, and far less into real estate or stock market investments. To its benefit, Taiwan's economy is based upon the output of numerous small and medium-sized businesses, thus providing a measure of resilience and flexibility its neighboring Asian competitors lack.

At present, the law in Taiwan is silent regarding DBS service. However, the scenario is not nearly as simple as it appears at first glance, and requires explanation of some recent history in this regard. Beginning October 1993, private firms could lease transponders from Taiwan's monopoly telecommunications services provider (then the Directorate General of Telecommunications - DGT, now Chunghwa Telecom which was divested from DGT in 1996). Effective December 1994, local and foreign satellite organizations could lease or sell transponders to broadcasters to relay program signals for their own use, and in April 1996, VANS providers could establish very small aperture terminal (VSAT) networks for domestic data service. Most recently, commercial satellite up/down link services were legalized in August 1997.

Industry insiders expect that DBS will soon have a presence in Taiwan. In fact, this sentiment is so strong that Taiwan has become the most popular target in this region for experienced DBS operators seeking to expand. Educated estimates range from three to six experienced DBS operators who have already begun work on establishing their systems. What they eagerly await, however, is the final passage of the Satellite TV Law. First promulgated by the GIO in September 1995 and supplemented later by competing versions, the bills would authorize operation of DBS systems and would allow 100% foreign direct/indirect ownership in a DBS operator.

In theory, DBS will present an enormous opportunity for Taiwan's disgruntled television viewers and a potential threat to local cable TV. However, there are a host of issues at play that will have broad implications in this competitive scheme. The issue of cable telephony development on Taiwan will play a central role. Reaching back several years to October 1995, Taiwan's Premier tasked the Ministry of Transportation (MOTC), the National Information Initiative (NII) Task Force and the GIO with the responsibility of assessing the significance of cable TV telephony and drafting a plan for local implementation. Pursuant to the study, the availability of cable TV Telephony was deemed worthwhile and the GIO assumed the responsibility for moving it forward in Taiwan. By the end of 1996, MOTC Vice Minister Miao chih-Kuo stated that the MOTC supported deployment of the technology. The immediate obstacle was the present Cable TV Law which, according to Article 22, precluded cable TV license applicants from providing telecommunications service in Taiwan. The GIO advocated amending the Law simultaneous to the liberalization of telecommunications services by 2001. At present, the GIO's amendment is before the LY. The consensus of industry and government insiders is that it will pass in late 1998-early 1999, thus allowing submission of cross-media license applications for deployment by 2001.

However, support for the cross-media legalization is lukewarm among the cable TV industry. Most of the 120 operators are small and relatively unsophisticated in the area of leading edge multimedia communication technologies. Rather than pondering the benefits of a new generation of cross-media applications, they are focused upon maintaining their cable markets and keeping the well-financed telecommunications services operators out of the running. Consensus has also formed that while an amended Cable TV law may technically permit introduction of cable TV telephony, implementation of a comprehensive new communications law will be required to harmonize existing regulatory inconsistencies and to better integrate the services. If history is a guide, legislation such as this is years away from realization.

However, even in its less than perfectly refined state, legalized cable TV telephony will provide cable operators with a much amplified range of service options to attract customers. Impetus for the development of such services has been provided by the creation of Taiwan's National Information Infrastructure (NII). The purpose of the NII is to lend support to the retention of Taiwan's information technology hardware industry, to hasten local software development and to further refine Taiwan's information infrastructure. A cabinet-level task force guides the implementation of the NII and has charted the following five goals: 1) promote the use of the Internet in Taiwan, targeting three million users by 2000; 2) deploy the Internet in the schools; 3) position Taiwan as an Asia-Pacific Internet hub by liberalizing communications within Taiwan and bolstering network connections to other countries in the region; 4) create a Global Chinese Network Information Center" to provide multimedia content to the world's Chinese-speaking population; and 5) develop Taiwan's multimedia networking industry.

Taiwan's island-wide broadband optical high-speed fiber backbone is well developed. The island's long distance wireline transmission networks are now all optical fiber and the inter-office trunks are expected to be optical fiber by 2000. Employing ATM switching devices, the network allows data transmission speeds to increase from 64K-1.544 Mbps to 45-155 Mbps. As well, local loops are projected to be 100% optical fiber by 2020.

Meanwhile, a portion of the island's cable networks are also well advanced. The Cable Law requires that, in order to receive the sought-after nine-year license from MOTC, applicant-operators must complete new systems or retrofit existing systems by 1999. The majority of Taiwan's operators have not made great strides in this regard. Because most of the operators are so small, they do not anticipate broadening their range of services into the multimedia/interactive arena, being far less inclined - or capable of making the kind of investment that would be required.

Rather than preparing for battle against the big operators and probably telecom service companies, they are building market share and subscriber base in order to position themselves for optimal buy out or merger offers. Further, pertinent zoning and construction codes and practices have not kept pace with the requirements of the Cable Law, thus creating bureaucratic impediments to the progress of underground cable installation.

While most of the operators have fallen behind on this timetable, approximately 50 operators have already moved from straight coaxial cable to hybrid fiber/coaxial cable. As well, approximately 40 operators have adopted encoding addressing systems, thus enabling future adaptation of interactive cable services.

The two major cable operators, Eastern and United, meanwhile have aggressively moved forward in constructing their networks. Eastern Multimedia has invested heavily in constructing an island-wide HFC network projected to be completed by 2001. Eastern has also negotiated ventures with various technology providers to introduce broadband interactive service. In April 1998, Eastern forged a strategic alliance with U.S. West, Inc. whereby the latter will provide its expertise in establishing advanced cable and telephone networks to upgrade Eastern's broadband service potential. In addition, in cooperation with United Fiber Optic Company and Hitron Technology, Eastern is developing a broadband interactive trial program scheduled to run through 1999.

United has moved very quickly in building out its island-wide HFC network, has undertaken a cable/telephony broadband interactive service trial program in Taipei and has an affiliation with a satellite up-link service. As well, last year a United affiliate won a mobile telephone license amidst Taiwan's broad telecommunications liberalization process and has exhibited great finesse in developing it into the most successful new operator - as measured by numbers of new subscribers - thus far.

So how will cable TV and DBS stack up in the upcoming competition for the lucrative Taiwan market? Key issues are as follows:

IV. VERSATILITY OF FIBER OPTIC CABLE VS SATELLITE

In a market such as Taiwan where the cable network is well developed, the biggest economic hurdle for satellites is competing with optical fiber for delivery of broadband services to the home. Simply stated, the satellite cannot perform with the same attributes as a strand of simple fiber-optic cable. Compression technology can be employed to increase the number of programs per channel, and if test results in several German pilot projects are reflective, the signals can be amplified and distributed directly to common TV receivers without conversion.

A truly interactive network must encompass each of the following characteristics; 1) it must sustain the transmission of signals adequate for video and high-quality graphics; 2) it must be selective such that each customer can independently make a selection regardless of what others tapping the network may choose; and 3) it must enable two-way communications, allowing users to transmit commands and to interact with the medium during the transmission. Delivery of multimedia content and interactive services can be envisioned in a wide variety of forms from the presently available electronic program guides and data services to a scenario wherein the household television, computer and telephone will be merged into one multi functioning "mega-device".

The proposition of an interactive cable networks, such as cable telephony, also offers a significant boost to the future of cable operations. Shanghai Cable TV has launched a pilot project in fifteen locations throughout the city. Using Phillips equipment, the platform reportedly would enable delivery of two-way voice, data and video services. MediaOne, meanwhile is proceeding with plans to offer cable telephony via a hybrid fiber/coax network to areas of Los Angeles and Atlanta. Other interactive applications include video-on-demand, home shopping, telemedicine, and education. Some visionaries are looking ahead to a scenario of manufacturers linking up directly with their customers in an effort to reduce the costs of employing wholesalers and retailers.

However, Taiwan's consumers still rely upon a stretch of paired copper telephone wires or coaxial cable to deliver voice and data from a distribution center. This "last mile problem" has been mitigated to a limited extent through research and pilot testing of ADSL technology which significantly increases data transmission. However, ADSL is expensive and its performance still not proven to be viable. Taiwan's Internet users' frustrations with the "Worldwide Wait" come as a result of relying on 28.8-Kbs connections to satisfy their needs. Broadband Internet connections transport data at rates approximately fifty times that amount, high-definition television at thirty times.

As long as the "last mile" bottleneck prevails in the market, impetus will exist to seek the faster transmission option. As well, employing MPEG2 standard, DBS must be considered a relatively efficient user of bandwidth. Via this technology, high-quality images can be transmitted using only six-megabits per second, thus allowing transmission of over 150 television and CD-quality audio channels.

Until the last mile is converted to fiber-optic, cable operators will be unable to match the enhanced picture quality or the volume of channels offered through DBS' digitally compressed signals.

Finally, consumers that eventually have the opportunity to benefit from cable convergence, will additionally need the set-top box - now estimated to cost approximately USD400 - a substantial expense the consumer will most likely have to bear.

Some Cable TV proponents argue that DBS is susceptible to "rain fade" - what occurs when inclement weather interferes with satellite reception. However, DBS industry supporters boast that with a 70 cm dish, transmitted from a high power Ku-band broadcast satellite, coverage of 98.8% can be expected during rain.

In comparison with all the services - real and proposed - accessible through fiber optic cable, DBS providers promise tremendous versatility from their systems as well, including pay-per-view movies, 24-hour distance learning modules, on-line shopping and Internet hookup - instantaneously and consistently. One DBS proponent comments that DBS offers programmers the benefit of readily accessible feedback - by return path - on the viewers' watching habits. A major European DBS broadcaster claims that it is developing a Ka-band return channel on its systems which will provide a return path directly over the satellite for small receive and transmit dishes, thus allowing data transmission at rates up to 150Kbps.

V. COST OF CABLE VS SATELLITES

While the cost of fiber-optic cable is minimal, the civil engineering costs - laying and installation - are enormous and can represent 75-85% of the total expense of the upgrade. Developments are underway to reduce that cost including Alcatel Cable Exchange, which permits retrofit of existing coaxial cables. However the technology has not yet been widely deployed. As well, the cost of wiring a home, an MDU or a neighborhood is expensive. The wiring cost is also variable and depends greatly upon the geography and remoteness of the subscriber's location.

For DBS providers, the enormous expense of course is that associated with owning or leasing the satellite and its transponders. The marginal cost of connecting subscribers however, is negligible - regardless of where the subscriber is located. As well, one experienced DBS operator seeking to enter the local market estimates that he can install a system for 20% of what it would cost a cable

TV operator to install an island-wide fiber network. Further, he adds that while the necessary IRD would run consumers approximately $200 now, he expects the cost of the unit to drop substantially over the course of the next several years - as it has over the past several years.

VI. LEGAL CLIMATE

Operating parameters under the respective regulatory regimes offers both DBS and cable operators distinct advantages and disadvantages. A tremendous advantage at DBS operators' disposal is the allowance of 100% foreign direct and indirect ownership. This draws in an abundance of experienced foreign operators and strategic partners - the type of pooled talent and resources that can facilitate commercial success. Under the amendments to the Cable Law, foreign direct and indirect investment will be limited to 20-60% in any one operator, thus limiting the attractiveness of investment in commercial operations to experienced foreign operators and other investors. This disparity in foreign investment caps could handicap the cable operators, and would be sorely felt in hamstringing their ability to draw in convergence technologies from abroad.

DBS proponents also view the Draft Satellite Law as imposing far fewer restrictions upon their operations than the Cable TV Law does upon cable operators. While the cable operators, under the Law and proposed amendments, will have substantial restrictions on cross-district operations, limitations on levels of ownership, strict merger regulations and program distribution guidelines, the DBS operators have far broader latitude. Cable operators may take some solace, however in the proposed content regulations under the Draft Satellite Law, which places a heavier burden on DBS operators to adhere to established standards.

VII. ADVANTAGE OF THE INCUMBENT

Possessing the trappings of simply having "gotten there first" provides a significant advantage to the cable operators. The operators know the market, have substantial experience managing their systems, are familiar with the ways and means of doing business and accomplishing objectives in Taiwan, possess enormous political legal clout, have visibility in the market, offer a proven product, have working relationships with Taiwan's residential property management community and multitudes of multiple dwelling unit tenant committees and are very well capitalized. DBS operators, despite claims of superior service, nevertheless face a formidable - and well-entrenched opponent. To overcome the cable TV operators' tactical strengths, DBS proponents must recruit or develop comparable political support and local business acumen, as well as convince the market that DBS is truly an investment worthy of its attention.

VIII. CONSUMER PERCEPTIONS

Taiwan's affluent consumers are willing to make an investment, given a product or service with perceived value. Households generally contain major consumer goods, and have steadily increased their purchases of such items. AC Nielsen reported in January 1998 that 51% own a CD player, 49% own a VCR, 47% own a portable tape player and 25% own a computer. 64% own two or more TV sets.

Looking at a recent example of consumer demand, in the first four months after wireless telephone service was liberalized, the mobile phone penetration rate jumped from 7% to 11%. Further, it is estimated that while Taiwan has approximately 2.5 million mobile phone users at present, this number will increase to 7.6 million by 2001 - a 34% penetration rate.

If the DBS operators can effectively package their service as a distinct improvement to cable TV service, the consumers' interest will certainly be stimulated. Taiwan's sophisticated consumers are not put off by new technology, nor are they resistant to non-Taiwan-origin products. However, a very significant factor in the success or demise of DBS will be its ability to provide local content - news, weather, daytime dramas and sports. Without the local feeds, DBS programming will fall short in the eyes of a large segment of the market. While presenting certain technical difficulties, one large U.S. DBS provider, EchoStar has announced that it is prepared to provide local content in the U.S. by means of a dual-dish consumer hookup merged through a single tuner.

IX. THE COEXISTENCE ALTERNATIVE

Clearly Cable TV and DBS provide valuable and desirable services - in some ways distinct and in some ways overlapping. It is interesting to note that in the biggest cable TV and DBS market of them all, both peacefully coexist. As of April, 1998, there were 8.9 million DBS subscribers in the U.S. (Satellite Broadcasting and Communications Association). Roughly two thirds of these subscribers also retained their cable TV subscriptions.

If the Taiwan market accepts the premise that DBS offers benefits of value to them, what is the outlook for the dual-subscription market, ie. that segment of the market which would subscribe to DBS and cable TV? In large part this will depend upon DBS' ability/inclination to provide local broadcasting content. Without local programming, a large segment of the market will either select cable TV or, weighing all other relevant factors, consider augmenting with DBS. Other factors of significant importance to the consumer will be the cost of both services, breadth and quality of service - including future interactive and multimedia offerings and the complexity to the consumer of having and using both systems.

From the operators' standpoint, Taiwan's many independent operators which rely on the large MSOs for programming and in some cases equity investment, will be loath to cooperate in any fashion without the support of the MSOs. Thus the MSOs, because of their size, resources and clout will most likely take the lead to the extent that cable TV operators engage in any cooperative ventures with DBS operators.

Some industry observers expect that some DBS and cable operators will eventually merge their operations. Following this line of reasoning, a DBS operator could - as independent cable operators are presently doing - build market share, thus building leverage for future merger or buy out discussions with the large MSOs.

X. CONCLUSIONS

Taiwan is presently amidst a powerful wave of liberalization - an inexorable force that will open up means of communication and offer a range of choices never before possible. As a Taiwan consumer can now select communications options such as cell phones, satellite communications and pagers, likewise they will soon have similar options regarding multi-channel television services. Whether and how DBS and cable TV compete or coexist will depend upon variables inherent in the separate technologies, regulatory structures and marketing approaches. Taking this debate one step further, whether or how Cable TV services or DBS ultimately benefit Taiwan's society must be the subject for another time.

Return to Top View Full-screen

CDMA Network and Technology Evolution

Jay G. Hemmady, Jerry E. Rog

Lucent Technologies

ABSTRACT:

This paper addresses two major aspects of the evolution of CDMA technology for wireless applications. First, the *CDMA network architecture evolution* to provide flexibility in handling a wide range of applications from high mobility to fixed wireless. The CDMA network architectures are transitioning from proprietary implementations to standardized implementations with a view to reduce costs of ownership and operations. Second, the CDMA *network technology evolution* to take advantage of advancements in software and hardware technologies. The network components are now taking advantage of commercially available hardware/software technologies to reduce the development cost, and to improve time-to-market for new services and capabilities.

View Full-text

CDMA Network and Technology Evolution

1.0 Introduction

In highly industrialized and developed countries, the wireless subscriber base has grown at rates of 25% to 40% a year, and the wireless phone has transitioned from its elite status to an essential accessory in many parts of the world. The trend in growth of wireless compared to wireline worldwide indicates that the number of wireless and wireline subscribers will converge by year 2010. The CDMA wireless subscriber base, since its introduction in 1996 for Cellular and PCS applications, is expected to grow to about 65 -70 million subscribers worldwide by year 2000. However, the minutes of use per wireless subscriber has not kept up with the growth rate in the subscriber base. This trend is expected to reverse shortly as new Internet based data services become popular among the wireless users.

The subscriber applications have varied from feature rich, high mobility services to basic fixed wireless telephone services. At the present time, the character of high and low/fixed mobility services have remained predominantly voice along with some low and moderate speed circuit and packet switched data applications. This scenario is expected to change as new Internet and other data oriented services are demanded by wireless subscribers.

From a Service Provider viewpoint, both fixed wireless and high mobility wireless systems are being looked upon as economical alternatives to wired systems because of excessive installation costs associated with wired systems. Availability of spectrum for wireless services has also been a factor in increasing popularity of wireless systems. In many countries, traditionally government owned communications services are giving way to open competitive markets. This has increased pressure on the part of Service Providers to reduce the overall cost of owning and operating a network, and providing high quality and value to retain/grow their subscriber base. Service Providers are interested in wireless solutions that provide - investment protection, increased voice capacity, higher packet data rates, better quality of service, as well as longer mobile talk and standby times. There is also a marked trend toward using Wireless Intelligent Networks (WIN) to provide new services.

These Service Providers needs have increased pressure on Equipment Providers to create and bring to market products that are cost effective, easy to operate, maintain, and evolve as technology and services evolve. The use of modular software to reduce time to market for new services, use of open/standard interfaces, industry standard hardware and software, etc., are increasingly being used in the high quality wireless products.

In light of these needs of wireless subscribers, Service Providers, and Equipment Providers, this paper addresses two major aspects of the evolution of CDMA technology for wireless applications:

- The **CDMA network architecture evolution** to provide flexibility in handling a wide range of applications is covered in Section 2 below. The CDMA network architectures are evolving from current proprietary implementations to standardized interfaces defined by international standards bodies, with a view to reduce costs of ownership and operation.

- The **network technology evolution** to take advantage of advancements in software and hardware technologies is covered in Section 3 below. The network component architecture is moving to commercially available hardware/software components to reduce costs, improve time-to-market for new services, and to improve Operations, Maintenance, and Administration (OA&M) of the systems.

2. 0 Network Architecture Evolution

The wireless network architecture should be chosen to serve today's needs cost effectively, and at the same time, be poised to meet the future needs without a complete overhaul of the infrastructure. It should be flexible enough to support multiple air interface technologies, allow new capabilities to be added over the years, and take advantage of performance improvements afforded by use of industry standard hardware and software platforms.

Three major components of a wireless network are:

- Base Stations (BS) and BS Controllers (BSC) providing radio air interface and radio controller functionality,
- Mobile Switching Center (MSC) providing mobility management, access to existing networks (PSTN, PDN, WIN), subscriber services, and Operations Administration and Maintenance (OA&M) for the network, and
- Transport facilities to interconnect various components of the system.

Figure 1 below depicts Lucent Technologies vision of an architecture that meets several important characteristics of a network. This architecture supports multiple air interfaces, and industry standard network interfaces to Public Switched Telecommunications Network (PSTN), Public Data Network (PDN), and other network elements. For CDMA applications, this network architecture supports various IS-95 based air interfaces, ANSI-41 for inter-system communications, ANSI IS-634 open interface between the BSC and MSC, and other wireless data related standard interfaces such as Mobile IP. The Wireless Intelligent Network (WIN) based on the TIA/EIA-41 family of standards support is incorporated in this network. The WIN architecture leverages today's network infrastructure to support service interoperability and transparency between various technologies. The WIN platform also provides a flexible architecture and protocol structure for the rapid and flexible introduction of new services.

Lucent's MSC platform is based on the 5ESS® -2000 Switch, which supports multiple applications, including wireline and wireless telephony - analog, CDMA, GSM, IS-136 TDMA, and others. The 5ESS switch also provides access to PSTN and PDN and supports a variety of signaling protocols. The access to Internet and PDN are via the InterWorking Function (IWF) device shown which converts the air-interface protocol into data networking protocols.

Another important characteristic of this architecture is the use of Asynchronous Transfer Mode (ATM) transport technology throughout the network infrastructure. For cost, maintainability, scalability, and multi-services support, it is desirable to have a common transport layer to network nodes within a network, and to interconnect various networks. A flat ATM network plane enables the evolution to new and more efficient methods for call setup, handoff, reliability and network management that require more distributed information flows than is possible in today's hierarchical topologies. The other benefits of using ATM are that it makes more efficient use of network infrastructure over circuit based network technology by providing an efficient integration of voice, image, data and traffic on to a single transport pipe. The user data, for wireless calls or data sessions, is transported at their native rates and in their native coded formats until converted into PCM or other modes of transport via the PSTN or PDN.

The architecture in Figure 1 leverages the ATM interface from the ANSI IS-634 Revision A standard to provide the BSC to MSC connections. IS-634 is uniquely positioned to evolve to high speed data and multimedia services through its use of ATM packet mode and its support for flexible location of the Selection Distribution Unit (SDU), i.e., the frame selection and speech coding functionality, either centralized in the MSC or BSC. ATM packet mode allows for the efficient use of modern transmission facilities including SONET/SDH, ADSL, HDSL, etc. as well as J1, T1 and E1 facilities. Flexible SDU location allows for more centralized, efficient pools of SDUs to be used with possibly different SDUs for voice and data.

Another key concept found in this architecture is the emphasis on *Application and Resource Servers* in the access networks. Lucent, in its evolution, continues to move from the traditional, tightly integrated service control architecture to a more computer-centric distributed client/server model. Application Servers manage the mobility, access to network resources, such as radios, channels, etc.

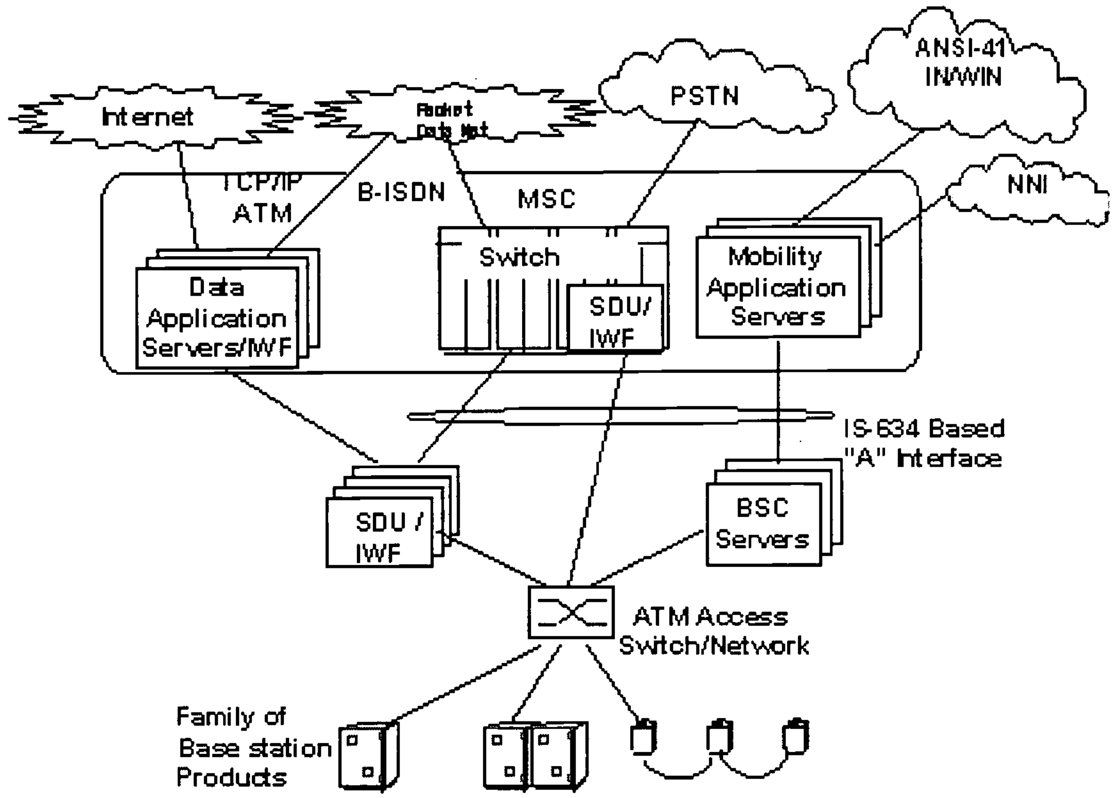


Figure 1 CDMA Network Architecture

Wireless Intelligent Network (WIN) services are a broad category of advanced capabilities that will need to be provided by the target network architecture. Examples of WIN services include voice mail systems, Home Location Register (HLR) databases, and Short Message Service (SMS). WIN services are typically implemented on Adjunct Processors and are accessed through a common IS-41 protocol stack. Application messages are delivered to the IN server through a TCAP and SS7 protocol stack. Further, by linking services with the core network, Lucent will establish the basic infrastructure necessary to achieve true wireless/wireline integration at the service level. Thus, users will have access to these advanced services regardless of whether they are accessing them from a mobile or fixed terminal.

Internet services are managed between the Mobility Application Servers and the Internet Service Provider (ISP) network using an InterWorking Function (IWF) devices. The use of *Mobile-IP* for managing service profiles and IP routing is the wave of the future. Since access to Internet services is controlled by the ISP, ISP services will be managed through a Home Agent which coordinates services through Foreign Agents providing the interworking function located at each MSC. Home Agents will be operated by the ISP provider. The Home and Foreign Agents control the type and grade (speed and error rates available) of access provided over the wireless connection. Different grades of service can be negotiated for each connection within the range allowed by the subscriber's profile. Internet protocols such as TCP/IP, PPP, etc. will be supported for mobile terminals requiring remote access services to the Internet or to Intra-net. ISDN connections will be accessed through the 5ESS-2000 Switch.

The IS-95 based CDMA air interface, through a series of performance enhancements and *incremental changes*, has evolved with respect to physical layer and signaling structures, when compared with the original deployments of IS-95A systems. This has been by design, to maximize investment protection and the utility of radio hardware and chipsets in base stations and mobiles. These enhancements have resulted in improved voice coders, packet and circuit switched data transmission, and improved modulation techniques to provide approximately a factor of 2 increase in spectral efficiency compared to existing IS-95 systems. Lucent has been at the forefront of these enhancements and has optimized its CDMA radio products using the IS95 enhancements.

3.0 Computing Technology and OA&M Evolution

Traditionally, the wireless system Computing and OA&M platforms have been built from proprietary hardware and software components. The trend now is to use Open System computing platforms to ride the technology curve in the industry, and to use modern network management methods to meet the requirements of evolving wireless systems. The use of client-service architecture, and Application and Resource Servers are also key concepts in a modern MSC architecture which is reflected in Lucent's vision in Figure 1. A server in this architecture is a general-purpose computing platform that hosts a wide range of wireless applications, and is available in both simplex and high availability configurations. The high availability Application Server configuration comprises two or more computer systems with one or more instances of application software module distributed across the computer systems. If a critical resource for one or more wireless applications become unavailable, only the impacted wireless application fails over to the alternate server to restore or maintain customer services.

The *modular middleware software* architecture is another important characteristics of this architecture, which allows multiple applications to reside on a single platform, and allows software updates and other system management functions with relative ease. The data base management, data replication services, communication services, and a variety of system management services are part of this middleware.

The framework for OA&M of wireless applications and their associated computer systems/platform is designed using off-the-shelf technologies. An industry standard SNMP-based Element Management System (EMS), HTML and Java, Web browser and Web Server, CORBA, and TCP/IP protocol suite, are major technologies used in this framework. A full implementation of the EMS consists of a distributed client-server framework for managing logical and physical entities in a wireless network, Fault, Configuration, Security, Accounting, and Performance Management capabilities. A Windows-based Local Maintenance Terminal (LMT) console GUI enabling connections to all Application Server console ports, and direct control and status of the reliability software from a single screen.

4.0 Summary

This paper has addressed two major aspects of the evolution of CDMA technology for wireless applications. First, the *CDMA network architecture evolution* to provide flexibility in handling a wide range of applications from high mobility to fixed wireless; and second, the CDMA *network technology evolution* to take advantage of advancements in software and hardware technologies. The motivation for both is a tremendous growth in CDMA deployments around the world, and the pressure on the part of both Service Providers and Equipment Manufacturers to increase revenues, reduce costs, increase functionality and flexibility to serve subscriber needs in a timely fashion. The CDMA network architecture evolution supports flexibility in handling a wide range of applications by evolving to ATM mode of transport, use of client server architecture in the MSC, and standardized network interfaces. The network technology evolution involves the use of modular middleware software on commercially available processor platforms for system management and other OA&M services. A combined evolution of the network and technology enables Service Providers to increase revenues, reduce operational costs, and provide high quality services to retain and grow their subscriber base.

Return to Top View Full-screen

The Configuration Management System for the Cellular Network

Kap-Dae Ahn, Nae-Hee Kim, Hyung-Sup Kim, and Yosub Kim

SK Telecom Central R&D Center, Republic of Korea

ABSTRACT

The rapid growth of cellular networks, appearance of various services and mixed use of many switching systems have increased the complexity of service networks over the past several years. As a result, appropriate network management systems (NMS) are required to provide subscribers with high quality of services and deal with network change or evolution and better accommodate subscribers' needs.

This paper presents the Configuration Management System (CMS) developed for the SK Telecom's cellular network. CMS not only helps operators to increase productivity through the systematic management of the operational data, but also enhances the stability of network operation. In the process of analysis and design, we adopted the Unified Modeling Language (UML), which is almost a standard in the object-oriented software development area. Moreover, we have attempted to build the CMS with an open system architecture through the introduction of Object Management Group (OMG)'s Common Object Request Broker Architecture (CORBA) and the development of Web applications.

View Full Text

The Configuration Management System for the Cellular Networks

INTRODUCTION

Code Division Multiple Access (CDMA) technology for digital cellular service is the most striking one among various approaches for the next generation IMT-2000 services as well as cellular services today. SK Telecom commercialized digital cellular services using CDMA for the first time in 1996 and has provided these services ever since. CDMA overcomes the capacity limits of previous Frequency Division Multiple Access (FDMA) technology used with analog service and enhances the overall quality of service[1].

However, after the launch of CDMA service, the number of subscribers has skyrocketed, now surpassing 600 million. In addition to this dramatic growth of subscribers, various new services have been developed, and many different switching systems are now being used concurrently. These developments have increased the complexity of service networks over the past several years.

As a result, appropriate network management systems (NMS) are required to provide subscribers with high quality services and deal with network change or evolution as well as to better accommodate subscribers' needs. SK Telecom constructed a fault management system (FMS) and a performance management system (PMS) to support stable network operation and maintenance. We also have developed the Configuration Management System (CMS) to support management functionality such as the reconfiguration and the optimization process of the service network.

In this paper, we propose a CMS for our cellular network. CMS deals with installing, initializing, modifying and tracking the configuration parameters of network hardware and software[2]. It supports the integral management of the configuration parameters of network elements, which are scattered over the network. In addition to these elementary functions, CMS also automates the workflow, simulations, verification of the configuration parameters, and so on. Finally, CMS serves as infrastructure for the integrated network management system (INMS), which is the integrated version of the CMS, FMS and PMS.

From the point of software architecture, CMS took the OMG's CORBA Object Request Broker as the communication middleware, which is a standard framework in distributed object-oriented computing environments. And, we adopted the Unified Modeling Language (UML) in the analysis and design phase, which is an emerging industry standard for object-oriented modeling. These techniques enable us to construct an open system architecture to deal with changing or evolving networks effectively and to facilitate INMS construction. In addition, we provide end-users with more familiar interfaces through the Web browser and make the most of platform independent characteristics through the use of Java.

This paper is organized as follows. Section 2 contains a brief survey on the background: components of SK Telecom's cellular network, network structure and hierarchy, adopted development methodology and Web technology. In Section 3, we present the functionality of CMS. We describe the architecture and implementation of CMS in Section 4. Finally, in Section 4, we summarize and conclude the paper.

BACKGROUND

In this section, we briefly present the components of SK Telecom's cellular network, its structure and hierarchy, methodology and techniques introduced in the construction of the CMS.

1. *SK Telecom's Cellular Network*

Generally, a cellular system consists of the Mobile Telephone Switching Offices (MTSO), cell sites and mobile stations. MTSO processes calls either originated from or terminated to mobile handsets and controls the entire operation of the cellular system. Currently, SK Telecom provides both analog and digital cellular services. Figure 1 below shows a conceptual model for SK Telecom's cellular network. As shown in figure 1, the network is classified into two categories by the type of data that flows through the network: One network is for the signaling data and one is for the voice messages.

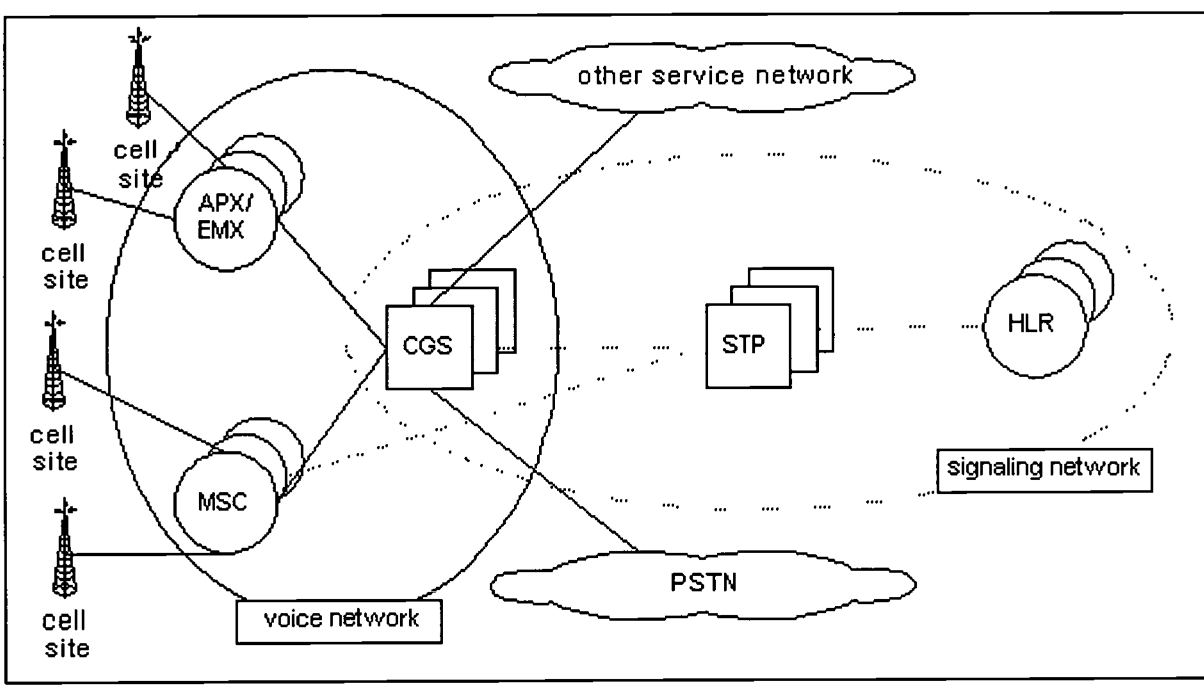


Figure 1. SK Telecom's cellular network

There are many types of switching systems in operation at SK Telecom, as shown in Figure 1. APX is a Autoplex 1000 switching system from AT&T for the Advanced Mobile Phone Service (AMPS). EMX is also a switching system for the AMPS from Motorola, and CGS-A is a cellular gateway system for the AMPS from AT&T. The Mobile Switching Center (MSC) is a switching system for the CDMA. There are three kinds of MSC, classified by vendor: LG, Samsung (SS), and Hyundai (HD). MSC includes Base Station Controllers (BSC) and Base Station Transceiver Subsystems (BTS) for the cell sites. CGS-D is a cellular gateway system for the CDMA from LG and SS. HLR is a system for the home location registration and finally, STP is a switching system for signaling from Tekelec. Besides these systems, there are other types of systems for additional services such as authentication and short message service.

2. *System Building Methodology*

a. Object-oriented analysis and design using UML

UML stands for Unified Modeling Language, a notation for modeling systems using object-oriented concepts[3]. It is the industry standard language in object-oriented modeling for specifying, visualizing, constructing, and documenting the artifacts of software systems. It simplifies the complex process of software design, making a "blueprint" for construction[4]. We use the Rational Rose that supports the UML, helping us to understand the problem more formally and giving us a common communication method.

b. Distributed Processing Environment with CORBA

Object Management Group (OMG)'s CORBA is a standard infrastructure for building systems in a distributed object environment. In CORBA, the services that an object provides are expressed in a contract that serves as the interface between it and the rest of the system[5]. CORBA objects can communicate with each other through the software bus called Object Request Broker (ORB). Following are some benefits of CORBA:

- It enables developers to construct software systems easily in a distributed computing environment where there are many types of heterogeneous hardware. Developers can increase their productivity through CORBA, in which implementation details of the internetworking is hidden.

- CORBA is the best framework in which the object-oriented concept is grafted into a distributed computing environment. Naturally the benefits of the object-oriented methodology such as reusability, extendability and hiding of implementation details are fused together.

- Give them an Interface Definition Lanaguage (IDL) interface and a thin layer of wrapper code, and legacy applications come into the CORBA environment on an equal basis with new software components[5]. In other words, it helps to construct open system architecture.

Because CMS has the primary configuration parameters of the service network, which is constantly changing in the real world, it can provide the data needed for other network management systems. In other words, CMS can be the infra-system of INMS. We expect that construction of the CMS based on CORBA help us to build the INMS more effectively.

c. Web and Java

Coupled with increased interest in the Internet and innovative technology development, Intranet is increasingly being used to enhance communication and share information within a company. Additionally, high speed networks such as private exchanges enable special Intranet services for the network management system, which requires high capacity traffic. Web services using Java are receiving the most attention in this area. The benefits of using Java and Web are summarized as follows:

- Web itself provides end-users with familiar user interfaces. Providing interfaces that are used in daily life makes users feel more comfortable.
- Cost of maintenance can be reduced. Distribution of the upgraded versions to millions of clients is achieved by just putting them on a Web server.
- Basically, Java is a platform independent language.

We have constructed the CMS by putting together Java, Web and CORBA. The applet is downloaded into each client from the Web server, and these clients get their results by requesting a service to an appropriate server object through ORB. CORBA deals with network transparency, while Java deals with implementation transparency[6].

CONFIGURATION MANAGEMENT SYSTEM

In this section, we present the functionality of the CMS.

1. *Operational data (parameters) management*

CMS gathers and manages the data that are stored and operated in network elements such as switching equipment, signaling equipment and cell sites scattered throughout the cellular network. The managed data are classified into two categories: configuration data and parameter data. The former is the data about the resources of the network elements. For example, the information about how many frequency assignments (FA) are contained in a specific cell, how channel cards are configured in the shelf and the equipage information about the switching system.

The latter is the data that represents the attributes of the operational network such as the power control parameters, access parameters, and handoff parameters defined in IS-95A, which is the protocol for CDMA air interface standard. Prefix information, routing parameters and signaling parameters are also contained in this category. Besides CMS provides the simple parameters stored in the network, it also provides the readjusted data, which are in relation each other, so that operators can grasp the present condition of the network status within short time. It also supports the efficient distribution of network resources and the optimization process of the network.

2. *Data Verification*

Besides the data defined in a standard protocol, increase of the number of switching systems and the appearance of new services have greatly increased the number of management data. Use of inadequate data makes the network unstable or deteriorates the quality of service. For example, unregistration of neighbor data causes a call drop when a handoff is made, and inadequate distribution of the prefix data can overload a switching system.

It is very inefficient that operators must routinely verify these types of data. Moreover, it is very difficult to discover inadequate data among the vast quantity of operational data. CMS enables the network to be operated correctly by verifying the erroneous data and maintaining a stable status in accordance with the nationwide network operation plan.

3. *Workflow Automation*

Some jobs such as growing cell or swing cell require many steps after hardware installation. For example, setting up configuration data such as the sector data and frequency assignment and setting up parameters for power control, the system and access are included. Specially, in a case of swing cell, the main job is to set the data of the swing cell by its previous data. In other words, an operator just copies the data from the previous cell to the swing cell. However, in this case, the number of parameters that should be copied are numerous and this kind of job itself contains many routine tasks. Moreover, there is only simple interface supported by the each network element. CMS formalizes this workflow, minimizing human error and increasing operator productivity by reducing the time needed to complete the job.

4. *Simulation*

CMS offers a simulation function for various types of calls that can be occurred in the real world. When a subscriber calls a specific dialing number, the call flows through the network from an originating system to the destination in the service zone covering the called party's location. Internally, the flow starts from the originating system in which digit analysis is performed, passes through intermediate systems and finally, reaches the destination system. CMS extracts and implements the logic about the call processing for each type of switch and shows the internal network data's status related to the setup of a call.

This function helps operators to confirm the network internal status at a time that determines the setup path of a call. In addition, by the simulation of routing path, operators can confirm the alternate routing path when a specific trunk or switch fails. Through this functionality, operators can check in advance any erroneous part that could affect the performance or stability of the service network.

5. *History management*

The maintenance of the network includes many steps such as changing the attribute data of the network. These can be done during the process of the network optimization, growth of the switch, reconfiguration and change of the network structure, and so on. However, during these processes, if different operators change parameters from the different view of operation, the integrity of the data may be compromised. Moreover, from the point of recovery, saving the changing history of parameters is very important because they can cause critical errors in the system. In CMS, when operators change the configuration parameters, the previous information is recorded in the database for further reference.

6. *Security management*

A system should prevent any fraudulent users from accessing or changing the data managed in the switches. Through a user management function, CMS allows only users with appropriate privilege to access or modify the parameters. Under this security policy, each user has the different privilege level by the unit of switch and functionality and this privilege can vary according to the operator's job, the branch to which the operator belongs or the type of operational switch.

7. *Coupling with other NMSs*

CMS includes the basic configuration data that can be used in other NMSs such as FMS, PMS and BIRDS (Base station Integrated Recovery, Diagnostics and Surveillance system), which has been developed for the fault and recovery management of the base station at SK Telecom. For example, BIRDS acquires the hardware configuration data of the base station such as the channel card information from the CMS, and controls the base station after diagnosis of the problem.

8. *Supplementary Functions*

CMS can manage additional information such as the manager, location and the latitude and longitude of the base station for the managed equipment. It also provides the management of the users that are currently logged in the CMS, the software processes related to the CMS, the database, and the software and hardware block version that make up the network elements.

ARCHITECTURE AND IMPLEMENTATION

Figure 2 below represents the deployment view of the CMS in SK Telecom's cellular network.

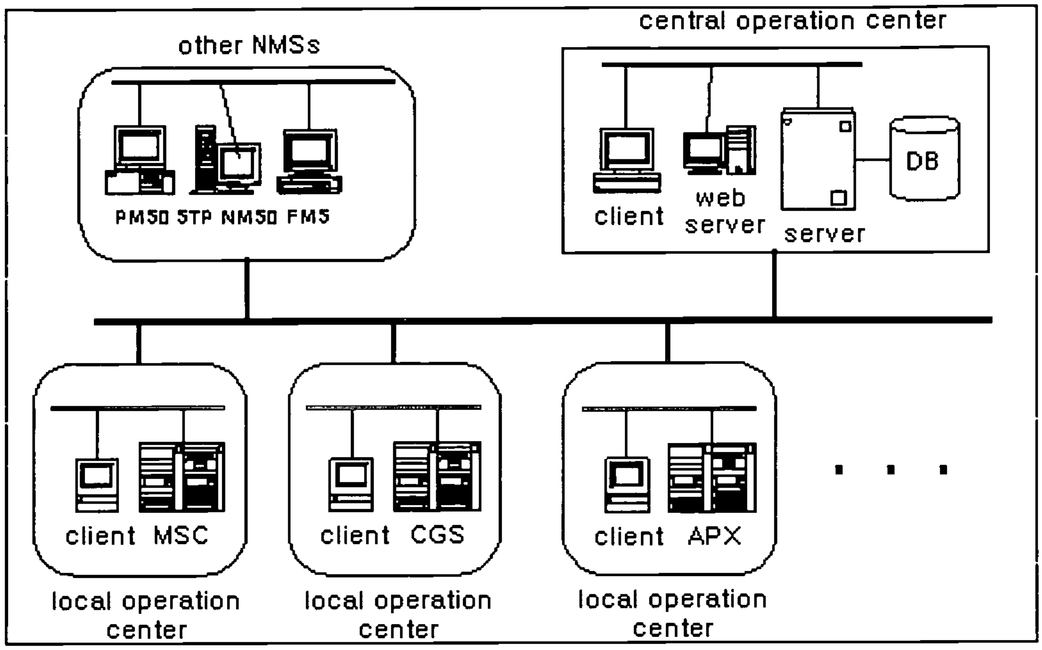


Figure 2. Deployment view of the CMS

In the central operation center, there is a database that stores the data gathered from the network elements and a server system that processes requests from clients. In addition, a Web server provides Web clients with applets. In the local operation center, a CMS client system contains client modules and gateway modules, which are responsible for interfacing with the local network element.

As for software modules, CMS components are classified into the following categories:

- ***Server module***

  For each function mentioned in the previous section, the server module accepts requests from clients, processes them and returns the results to the clients. Clients have two types of requests: query and update. For a query, the server module reads the requested data from a database, processes them properly and returns them to the clients. For an update, the server determines the target network element in which the requested update occurs, makes the gateway to update the data in the local network element and reflects the result in the database.

- ***Database***

  The database contains configuration data periodically gathered from the network. This configuration data is maintained consistently in the centralized database. Managed data contains the data from the network elements and those for the management itself such as manager information and branch information.

- ***Gateway***

The gateway gathers data from the scattered network elements and processes the data properly to load them into the database in the server system. When an update request is received via the server module from a client, the gateway acts as an interface to the local network element.

- ***Client***

  The client includes the Motif-like GUI client and Web client. The client is responsible for user interface. User interface includes the map that represents network elements and results for some special functions such as the neighbor list of a specific cell site.

- ***Web Server***

  By the requests of Web browsers, the Web server provides Web clients with the applets that implement the CMS applications. In addition, the Web server offers some plug-ins and files needed to work the CMS properly in the Web browsers.

When we built the CMS, we used Rose, which supports the UML from the analysis to the design phase. Based on the generated codes from the design model, we developed the CMS using C++ and Java. Iona's Orbix and OrbixWeb were used as the communication middleware (ORB), and Oracle was used for the centralized database. Figure 3 belows shows some outputs from Rose.

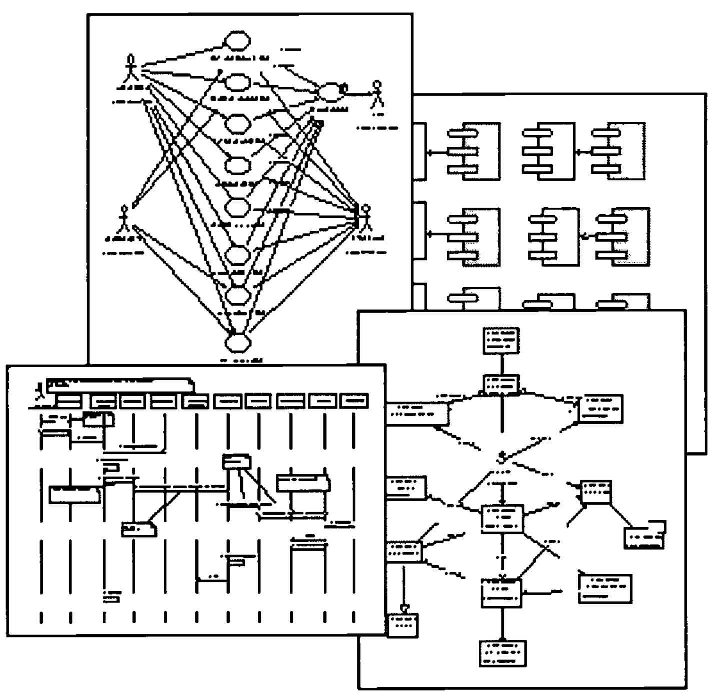


Figure 3. Diagrams from Rose

When we introduce the ORB, we assort the independent service objects and define the interface for those objects as ORB objects. We separate the server objects from interface objects to keep the independence of the middleware. The objects mentioned in the previous section such as server objects and gateway objects are examples of service objects on the ORB. Figure 4 below shows the relationship among the components based on the ORB and the gray circle represents the ORB interface objects.

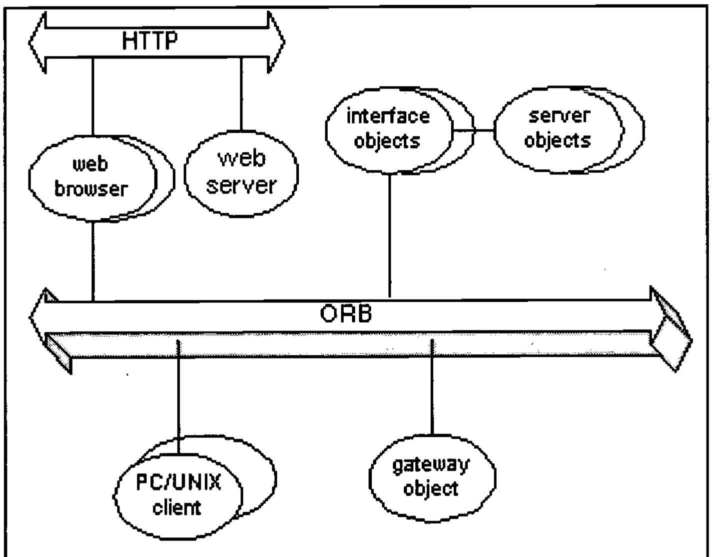


Figure 4, relationship of the components based on the ORB

CONCLUSIONS

In this paper, we present the Configuration Management System (CMS) for SK Telecom's cellular network. CMS helps an operator to make rapid decisions about network management through the integral management of the network resources and configuration parameters. Additionally, it automates the workflow, data verification and simulation functions, increasing network efficiency and optimizing processes and operations. As a infrastructure of an Integrated Network Management System (INMS), CMS provides the configuration parameters needed to other network management systems.

We introduced the object-oriented methodology, which has various advantages. In the analysis and design phases, we adopted the UML, which is almost a standard modeling language in the object-oriented area. Moreover, we have tried to build the CMS with an open system architecture through the introduction of OMG's CORBA and the development of Web applications using Java.

In the future, we plan to build an INMS and management system for next-generation networks.

REFERENCES

V. K. Garg, K. F. Smolik and J. E. Wilkes, *Applications of CDMA in Wireless/Personal Communications*, Prentice Hall, 1997

ITU-T Recommendation M.3400: "*TMN management functions*", 1997

C. Larman, *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design*, Prentice Hall, 1998

J. Siegel, *CORBA: Fundamentals and Programming*, John Wiley & Sons, Inc, 1996

R. Orfali and D. Harkey, *Client/Server Programming with JAVA and CORBA*, John Wiley & Sons, Inc, 1998

Return to Top View Full-screen

Interactive Services using SMS in the CDMA network

Hyun-Wook Kim, Yeon-Kyu Kim, Sung-Bum Lee, Hook Suk Byun

SK Telecom Central R&D Center, Republic of Korea

ABSTRACT

The CDMA cellular system has many advantages over other cellular systems, especially in terms of capacity, voice quality, and interference immunity. The short message service(SMS) is a highly prospective service with the CDMA cellular system. We propose a new interactive service based on the transactions of MT SMS and MO SMS. Although no international standard for this service, we have devised and tested it for commercial operation. The experimental results were favorable for commercializing.

View Full Text

Interactive Services using SMS in the CDMA network

I. INTRODUCTION

The CDMA cellular system has already been launched sucessfully in many countries, starting with Korea. This system has numerous advantages over other ones in respect of channel capacity, voice quality, noise immunity, multiplexing with other media, etc. Since this system is digital, data services such as the Short Message Service(SMS) can be applied easily.

SMS is similar to a two-way paging service using a CDMA channel. SMS messages are delivered in the form of Data Burst Message in the Paging channel, Forward Traffic channel, Access channel, or Reverse Traffic channel that were defined in IS-95a. Since SMS messages may use Traffic channels, it can be transmitted by Data Burst Message even when the cellular phone cannot receive any call or is in conversation mode. Although the message length is short, it is very useful for some services such as voice mail notification and message transmission.

There are three basic kinds of SMS: Mobile Terminated(MT), Mobile Originated(MO), and Cell Broadcating(CB). These services are already defined in TIA/EIA/IS-637 specifications. In this paper we propose an interactive service based on the basic SMS types. The Interactive Service can be achieved by sequential transactions using MT SMS and MO SMS. This is very stable and useful in the CDMA network. Using this service, one can make queries about stock prices, news, or hotel reservations and can get an answer. For example, if someone wants to get current news, he just selects the News category in one of several ways and sends an MO SMS message. Then the system responds to the cellular phone by an MT SMS message with the correspoding information. Category selection can be recursive.

The proposed Interactive Service has been implemented successfully in SK Telecom which is one of the world's largest cellular service providers and has more CDMA subscribers than any other company. The test results has been successful, and thus this service has strong potential for being popular with subscribers.

In section 2, Short Message Service will be explained. Then we show our interactive service in Section 3. Section 4 presents parameter assignment for the proposed scheme. Finally, conclusions and future remarks will be presented.

II. SHORT MESSAGE SERVICE IN THE CDMA NETWORK

SMS transmits a short message using Data Burst Message as defined in IS-95-A. The higher layer functions and protocols of this service are defined in TIA/EIA/IS-637.

1. *General descriptions of SMS*

SMS provides a means of transmitting or receiving a short messgage. An SMS subscriber can use this service by pressing the "* " button the direct SMS access key on the wireless handset. In the system, the Message Center(MC) must be appended to the general CDMA network. Moreover, IS-637 must be implemented both in the network and in the wireless handset.

SMS is broadly categorized into two types: Cell Broadcasting service, Point-to-point service. The first is a unidirectional SMS service. The MC just transmits messages to all handsets that can monitor the Paging channel. This is fast,but cannot guarantee message transmission. The latter is a bidirectional SMS service. Both MC and handset can send a message. For example, a message is sent to a specific handset. In the point-to-point service, handset acknowledgement is requested for message receipt. So the MC requests acknowledgement, and the handset sends acknowledgement. According to these procedures, a reliable message transmission can be achieved. Point-to-point service is separated into two types again: MT SMS, MO SMS. And several applications using these two services can be developed. One of these is the Interactive Service, which is the main topic we will discuss.

2. *System Configuration*

Figure 1 shows the system configuration for supporting SMS services. A typical CDMA system is composed of Home Location Register(HLR), Mobile Switching Center(MSC), Base Station Control(BSC), and Base station Tranceiver System(BTS). For SMS, at least two components, a Message Center and a SMS Server, must be added to the typical CDMA system. And SMS software must be installed in the wireless handset.

For MT SMS, the MC first obtain the subscriber information from the HLR which is linked directly to the MC, and then send a Mobile Application Part(MAP) message to the MSC. The MSC routes to the BTS in which the destinated handset is currently registered. For MO SMS, the message sent from handset is routed to MC, and then transmitted to the intended destination.

In the Um interface, which is the air interface part of the CDMA system, an SMS message is transmitted in the form of a Data Burst Message defined in IS-95-A. This message is available when the service option is set to 6, and has a limited length. A detailed description on the message format will follow in the next section.

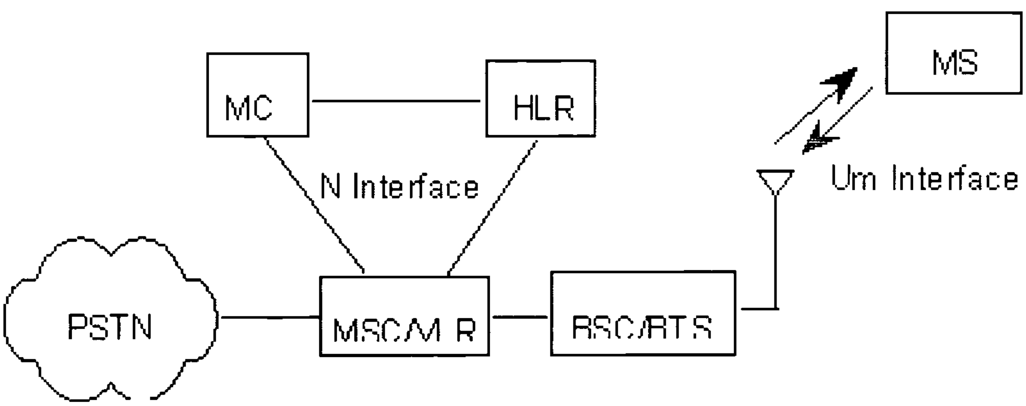


Figure 1. System configuration for the SMS

3. *SMS Protocol Stack and Message Format*

Figure 2 shows the SMS protocol stack. SMS is based upon the Link Layer that is responsible for the Data Burst Message and that is defined in IS-95-A. The Relay Layer performs address processing, channel selection, etc., and the Transport Layer plays the role of routing between the different Relay Layers. The highest layer, the Teleservice Layer, supports various application.

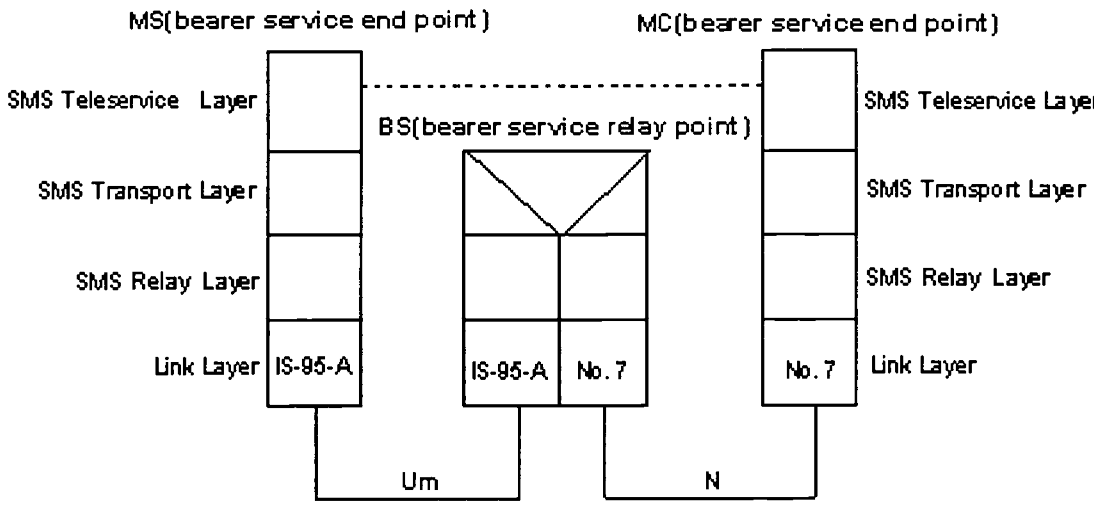


Figure 2. SMS protocol stack

The message format of each layer is shown in figure 3. The message format of the Link Layer is defined in the IS-95-A transmission protocol. The SMS Relay Layer provides the interface between the SMS Transport Layer and the Link Layers used to carry short message traffic. The SMS Transport Layer resides in the SMS bearer service end points and relay points. In a bearer service end point, the SMS transport layer provides the means of access to the SMS system for Telesrvices that generate or receive SMS messages. In a bearer service relay point, the Transport Layer provides an interface between Relay Layers. The Teleservice Layer supports basic SMS fuctions through a standard set of subparameters of the Transport Layer's Bearer Data parameter.

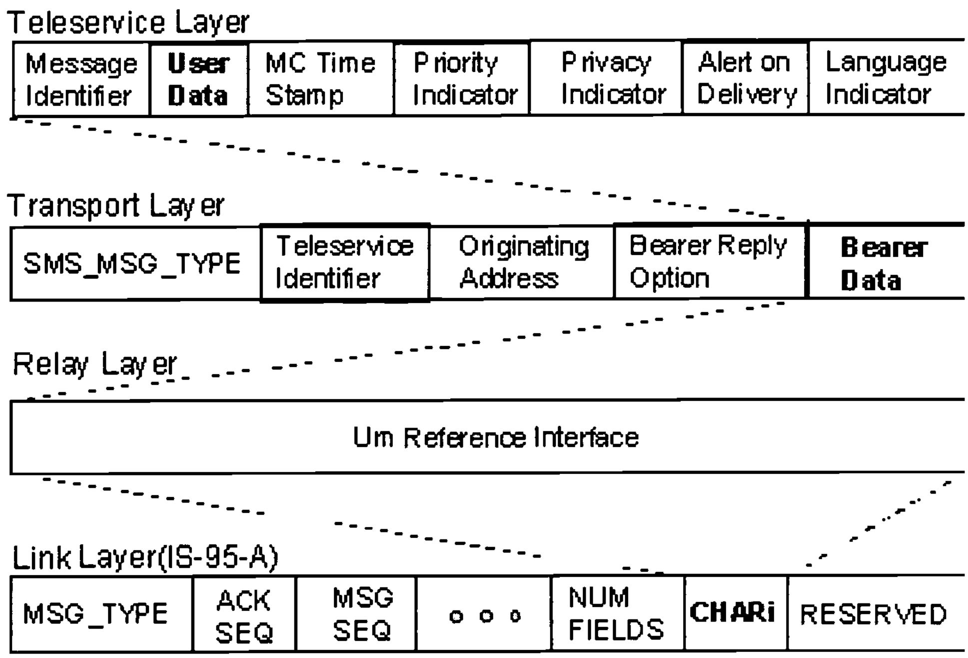


Figure 3. IS-637 message structures

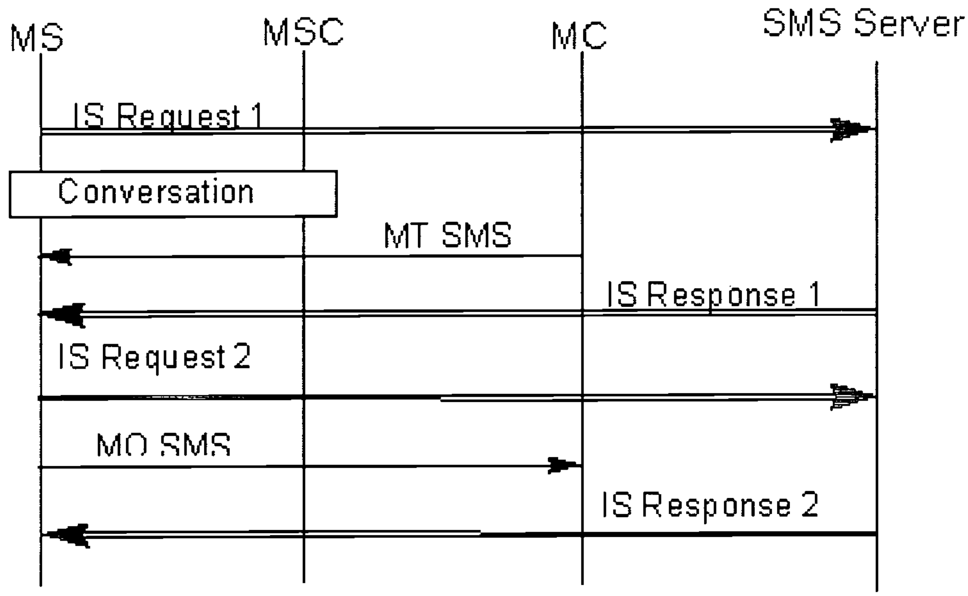
As Figure 3 shows, the Teleservice Layer consists of Message Identifier, User Data which contains the contents of user message, MC Time stamp, etc. These ard a Bearer Data in the Transport Layer. Some header fields such as SMS_MSG_TYPE. are appended to comprise the transport layer message. The transport message becomes CHARi field of Link Layer through the Relay Layer. Then the Link layer message is transmitted to the handset in the form of a Data Burst Message.

III. INTERACTIVE SERVICE USING SMS

1. *The way of interactive service provision*

Interactive service is achived by a sequential transaction set of MT SMS and MO SMS. Figure 4 shows an example. When a subscriber wants some information, he can request the information with Interactive Service routines provided by the handset. The handset sends this information using MO SMS with a special TI. After processing the received SMS message, the system delivers the information to the subscriber via a MT SMS.

As shown in Figure 4, a subscriber can make general phone calls and short messages while using interactive service since the Interactive Service can be multiplexed.



* IS : Interactive Service

Figure 4. A scenario of interactive service

MT SMS messages for Interactive Service are displayed on the handset LCD directly after arrival. Therefore, a user can see the result immediately, and perform the next step easily if needed. After a user gets all the informations he wants, he can quit by pressing the "END" button.

2. *System configuration*

Figure 5 shows the system configuration for supporting interactive services.

< Figure 5. System configuration for interactive services >

The difference between this system and the general system that supports SMS is just the SMS server and external information providers(Ips). The SMS server must support interactive requirements, and the IPs are attached to the SMS server.

For interactive service, a SMS Server is attached to the typical system. The MC is linked to both the HLR and MSC, and performs a function defined in IS-637. The SMS server is linked to the MC, and supports SMS. Moreover, linked to external IP, voice mail service, etc., the SMS server provides various additional services. Basically, the MC performs the Transport Layer processing defined in IS-637, the

- SMS server supports higher layer processing for several applications, and the IP provides various kinds of information.

IV. PARAMETER ASSIGNMENT

1. *System access for interactive service*

A user can request information through the following steps:

1. Select Interactive Service menu on the handset

2. Input the User Data field in the form found in Table 1.

3. Press "SEND" button.

The handset should assign an external IP server address into the Destination Address field, and '65527' into Teleservice Identifier field respectively.

Table 1. Interactive service access from the handset

User Data field(ex)	Means	Server Response
*011	Top menu request	Top menu
*12345	Information request by quick code	Corresponding information
*movie	Information request by category Name	Corresponding information

2. *TI assignment and IS-637 parameter*

The Teleservice Identifier(TI) field in the Transport Message must be determined for interactive service. Table 2 shows TI valuea and their meaning in interactive service.

Table 2. TI assignment for interactive service

TI	Direction	Usage	Mobile station action
65527	M® S	Initial Access	MO SMS generation
65528	M¬ S	Transmit menu list	Menu display
65528	M® S	Selection of menu	Transmission of selected string
65529	M¬ S	Prompt for character input	Prompt for user input
65529	M® S	Input message	Transmission of edited message
65530	M¬ S	Prompt for numeric	Editing for numeric characters
65530	M® S	Selected menu	Transmission of selected menu
65531	M¬ S	Call back number message	Display call back number
65531	M® S	Previous and next search	Transmission of selected items
65532	M¬ S	Text message	Text display and scrolling
65532	M® S	Error message	Display error message and termination

Tables 3, 4 show the parameters ralating to the language used in the service that are important for interactive service. Currently only handsets that supports the Korean language can be used for interactive service. Thus the MSG_ENCODING field in the User Data and LANGUAGE field in the Language Indicator must be set to '10000' and '0xFE', respectively.

Table 3. User Data of IS-637

Field	Length(bits)	Value
SUBPARAMETER_ID	8	'00000001'

SUBPARAMETER_LEN	8	Total length in byte
MSG_ENCODING	5	'00000' – Octet , '10000' – Korean
NUM_FILEDS	8	Length of CHARi
CHARi	8 x NUM_FIELDS	Message content
RESERVED	3	'000'

Table 4. Language Indicator of IS-637

Field	Length(bits)	Value
SUBPARAMETER_ID	8	'00000001'
SUBPARAMETER_LEN	8	Total length in byte
LANGUAGE	8	'00000001' – English, '11111110' - Korean

V. PRACTIVAL EXPERIMENTAL SCENARIO AND RESULTS

1. Interactive service access and termination

A user can access the interactive system by selecting 'Interactive' in the SMS menu. After selection, the handset displays the prompt "Press <SEND> or input *direct access code* '*011'". Figure 8 shows the handset LCD. '*011' is the default value of User Data field. A user can change the User Data value by pressing the approapriate *direct access code*.

(a) SMS menu (b) access for interactive service

Figure 8. LCD display for initial access for interactive service at MS

As Figure 9 shows, the system menu has a tree structure. The root node is the top menu. One can access the root node by setting User Data field to '*011'. Then supported categories are listed on the LCD. By selecting the category, one can access the child node. The child node is a submenu that represents more specific items. Recursive selection enables a subscriber to obtain the information that he wants.

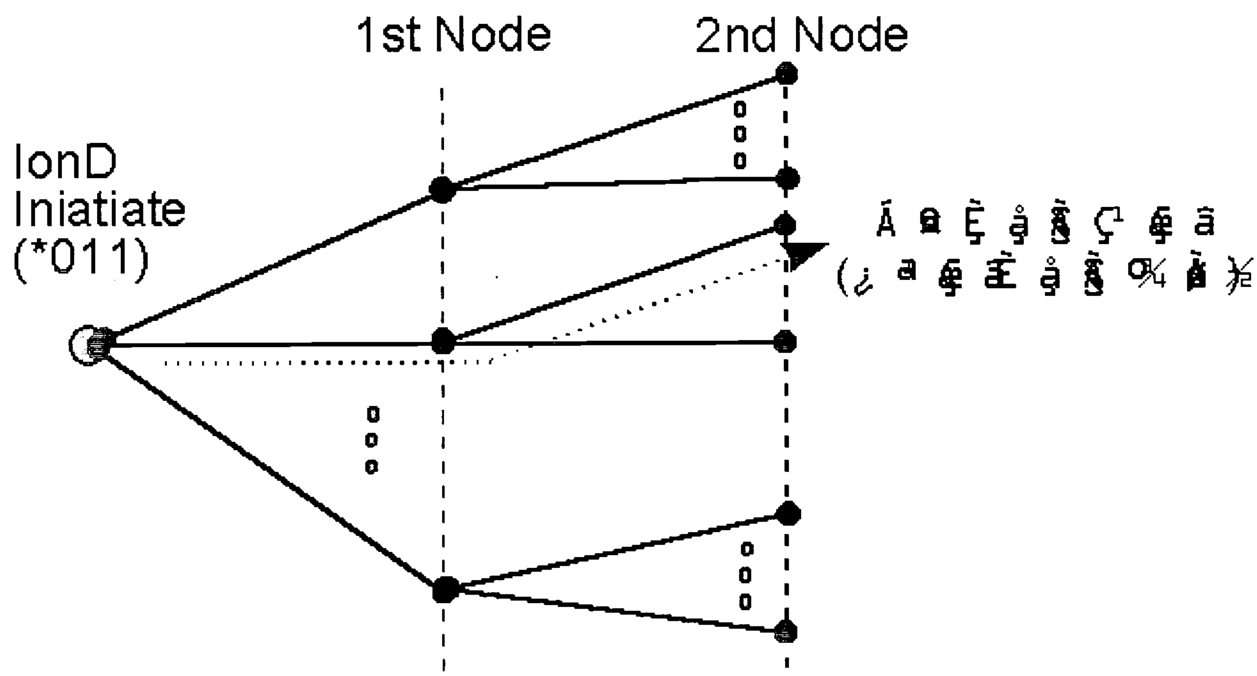


Figure 9. Menu structure>

It is also designed to access the first node or second node directly by using *direct access code.*

Figure 10 shows an example of field values for initial access. If someone wants to use a direct access code, he can do just by editing '*011' to '*12345' – one of the direct access codes. Then the User Data field in Figure 10 will be changed to '*12345'. After pressing the <SEND> button, the handset establishes message fields such as figure 10, then sends the MO SMS message.

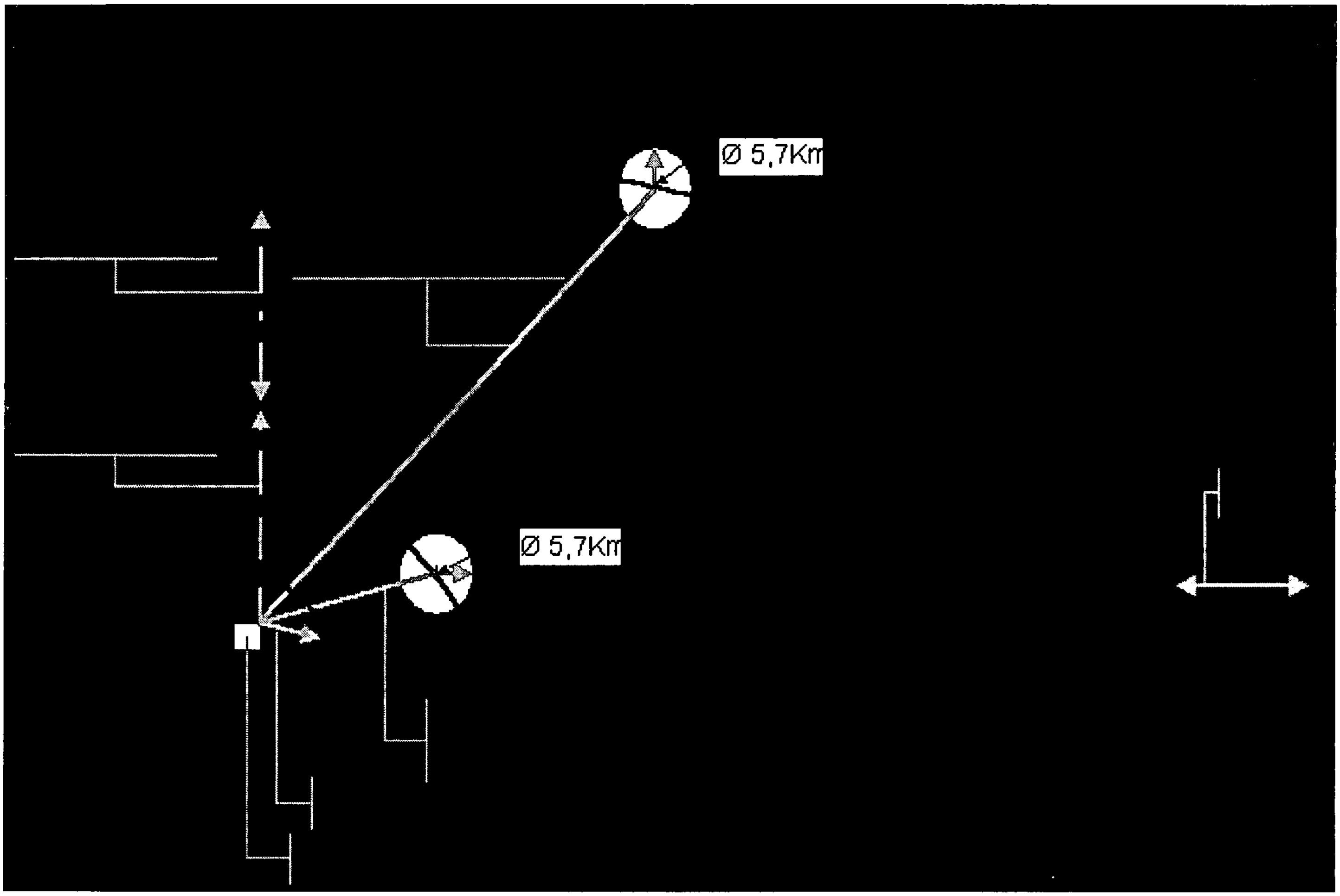


Figure 10. An example of field values for initial access

There are three conditions of interactive session termination. One is a normal termination, and the others are abnormal. The normal termination is done by pressing the <END> button. The SMS server maintains a timer. And when the timer expires, the SMS Server terminates its process. One of the abnormal terminations is when mobile station receives the TI field set to 65532. The other is when a user doesn't respond for 5 minutes after receiving the final MT SMS message.

2. *Message Processing*

There are six kinds of messages that the system sends: (1) menu list, (2) prompt for character input, (3) prompt for numeric input, (4) call back number message, (5) text message, and (6) error message. Each of them has the its own TI value as described in Table 2. In one message body, several fields are separated by carriage returns. A call back message will be described as a practical example.

A call back type message carries items with call back information such as a phone number. Figure 11 shows a User Data field for a call back message and LCD display when receiving that message. When a user selects the item, the mobile station is linked to the call back number.

When more items are provided than can be displayed, the word 'Continued' is displayed. Selection of this makes it possible to see more items. The response message uses MO SMS. The TI field value of the response message is set to that of the message just received. The User Data field of the response message is filled with the data string a user selected.

Figure 11. User Data field for a call back message & handset LCD

Even after responding, the previous message will not be deleted until the next message arrives. Each type of message is processed in the same way.

VI. CONCLUSIONS

SMS provides a reliable exchange of short messages and also offers a chance to overcome the limitation of voice-oriented service. These points have caused a rapid increase in subscribers, and have enabled several supplementary services. Therefore SMS is now one of the basic supplmentary services for a new cellular phone subscriber.

There are many applications of SMS, and we proposed a new service, interactive service. This service enables a user to get the information he wants anywhere, anytime if he is in the service area. This service is based on the transactions of MT SMS and MO SMS. No international standard exists for about interactive service, but we devised the one descibed above and completed testing.

Experimental results were good enough for commercialization. The success rate of interactive is equal to that of general MT/MO SMS. However, the real-time property cannot be guaranteed because of the store-and-forward routing scheme for SMS messages. This may cause some inconvenience of subscribers,and the problem must be addressed in future system design.

VII. REFERENCES

[1] TIA/EIA/IS-95, *Mobile Station-Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular Systems,* Jul. 1993.

[2] TIA/EIA/IS-637, *Short Message Services for Dual-Mode Wideband Spread Spectrum Cellular Systems*, Feb. 1998.

[3] TIA/EIA/IS-41-C, *Cellular Radiotelecommunications Intersystem Operations : Signaling Protocols*, Feb. 1996.

[4] TIA/EIA/IS-53-A, *Cellular Feature Description*, May 1995.

[5] TSB 58, *Administration of Parameter Value Assignments for TIA/EIA Wideband Spread Spectrum Standards*, Dec. 1995.

Return to Top   View Full-screen

Speech Quality Measurement in a CDMA cellular network

Kwang-Hoon Kim, Young-Rul Kim, Joo-Wan Kim, Seo-Sung Hee

SK Telecom Central R&D Center, Korea

ABSTRACT

Speech quality in a CDMA cellular system begins to drastically decrease as the number of subscribers increases over certain level. The evaluation of speech quality is an essential work for service provider to provide better quality for customers.

To obtain reasonably accurate estimate of subjective quality, we referred to PSQM(Perceptual Speech Quality Measure) which is considered by ITU-T(p.861)[1] and modified that algorithm. And we performed an experiment to collect real distorted data and conducted a survey to obtain statistical MOS(Mean Opinion Score). With these we can get high correlation coefficient more than 0.9 between modified PSQM values and MOS data.

However, in CDMA cellular system, it is not an easy task to synchronize original and transmitted speech in end-to-end real-time measurement system. Although modulated PN sequence is useful in analog cellular system, it is not appropriate to use in CDMA cellular system. Therefore we adopted tone detection method by using IIR digital filter for rough synchronization and fast cross correlation method for exact synchronization.

View Full Text

Speech Quality Measurement in a CDMA cellular network

I. INTRODUCTION

One of the important operating considerations of cellular phone service providers is to maintain good speech quality of the cellular phone network and the measurement of speech quality is an essential work for that. Subjective evaluation by repeated listening tests at various sites within the coverage area is impractical due to its intrinsic laborious and expensive nature. As a result, it would be desirable to have an automatic objective evaluation system which applies a good objective speech measure to estimate the subjective quality of the cellular phone network.

In this paper, we report modified PSQM algorithm and synchronization method of speeches in real-time automatic objective evaluation system we developed for CDMA cellular network and we have found a good correlation value between modified PSQM values and MOS data collected in real conditions.

II. EXPREIMENTAL DESIGN

1. *Data Collecting And Subjective Measure*

Fig.1 shows the block diagram the method collecting distorted data. The original speech signals are played from a cellular phone(CDMA) via a hand-free(H/F) kit interface box. The whole setup is installed in a van which moved along some designated routes. Simultaneously, in the laboratory, the distorted speech signals are recorded from a normal telephone to a DAT deck via an interface circuit. and vice versa. We tried to get all kinds of distortions that can be occurred in CDMA channel such as mute, interference, background noise and echo, etc.

In order to develop an objective measure that correlates well with subjective quality assessments, we need to be cognizant of subjective measures which are the ultimate arbiters of speech quality. Most commonly used measures is the mean opinion score(MOS)[2].

MOS scores require lengthy subjective testing, but are widely accepted as a norm for comparative rating of different system. The automatic predictions of MOS scores directly from the speech signals and without human subjects could, therefore, be of great practical value.

The rating scale employed in MOS testing is illustrated in Table 1 along with a general description of the levels of distortion typically associated with each numerical score. (These descriptions are not given to the subjects who perform the ratings). An MOS is a mapping of perceived levels of distortion into either the descriptive terms ""excellent, good, fair, poor, unsatisfactory," or into equivalent numerical ratings in the range 5-1. The numerical mapping is clearly a mixed blessing. On the one hand, it permits the ranking of distorted speeches and direct comparisons with objective measures. On the other hand, it lumps different kinds of distortion together, which gives little insight into the causes of distortion.

Table 1. Descriptions in the Mean Opinion Score(MOS)

Rating	Speech Quality	Level of Distortion
5	Excellent	Imperceptible
4	Good	Just perceptible but not annoying
3	Fair	Perceptible and slightly annoying
2	Poor	Annoying but not objectionable
1	Unsatisfactory	Very annoying and objectionable

We prepared 9 sets of Korean speech materials, and the talkers are three men and three women. Each speech material is composed of two 2 to 2.5-second sentences and 1-second gap exists between them. And we collected 260 speech samples. For all conditions of MOS test, we followed the recommendation of ITU-T p.800[3,4]. We gathered 100 persons who had never participated in MOS test before.

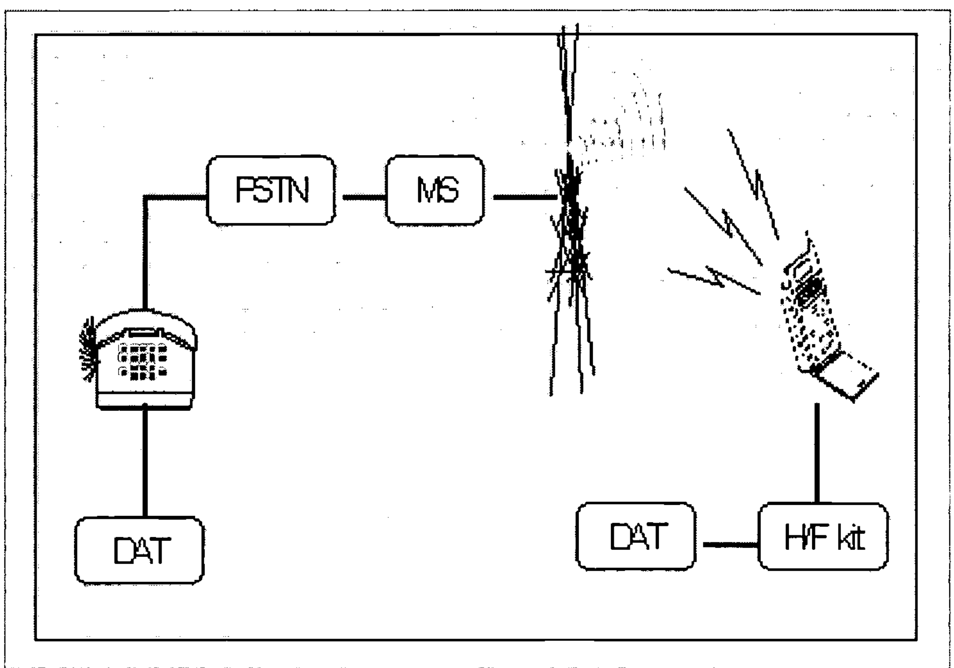


Fig. 1. The block diagram for collecting distorted data.

2. *Objective Measure*

Within the PSQM, the physical signals constituting the source and coded speech are mapped onto psychophysical representations that match the internal representations of the speech signals(the representations inside our heads) as closely as possible. These internal representations make use of the psychophysical equivalents of frequency (critical band rates) and intensity (Compressed Sone). Masking is modeled in a simple way: only when two time-frequency components coincide in both the time and frequency domains, masking is taken into account.

Within the PSQM approach, the quality of the coded speech is judged on the basis of differences in the internal representation. This difference is used for the calculation of the noise disturbance as a function of time and frequency. In PSQM, the average noise disturbance is directly related to the quality of coded speech.

The transformation from the physical (external) domain to the psychophysical (internal) domain is performed by three operations:

- Frequency warping : to reflect the frequency sensitivity of human auditory system and to transform frequency band region into critical band region
- Intensity warping : to reflect the loudness sensitivity of human auditory system with respect to frequency
- Asymmetry processing : to reflect the asymmetry characteristic of human auditory system for different reaction to muted and noise-added speeches

Besides perceptual modeling, the PSQM method also uses cognitive modeling in order to get high correlation between subjective evaluation and objective assessment.

In addition, we modified three scaling parts to evaluate speech quality effectively.

- Local scaling: If the frame energies of original and distorted signal are within pre-defined threshold level, normal local scaling in PSQM algorithm would be done. If not, to widen the difference to enhance correlation with MOS data.
- Loudness scaling: Refer to local scaling, if normal local scaling was done, adopt loudness scaling. If not, do not adopt loudness scaling to remain prior effect.
- Asymmetry processing : Same as above

Fig. 2. shows the block diagram of modified PSQM calculation.

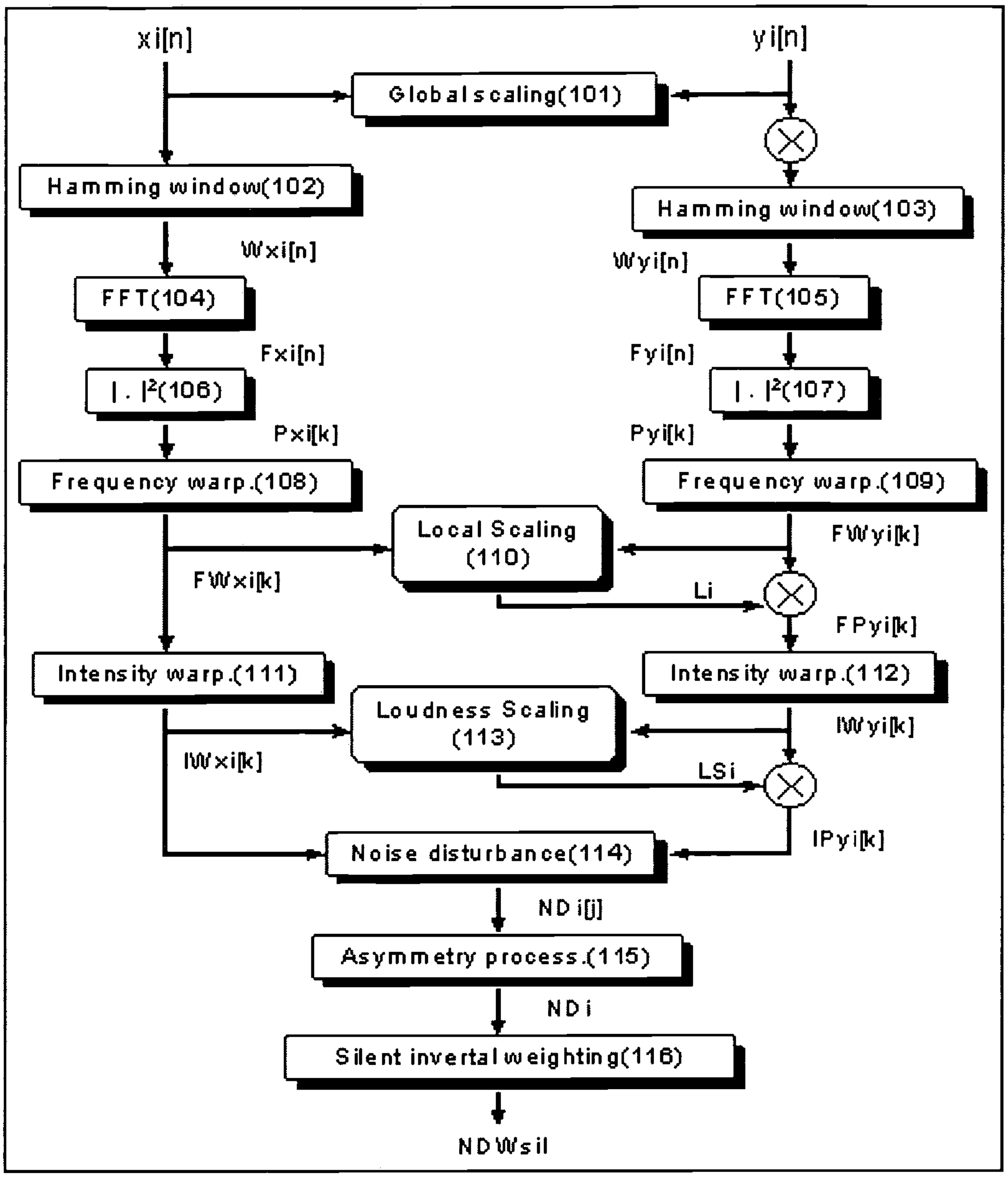


Fig. 2. The block diagram of modified PSQM calculation.

3. *Experimental Design*

Fig. 3 shows the automatic speech quality assessment system in CDMA cellular network.

We developed voice control unit(VCU) with TMS320C30 supplied by Texas-Instrument Corporation.

However, in CDMA cellular system it is not an easy task to synchronize original with transmitted speeches in real-time measurement. We take two steps for exact synchronization. Tone detection method is for rough synchronization and fast cross correlation method is for exact synchronization. Tone detection can be realized by IIR digital filter design and fast correlation is easily and quickly calculated as follows.

where

$X^{*}(k)$: *FFT conjugate of original speech*

$Y(k)$: *FFT of distorted signal*

F_0^{-1} : *inverse discrete Fourier transform*

N : *FFT sample size*

By applying these methods[6], we saved the signal processing time and remarkably achieved the accuracy of speech synchronization.

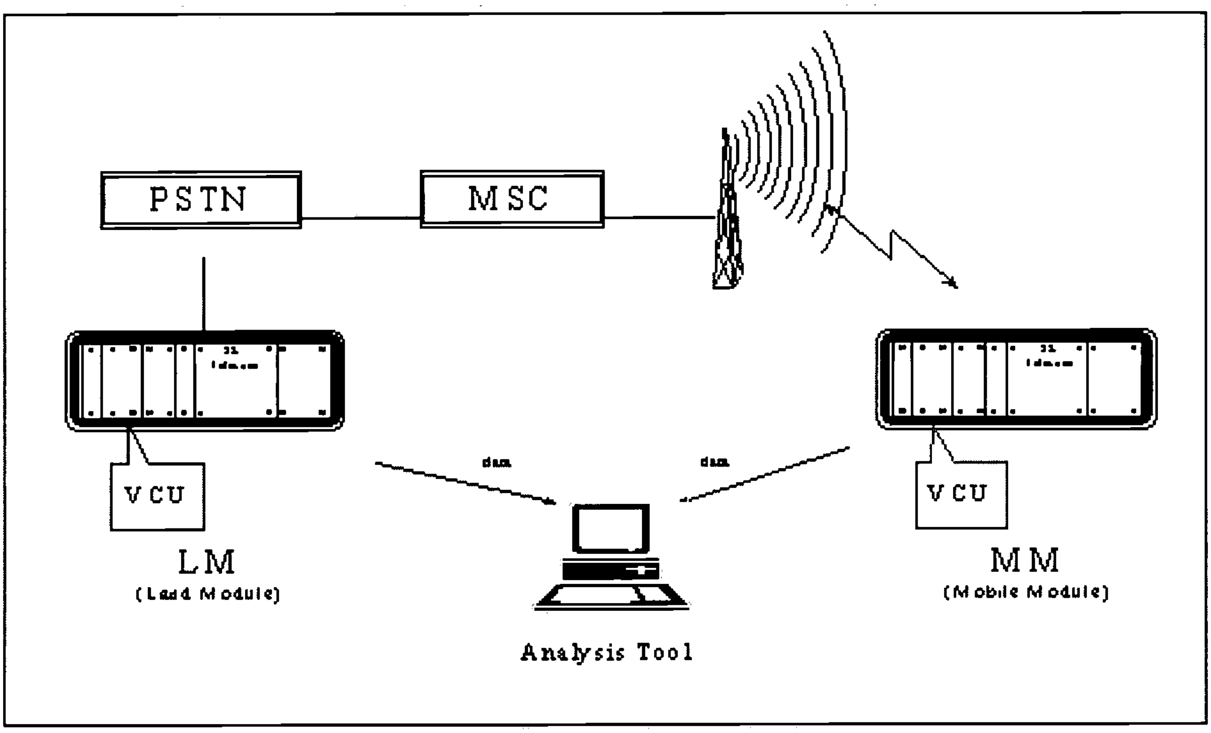


Fig. 3. The automatic speech quality assessment system in CDMA cellular network.

III. RESULTS

Objective measure in terms of correlation coefficient is

$$\rho = \sqrt{\frac{\sum (PMOS_i - Avg)^2}{\sum (MOS_i - Avg)^2}}$$

where

$PMOS_i$ *: Predicted MOS,* Avg *: Average of MOS data*

A ?= 1 means the objective speech measure can predict MOS perfectly, while ?= 0 means that it is not correlated with the subjective quality. A comparison of 260 sample speeches leads to higher correlation than other measures[5]. Correlation coefficient is 0.92 on average and standard deviation is 0.29 for 260 real collected data in CDMA cellular network.

Table 2 shows the correlation coefficient for each speech materials.

Table 2. Correlation coefficient for each speech materials.

	Ave-rage	tel line												extension	
		Uplink						Downlink						up	down
?	0.92	0.93	0.94	0.89	0.87	0.77	0.88	0.94	0.94	0.94	0.96	0.96	0.95	0.95	0.96
?	0.29	0.22	0.23	0.32	0.29	0.34	0.34	0.30	0.25	0.32	0.29	0.29	0.30	0.22	0.32

where ? is a standard deviation.

IV. CONCULSIONS

In this paper, we improved PSQM algorithm to evaluate speech quality more effectively and realized real-time automatic speech quality measurement system. For exact speech synchronization, we took two steps. One is tone detection method with IIR digital filter and the other is fast cross correlation method. So we can enhance correlation between modified PSQM values and MOS data. Obtained correlation coefficient is 0.92 on average for 9 sets of speech materials. I think it is a reliable result because we collected most various cases as possible in mobile channel.

In Korea, there are five mobile telecommunication service companies. So we are researching and developing multi-channel voice quality measurement system to analyze the voice and call quality of five channels with applying these methods.

V. REFERENCES

1. ITU-T Recommendation 861, *Objective Quality Measurement* of *Telephone-band(300-3400Hz) speech* codecs, Aug. 1996.

2. *IEEE recommended practice for speech quality measurements*, IEEE Trans. Aud. Electroacoust., pp. 227-246. Sept. 1969.

3. ITU-T, *Method for Subjective Determination of Transmission Quality*, Aug. 1996.

4. CCITT Recommendation 562-2., *Subjective Assessment of Sound Quality*, 1986

5. K. H. Lam, O.C. Au, C.C. Chan, K.F. Hui, and S.F. Lau, *Objective Speech Quality Measure for Cellular Phone*, 1996.

6. Y. R. Kim, S.H. Seo, K.H. Kim and J.W. Kim, *Voice Synchronization for subjective voice quality measurement*, Patent pending, 1998.

7. K. H. Lam, O.C. Au, C.C. Chan, K.F. Hui, and S.F. Lau, *Objective Speech Quality Measure for Chinese in Wireless Environment*, Proc. Of ICASSP, Vol. 1, pp277-280, May 1995.

Return to Top View Full-screen

Netplan Software: Design and Optimization of the Intelligent Network for IN and AIN Services

Mario Pietrogrande

NETPLAN Associates, Italy

ABSTRACT

The purpose of the Intelligent Network NETPLAN software module is the technical and economic optimization of intelligent network devices and circuits which connect subscribers to servers. Servers are specialized computers interchanging signals and performing command and control functions with intermediate IN stages, via data links.

View Full Text

NETPLAN SOFTWARE:

DESIGN AND OPTIMIZATION OF THE INTELLIGENT NETWORK FOR IN AND AIN SERVICES

The purpose of the Intelligent Network NETPLAN software module is the technical and economic optimization of intelligent network devices and circuits which connect subscribers to servers. Servers are specialized computers interchanging signals and performing command and control functions with intermediate IN stages, via data links.

Hierarchic and non-hierarchic stages of the intelligent network are listed below and are denoted "IN devices":

However, the Intelligent Network includes many additional devices, generally computers, which receive information, process it and send commands to any one of the IN devices listed above. These additional devices are denoted "servers" and referred to with the abbreviation OTH. Example of such servers are: Service Management System (SMS), Credit Card Control (CCC), Telecommunications Management Network (TMN), Short Message Service Center (SMSC), and many more. Some are for specific telecommunications operation use (e.g., TMN), others are for private specific use (e.g., CCC).

The NETPLAN software is designed to optimize that part of the intelligent network that connects the subscriber exchange (via the access point) to a server, by selecting the most convenient route which includes one or more of the IN devices (points) indicated above. However, the optimization process does not include the OTH servers, because they are the same for any route chosen.

The optimization of the IN is an on-going process, due to the creation and development of new specialized services which are continuously added to the advanced intelligent functions. Consider the following:

1. The first Intelligent Network Service was the 800 toll-free service to telephone subscribers. Since that time (1976), many more services have been created and added to the intelligent network. NETPLAN version 7.2 includes the optimization of 50 IN and AIN services. The NETPLAN programs are designed to increase this number of services to 70, by adding additional new services to the input file.

2. The original Intelligent Network hierarchy consisted of three stages from the access point IN device to connection to the OTH server: the Switching Service Point (SSP), the Signal Transfer Point (STP), and the Service Control Point (SCP).

   · The SSP receives a request for an IN service from the PSN via Access Point.

· The STP transfers the request from CCIS7 to data connection (packet data).

· The SCP analyses the type of service requested, and interchanges signals and commands with the server selected.

3. For reasons of economy and added flexibility, two non-hierarchic stages have been added to the intelligent network, namely the Intelligent Peripheral Point (IPR) and the Service Node (SND) devices, which can either be connected directly to OTH servers or incorporate stand-alone intelligence.

The NETPLAN software conforms to both hierarchic and non-hierarchic approaches.

4. The NETPLAN software is also designed to support a variety of Service Switching Point (SSP) devices, depending upon vendor characteristics, year of manufacturing and device functions. The software flexibility permits the association of every SSP, in any national network, to different services and routing schemes.

5. The Intelligent Network major objective is to provide value-added services most economically. Accordingly, the extent of the routing within the IN should be minimized by connecting OTH servers non-hierarchically to lower stages of the IN. Several examples confirm this trend. For instance, today the use of the Internet Service is so extended that its routings are made as direct as possible, often outside the IN structure or at most involving only the first stage of the IN.

NETPLAN INPUT DATA PREPARATION

The NETPLAN software is designed for a very rapid handling of input data, and requires continuous man-machine interface. For each data input file program, a pre-formatted form appears on the screen, to be filled in by the planner. The procedure is illustrated step by step below.

Here, the novel approach is the creation of a number of IN "Schemes" per country, as actual input data. An IN scheme is a set of data relating one (or more) SSP to services, routings, use, network alternatives and time phases. The number of schemes has been reasonably limited to 10, but can be increased if so desired.

Notice that steps 1 and 2 below are not related to the actual profile of the network under study, nor to any alternative or phase. From step 3 onwards, however, existing and future data from the network under study is required, derived from the previous SDH network optimization.

Step 1. Services

A list of 50 IN and AIN services has been prepared and has been included as input data. This list can be increased to 70 IN and AIN services. (See Annex below).

Step 2. IN Schemes

Due to the large variety of existing and new services, devices and servers in terms of quantity, function, use and routing, the planner is called to examine up to ten (10) IN schemes. Each scheme is identified by a double letter ("AA" to "JJ").

Each scheme is composed by: a) the list of IN services (Step 1 above), b) the route associated to each IN service (Step 2a below), and the use of each IN service (Step 2b below). A set of 10 different schemes can be prepared for each country, or existing lists

may be used as default data.

Due to the variety of equipment and IN service use within a country, the planner will select the scheme that best relates to the present and future phases for each city, region, or area code under consideration (Step 5). Notice that an IN service may be available in one city, but not in another city or area.

Thus, maximum flexibility in foreseeing any possible situation is achieved by the use of the NETPLAN IN module.

Step 2a. Routing

An IN routing is defined as the path of a service from starting point to destination, within the intelligent network structure. The ten possible IN routings are shown in B-K below (also shown in the Annex). Route A is outside of the IN structure.

A = TEL+LEX+SSE (Telephone+Local Exchange+Special Service Exchange)

B = ACP+SSP

C = ACP+SSP+OTH

D = ACP+SSP+IPR

E = ACP+SSP+IPR+OTH

F = ACP+SSP+SND

G = ACP+SSP+SND+OTH

H = ACP+SSP+SND+STP+OTH

I = ACP+SSP+SND+STP+SCP+OTH

J = ACP+SSP+STP+OTH

K = ACP+SSP+STP+SCP+OTH

Step 2b. Use

For each scheme ("AA" to "JJ"), the planner will complete a computer-formatted table, showing the 50 (up to 70) IN/AIN services, by filling in the information detailed below.

· Existence (Y/N) - For each service, whether available or not.

· Routing - The possible routes between Access Point (ACP) and server (OTH) are indicated on the table with letters A to K. For each IN/AIN service, the planner will indicate up to three proposed routes, per IN scheme. The programs will select, among the three proposed routes, which one best conforms to the network characteristics.

· Usage - For each service, the number of calls during the peak hour. (This value can be derived either from the Number of Subscribers, or from the Busy Hour Call Attempts).

· Time of occupation - For each service, the average time of use of devices and of circuit occupation along the route (voice, 64 kb/s, and data).

Step 3. Diskette insertion

A request appears on the computer screen asking for the insertion of two NETPLAN diskettes. The first diskette is the selected alternative of the main national network. The second diskette is the optimized SDH configuration. The data stored in and retrieved from these diskettes relates to traffic, lines, trunking, network evolution, BHCA, and is used as input data for the intelligent network optimization of each alternative and each phase.

Step 4. Computation

The software initiates all computations, for each network alternative and for each phase, generating, in progression, tables listing all ACP's, SSP's, STP's and SCP's.

Step 5. Scheme selection

At this point, the planner selects that scheme ("AA" to "JJ") which best conforms to the routing and the use of IN services within the alternative and phase considered. The planner's input is limited to adding to each SSP location (generated by the computer in step 4 above) the letter which identifies the selected scheme. This is necessary as IN/AIN services may be selectively available, for instance only in some cities or regions; and, where available, subscribers ' habits may vary from place to place.

Step 6. Redundancy

The planner must input the redundancy desired in all connections from subscriber to server.

Step 7. Unit cost

The planner must input the estimated unit cost of each device and of each circuit.

THE OUTPUT OF THE OPTIMIZATION PROCESS AND COMPARATIVE ANALYSES

The NETPLAN IN module software is very complex, but also user-friendly. It includes over 45 menu-driven programs with 20,000 lines of instructions, and is run in only a few minutes.

The NETPLAN software generates reports and graphics which can be viewed on the screen or printed at any time. Also, menus, reports, tables and graphics may be seen and/or printed in any of three languages: English, Spanish, or French.

On-screen help is provided. Input data is always associated with a description of the input file preparation. If an error occurs, the program stops and indicates on the screen the necessary correction.

The relevant information generated includes:

- The quantity, location and size of every device within the Intelligent Network.
- The required data, voice and 64 kb/s circuits from access point to servers.

· The estimated investment for IN devices and for connecting circuits.

· The Present Worth of Annual Charge.

· Graphics showing all connections, as well as quantities of devices and links.

· Traffic in Erlang for each service, each route and each IN device.

· Available IN and AIN services at each SSP.

· Redundancy selection.

· The input data relative to the association between each SSP and the selected scheme.

· For each IN device, its connection to the following IN device.

· Up to ten IN schemes.

· Comparative analyses among alternatives and phases, to permit technical and economic evaluation of alternate solutions.

The heuristic approach used in the NETPLAN software allows the evaluation of the introduction of new IN and AIN services, in terms of required investment versus resulting added value. The "what happens if..." sensitivity analysis is performed in only a few minutes.

Return to Top   View Full-screen

Prospects for the South Pacific Transit Undersea Cable

Eduardo Saravia and Roberto Cofre

CTC Mundo, Chile

ENTEL, Chile

ABSTRACT

The initiative of a fiber optic submarine cable between Latin America and the Asia Pacific, named South Pacific Transit Cable (SPTC), was initially proposed by representatives of the Pacific Telecommunications Council (PTC) in the meeting of the Comision Interamericana de Telecommunicaciones (CITEL) of the OAS, held in Santiago, Chile, in May 1992. The basic concept is to have a cable that could fill in the gap in the South Pacific by linking Chile to New Zealand and Australia. Recent developments, such as the entrance in service of the Pan American cable in December 1998, the advent of the Southern Cross cable and the planning of the Pan-American Crossing cable are clear indications of the high degree of the telecom activities in the Pacific region. The main driving forces are the rapid growth of the Asian and the South American markets, the success of the regional privatizations and deregulations of the telecommunications sector, the dramatic increase of Internet users, the consolidation of strategic alliances and the need to increase interconnectivity between submarine cable systems.

View Full Text

Prospects for the South Pacific Transit Undersea Cable

1. Introduction

The initiative of a fiber optic submarine cable between Latin America and the Asia Pacific, named South Pacific Transit Cable (SPTC), was initially proposed by representatives of the Pacific Telecommunications Council (PTC) in the meeting of the Comision Interamericana de Telecommunicaciones (CITEL) of the OAS, held in Santiago, Chile, on May of 1992. The basic concept is to have a cable that could fill in the gap in the South Pacific by linking Chile to New Zealand and Australia. Recent developments, such as the entrance in service of the Pan American cable in December of 1998, the advent of the Southern Cross cable and the planning of the Pan-American Crossing cable are clear indications of the high degree of the telecom activities in the Pacific region. The main driving forces are the rapid growth of the Asian and the South American markets, the sucess of the regional privatizations and deregulations of the telecommunications sector, the dramatic increase of Internet users, the consolidation of strategic alliances and the need to increase interconnectivity between submarine cable systems.

2. Current Transpacific Cables

Several fiber optic cable systems have been in operation across the Pacific such as the NPC, TPC4 and TPC5 in the North Pacific and the Tasman-2 , PacRim East and West cable systems crossing the Pacific and linking Australia, New Zealand, the United States and Japan, in combination with the HAW-5 and TPC-4 cable systems. The PacRim two-cable systems, each of 560Mbps, were originally designed to meet forecast demand up to the year 2005. However, by 1996 the heavy service demand have led to the full allocation of the designed capacity and a new cable system, the Southern Cross cable network, is being currently implemented to begin service by the end of 1999. Figure 1 shows a layout of the existing main fiber optic submarine cables in the Atlantic and Pacific regions.

Besides this impressive level of submarine cable activity in the North Pacific, there are several existing and on-going projects in Central and South America with high capacity links to the US and Europe. The Pan American SC will be in service by December 1998, the Americas-II SC is under construction with expected RFPA of November 1999, the Maya-1 SC has been recently iniciated with the signing of the C&MA in September this year. Additionally, two other cable systems are being seriously considered such as the Pan-American Crossing Cable linking California to Mexico and Panama, and the Arcos-1, a ring in the Caribean and Central America, in a festoon and trunk&brach hybrid architecture.

3. New Telecom Environment in the South American Region

The new telecommunications environment is gradually taking shape in South America as a result of the implementation of the deregulation of the traditional domestic markets allowing an increasing number of countries to accept free market practices in the fixed, long-distance, international and mobile networks. Privatization that followed deregulation has made possible to new entrants to compete and gain significant market share in a very short time window, by offering lower international call rates and better services. Chile was the first country in Latin America to privatize the telecom sector in 1988 and deregulate it in 1994. Telecommunications is today the most dynamic area of the Chilean economy with a high degree of competition both in the domestic and international markets. In Argentina the privatization of the telecom industry took place in 1990 and it was deregulated in November this year, with the competition of Telefonica and Telecom offering all the telecom services across the country. However, the major impact to the Latin America telecom environment has been the privatization of Telebras, the public telecommunications company in Brazil this year. This is by far the largest privatization in Latin American history reaching the paid price of $19.1 billion dollars for a single public company. Telebras was broken into twelve companies including three fixed-line, eight wireless, and one long distance, with the important participation of Telefonica Spain in the fixed-line business and MCII as the major long distance carrier. Brazil is a country with a population of 160 millions, a Gross Domestic Product of 800 billion dollars, a teledensity of about 11 main lines per 100 inhabitants, and with an international outgoing telephone traffic estimated of 450 million of minutes per year, in 1997. The telecom market in Brazil will be open to full competition by January 1, 2002.

4. Routes and Architecture of the SPTC System

A conceptual SPTC system has been designed to interconnect New Zealand to Chile bearing in mind the minimization of the cost of the project without sacrificing bandwidth for future needs. The system consists of a point-to-point two fiber pair cable configuration, with a capacity of 16x10Gbps per fiber pair, utilizing WDM technology. It is envisioned that the system will have an initial capacity of 5Gbps (1x1) with a configuration of 2.5Gbps for service and 2.5Gbps for protection. Figure 2 illustrates the outline of the cable system for three optional routes. The three routes range in length from about 9,000Km to 11,000Km. The shortest link is from Auckland to Punta Arenas with a length of 9,150Km. The second design link extending from Auckland to Puerto Montt is about 10,000Km long, which would be one of the longest optical spans capable of conveying 16 wavelengths of 10Gbps line rate. The third design is a link from Auckland to Valparaiso, with an intermediate stop in Easter Island. The advantage of this design is the significant reduction of submarine repeaters by using two shorter span segments in the link. Present domestic network in Chile is SDH based all fiber optic system which extend from Arica in the North down to Puerto Montt in the South. As for the communication to Punta Arenas, which is a large and well developed city, various plans are being considered to replace the existing satellite links by submarine cables in the near future. An interesting design option considers the idea of branching out the SPTC near the Chilean coast into two segments. One segment going to Puerto Montt and the other to Punta Arenas.

5. Area of Interest of the SPTC

The area of interest to the SPTC is defined by the degree of interconnectivity with existing cable systems and its advantages when compared with the alternatives. At one end of the Cable, the landing in Auckland, New Zealand, could permit the access of traffic to the Asian Pacific region through the

TASMAN-2, the PACRIM WEST cable systems. Additionally, the Asian local fiber optic network could be reached from the North of Australia through the JASURAUS cable, providing access to the telecom markets in Taiwan, Hong Kong, South Korea, Singapur, Tailand, Malasia and Indonesia, besides Japan and China. The traffic riding on the SPTC from New Zealand could have access to the South American countries in the Atlantic, such as Argentina, Brazil, Uruguay and Paraguay, as well as, to the countries in the Pacific and in Central America including Chile, Peru, Ecuador, Colombia and Venezuela.

Figure 3 shows the existing and under construction submarine cable system in the area of interest offering the opportunity to the SPTC traffic to reach Southeast Asia, North America and Europe. Although most of these cables are currently close to reaching their full capacity, possible upgrades based on WDM technology are being evaluated that could be implemented in the near future. Based on these considerations, it is possible to conceive an area of interest to the SPTC concentrated in South America, Japan, China, the South East Asia, Australia and New Zealand, in which this cable could certainly play an important role in the global connectivity among cable systems.

6. Economics Statistics in the Area of Interest

The area of interest, or influence, to the SPTC includes about 37% of the world population with the major contribution of 84% being from the Asia Pacific and 16% from South America. The most developed economies in this area are in Japan, Singapur, Hong Kong, Taiwan, South Korea, New Zealand and Australia. These economies score very high marks in the Per Capita Income, the Gross Domestic Product (GDP) index, in the international trading, and in having low inflation rates and sustainable economic growth.

Developing countries in the referred area like Chile, Argentina, Brazil, Malasia and Tailand are emerging economies with promising potentials for steady growth and increasing international commerce. Moreover, these economies are taking advantages of the globalization and integration initiatives being pursued across the board concerning tariffs and taxes of traded goods and services. In particular, Chile was the first country in South America to become part of the APEC forum; and most of the Latin American countries are part of free trade agreements including MERCOSUR and the European Community Agreement.

In spite of large differences in volume and amount of the international trading in this area of interest, there exists an increasing level of commerce activity among the Asia Pacific and Latin American countries. Another encouraging sign towards the enhancement of economic exchange in the South Pacific region is the high degree of investment of developed Asian Pacific enterprises in Latin America, specially from Japan, South Korea and Australia.

7. Telecom Statistics in the Area of Interest

It is expected that this significant progress on integrating the economies across the South Pacific will have a positive impact on the development of the telecommunications markets in the area of interest, since it is a proven fact that the telecom industry follows very closely the economic developments in each country. To illustrate this situation more clearly in this case, Figure 4 shows the teledensity in 1997, given in number of main lines per 100 inhabitants, for the Asia Pacific countries, summing up to the total of 197 million lines in this area. Numbers above 50 lines, which is the case of Australia, Hong Kong, Japan, S. Korea, Taiwan, New Zealand and Singapur, are indicative of countries with mature telecom markets and well developed economies. A singular case is China since with a low teledensity of 6 lines per 100 inhabitants, it contributes with 75 million telephone lines to the area. There is the plan of the Chinesse government to increase the number of lines in 15 millions by the year 2000.

The situation of the teledensity in South America is depicted in Figure 5. There are a number of countries with teledensities near 20 main lines, and above, per 100 inhabitants, in correspondence with their degree of economic development and the level of investment in the telecom sector. It is expected that Brazil will have a significant growth of teledensity due to the entrance of Telefonica in the local telephony market in this country. In this direction Telefonica recently announced their plan to invest a total of 3.4 billion dollars in 1999, in Sao Paulo State, which will have a direct impact on the local telephony infrastructure in Brazil.

As for the international outgoing telephone traffic in this area of interest, the traffic in the Asia Pacific countries has increased from a total of 6,500 millions of minutes in 1993 to near 9,800 millions in 1997, at an average annual growth rate of 14%. The international traffic from South America to the rest of the world has also increased from a total of 750 millions of minutes in 1993 to 1,200 millions in 1997, at a growth rate of 18% per year. Similarly to other developing regions of the world, growth in the number of cellular mobile telephone subscribers in Asia Pacific is most dramatic. From nearly 6 million subscribers in 1993 to 74 millions in 1997, with an average growth rate of 89% per year. The situation in South America is also remarkable for the cellular telephone businesses, increasing from 600 thousand subscribers in 1993 to about 10 millions in 1997, that is a 98% growth rate per year.

Finally, considering the Internet services, the number of Internet hosts in the Asia Pacific region rose from 165 thousand hosts in 1993 up to 2.5 millions in 1997, at 110% increase per year. The number of hosts in South America has also experimented significant growth in the same period, that is, from 6 thousand hosts in 1993 to about 190 thousands in 1997, at a rate of 150% yearly. This growth is expected to be one of the main drivers of the need for international cable capacity over the next 5 to 10 years.

8. Prospects for the SPTC

The dramatic growth experimented by the telecom services and demand worldwide and particularly in the area of interest, as described in the above sections, will continue to impact and be impacted by the submarine fiber optic systems. Investment in submarine cable systems has been steadily growing in the Pacific and Southeast Asia regions, and several fiber optic networks are being upgraded and installed through the Pacific. Moreover, this new telecommunications environment which is taking shape around the world will require of high capacity at any time, efficient network restoration, high quality of transmission and globalization. It is forseable that under this environment, the SPTC could play a three fold role in the South Pacific region.

Firstly, SPTC would establish a direct link between New Zealand and Chile that could be interconnected with existing and widely spread telecom networks to reach most countries in Asia Pacific and Latin America.

Secondly, based on the large capacity submarine cable systems in the Americas, such as the Pan American, Americas-II and Atlantis-2, it is conceivable that traffic from Southeast Asia could ride the SPTC to reach Central and North America, and eventually Europe.

Thirdly, with the advent of the Southern Cross Cable system, the existing Pan American cable and the projected Pan-American Crossing (PAC-1) cable linking California to Mexico and Panama, there is an opportunity for the SPTC to close the large ring in the Pacific, providing a cable-to-cable restoration path in case of a cable failure in this network. Figure 6 illustrates this large closed loop restoration network based on existing and projected submarine systems.

It can then be anticipated that the demand of capacity in the SPTC will be determined by the combination of these three components, with their actual weight being defined by the competitive price of the cable capacity. As this price decreases, it is expected that the demand of main traffic will tend to dominate the use of the cable, whereas the opposite will be true in a high price situation and the restoration traffic will drive the demand of the system. Traffic forecast under the new telecommunications environment in the area of interest plus the introduction of the latest cable submarine technology in the project, which is bringing down the cost of the most recent cable systems, will tend to indicate the time frame for the technical and economical feasibility for the actual implementation of the South Pacific Transit Cable System.

9. Summary

The SPTC system when becomes a reality will provide Asia Pacific and South America with submarine fiber optic cable facilities much needed to fill the telecommunication gap across the South Pacific. The dramatic growth experimented by the telecommunication sector and the economies in general in this region are the major driving forces to develop such a system and to utilize it in a cost effective manner by all the interested parties. This is, by combining the advantages of a direct transit through the South Pacific, the cable-to-cable restoration capacilities through a large fiber optic ring in the Pacific, and the access to far reaching points in Europe and North Africa by using the SPTC as viable route.

10. Acknowledgements

The authors would like to acknowledge Alcatel Submarine Networks and Tyco Submarine Systems for providing the ROM studies for the South Pacific Transit Cable System and for their continous interest in this initiative.

Submarine Optical Fiber Cable Systems

- Answering the Global Demands for Connectivity and Capacity Expansion -

Osamu Harada

NEC Corporation, Japan

ABSTRACT

Recent evolution of the information society requires global networks with huge traffic capacity and multi-point connectivity. The most advanced submarine optical fiber cable systems surely offer the infrastructure for such networks. This paper describes the history of the successful achievements of optical submarine cable system, and how such technologies have been answering the market demands. It will also introduce the latest technical achievements as well as possible applications of such technologies on advanced networks to meet the global demands for connectivity and capacity expansion.

View Full Text

Submarine Optical Fiber Cable Systems

- Answering the Global Demands for Connectivity and Capacity Expansion -

I. INTRODUCTION - - INCREASING TRAFFIC CAPACITY AND NETWORKING FLEXIBILITY

Transoceanic traffic has been increasing, and it is expected to continue to expand dramatically over the next few years, mainly driven by Internet traffic. Some study reports show that Internet traffic is doubling every four months and also voice traffic will fall to less than 1% of the total by 2004.

Since the mid of 1990s, submarine cable systems using EDFA have continuously been developed to cope with traffic capacity increases as shown in Figure 1 (see Figure 1). We have recently developed a submarine cable system operating at 10Gbit/s x 16 waves to meet the expected capacity expansions over the next few years. In Section 2 of this paper, the development histories and latest achievements in submarine cable system technologies employing EDFA are introduced.

Network security is also essential for configuring modernized submarine networks. Historically, a lot of efforts have been made to ensure high reliability of submarine systems, including development of undersea repeater, cable and terminal equipment with remarkable high reliability, as well as improved marine installation/protection methods. Furthermore, additional network protection schemes employing ADM Ring MUX technologies have successfully been employed to increase network security further, addressing remarkably demands of expanding network size with network distribution flexibility. By using ADM Ring MUX, ATM and Branching Units, network flexibility and connectivity is guaranteed. In Section 3 of this paper, such technologies are introduced with typical examples of the advanced networks are introduced.

II. DEVELOPMENT HISTORIES AND LATEST ACHIEVEMENTS IN SUBMARINE TRANSMSSION TECHNOLOGIES TO INCREASE TRANSMISSION CAPACITY

1. *Repeatered Submarine Cable System*

Submarine systems employing erbium-doped fiber amplifiers (EDFA) have made it possible to achieve high bit-rate transmission with simplified configurations for submerged plants as well as terminal portions. In a repeatered submarine system, EDFA repeaters are concatenated with single-mode fiber cables and the optical signal is transmitted through the fiber under periodic direct amplification.

The first long-haul EDFA systems were implemented in 1995, and operated at a single 5 Gb/s optical channel in which two STM-16 signals are multiplexed in the time domain. The TPC-5, Malaysia Domestic and TAT12/13 are typical examples of such systems. Although the gain bandwidth of Al-codoped EDFAs could be wider than 20nm, gain narrowing effect due to concatenation of numbers of amplifier repeaters limited the bandwidth, resulting in an usable bandwidth of a few nm for trans-oceanic systems. This was the primary reason why the first generation of EDFA-based submarine cable systems were operated at single-channel.

WDM technology has successfully been adopted in recent years, driven by increased capacity requirements. As a result, repeatered systems operating at 8 and 16 times 2.5 Gb/s, providing 20 Gb/s and 40 Gb/s respective total capacities, are available now as established mature technologies. WDM has changed the architecture and capabilities of submarine cable systems by providing great increases in system capacity. Technically, the WDM scheme progress has been brought about by increased understanding of the effects that limit the performance of WDM systems: Improvements over single channel systems have been made in such areas as dispersion management, EDFA gain equalization and transmitter modulation schemes. Nonlinear interaction between many WDM channels has been managed by shifting the zero-dispersion wavelength outside the channel operating window, while the end-to-end total dispersion is reduced by adding dispersion compensation fiber for minimizing the wave form distortion. This is usually implemented by the combined use of non-zero dispersion shifted fiber with around –2 ps/nm/km dispersion and standard single-mode fiber with +18-20 ps/nm/km dispersion. For very long-distance systems, dispersion compensation has also been made in terminal portions on a channel to channel basis to compensate for high-order fiber dispersion.

The available gain bandwidth of a long amplifier chain has been increased by gain equalizing with passive optical filter. The filter profile is designed to have inverse characteristic of EDFA gain profile. Also contributed to flatten the gain bandwidth is the optimization of Al doping concentration for the Er-doped fiber. By such an optimization, the end-to-end link optical bandwidth has eventually been increased to wider than 15 nm even for a very long-length amplifier chain with transoceanic distance, which ensures up to 16 channels WDM signal transmission with 0.8 nm (100 GHz) channel spacing.

Another important technology of WDM systems is bit-synchronized polarization scrambling. In this technique, optical polarization of transmitter NRZ pulses is modulated with the clock frequency. Then, excess noise accumulation caused by polarization hole burning, polarization dependent loss, and residual FWM components are removed as being outside the receiver bandwidth, resulting in minimized fiber transmission degradation. The phase modulation effect accompanied with synchronous polarization modulation eventually contributes to increase the eye opening of the received data. With these technical achievements, 1 channel (2.5 Gb/s), 8 channels (20 Gb/s) or 16 channels (40 Gb/s) transmissions over 13,000 km have been confirmed in our laboratory test systems.

Research and development for increasing the bit rate to 10 Gb/s and beyond is one of today's major challenges. At 10 Gb/s, transmission impairment due to the combined effects of dispersion and non-linearities are more stringent. In addition, increasing repeater output power and/or enhancing noise performance are needed to maintain suitable end-to-end SNR for 10 Gb/s WDM channels. Large effective area fibers and 980 nm pumped EDFA are some of the solutions being explored. We have confirmed 16 channel 10Gb/s transmission over a trans-oceanic distance by circulating loop experiments, in which 980/1480 nm hybrid-pumped EDFA are used. It is expected that a submarine cable system employing such technologies will be delivered to the market in 1999. Various technological breakthroughs are under testing for further improvement in capacity and transmission length.

2. *Non-Repeatered Submarine Cable System*

Increasing transmitter power and receiver sensitivity can principally enhance non-repeatered system lengths. Application of EDFAs in terminal equipment, as both optical boosters and preamplifiers, has greatly contributed to improving these performances. In addition, remotely pumped amplification has enabled further increase in transmission distance. Here, in the remote amplification scheme, very high power 1480 nm band laser light is sent from the terminal to an erbium-doped fiber several tens of kilometers distant from the link end

System design for non-repeatered systems is straightforward, except for consideration on nonlinear constraints inherent to high power signal transmission. Suppressing stimulated Brillouin scattering and balancing the effects of dispersion and self-phase modulation, up to +18 dBm per channel signal power has been transmitted through a single-mode silica fiber with length over 400 km. Beyond this level, large spectral broadening due to fiber nonlinearities reduces the preamplifier receiver sensitivity. In fact, we have installed 2.5 Gb/s 400 km non-repeatered submarine link in Indonesia this year, in which system dynamic range of more than 82 dB has been achieved on commercial basis.

Huge capacity transmission is also being addressed as in the repeatered systems by applying 10 Gb/s WDM technology. We have found that 10 Gb/s WDM signal could be transmitted through a low-loss silica fiber with little power penalty using dispersion compensation in the receiver, resulting in successful transmission of 16 channel 10 Gb/s (160 Gb/s capacity) WDM signal over 340 km of single-mode fiber.

Further evolution will be possible by developments such as higher power pumping lasers, high-power EDFA with much wider bandwidths, efficient doped fiber and development of ultra-low loss fibers beyond silica fibers.

3. *Network Security and Network Flexibility*

Many efforts have been made to realize systems with extremely high reliability, including improvement on optoelectronic components, undersea repeaters, cable and terminal equipment. Since the first generation, submarine cable systems were traditionally installed as point to point links and the redundant protection scheme within the system has been employed to increase the reliability of the system further as shown in Figure 2 (see Figure 2).

The scale of the network and its traffic-carrying capacity is expanding, and multiple landing requirements have surfaced in recent years. Undersea Branching Unit for diverting a fiber pair(s) or a designated color channel(s) is required in the network for multiple landings. Ring network architectures are currently being employed to increase network reliability and flexibility further. Typical examples utilizing 4-Fiber-Multiplex Section Shared Protection Ring

Configuration (4F-MS-SPRing) in the Pacific Region are the US-China, Japan-US and PC-1 , which are currently under construction. This type of system provides the highest network reliability due to its multiple path protection feature for each working channel. Figure 3 *(see Figure 3)*. shows a typical example of this network.

In the next generation submarine network, the system is configured like concatenated rings as shown in Figure 4 *(see Figure 4)*. Project Oxygen operating at 10Gbit/s x 16WDM planned by CTR is an example of such a networks. Combined ring and ATM technologies used in the network provide the ultimate network solution. 10Gbit/s WDM technologies, 4F-MS-SPRing technologies and ATM technologies are the key elements for providing increased reliability, capacity, connectivity and network flexibility.

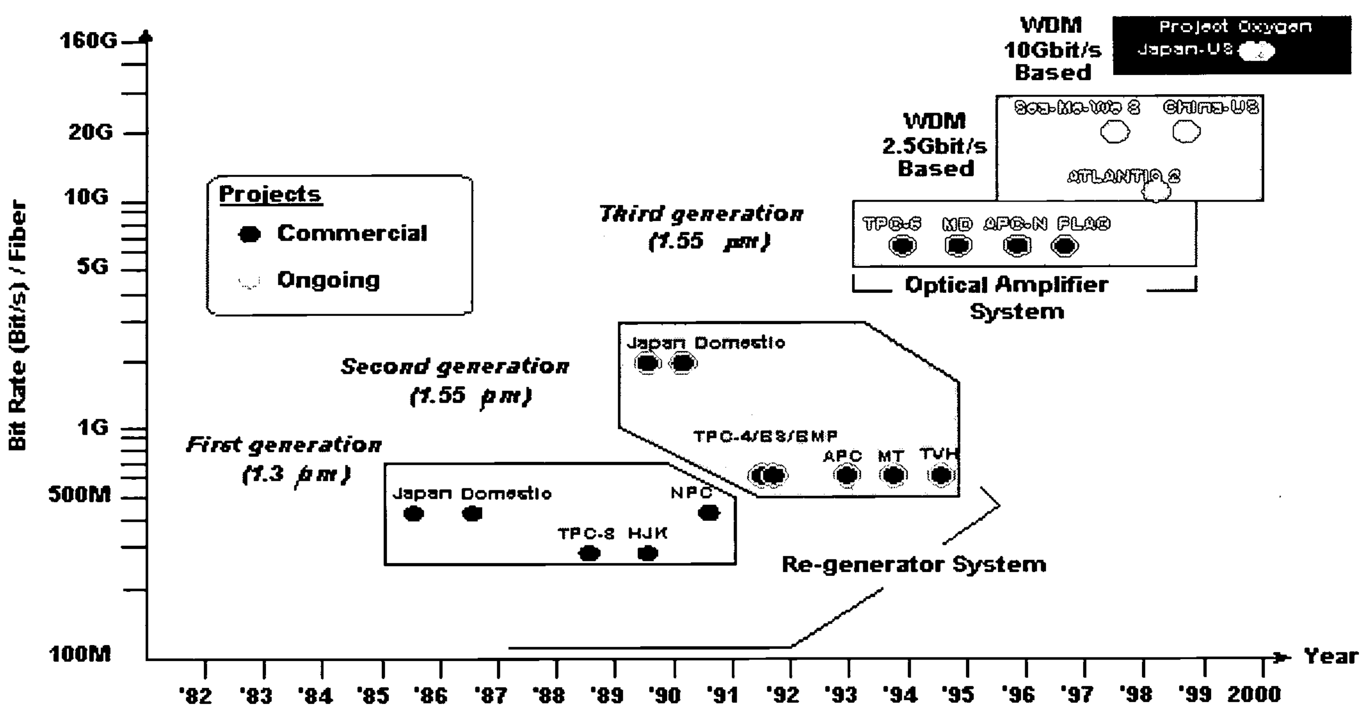
III. CONCLUSION

Recent evolution of the information society requires global networks with huge traffic capacity and multi-point connectivity, and the most advanced submarine optical fiber cable networks surely offer the infrastructure for such networks. Our submarine industries will continue to answer the global demand for connectivity and capacity expansion, which shall be required for the future network dominated by Internet traffic in 21st century.

Return to Top View Full-screen

Figure 1.

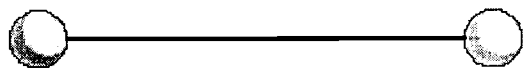
Submarine Cable Systems Development History



[Go Back](#)

Figure 2.

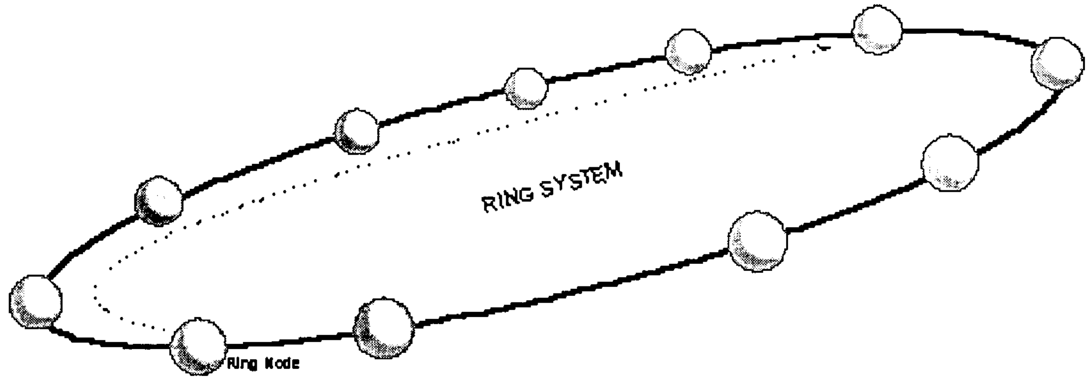
Submarine Cable System –Point to Point Configuration



Go Back

Figure 3.

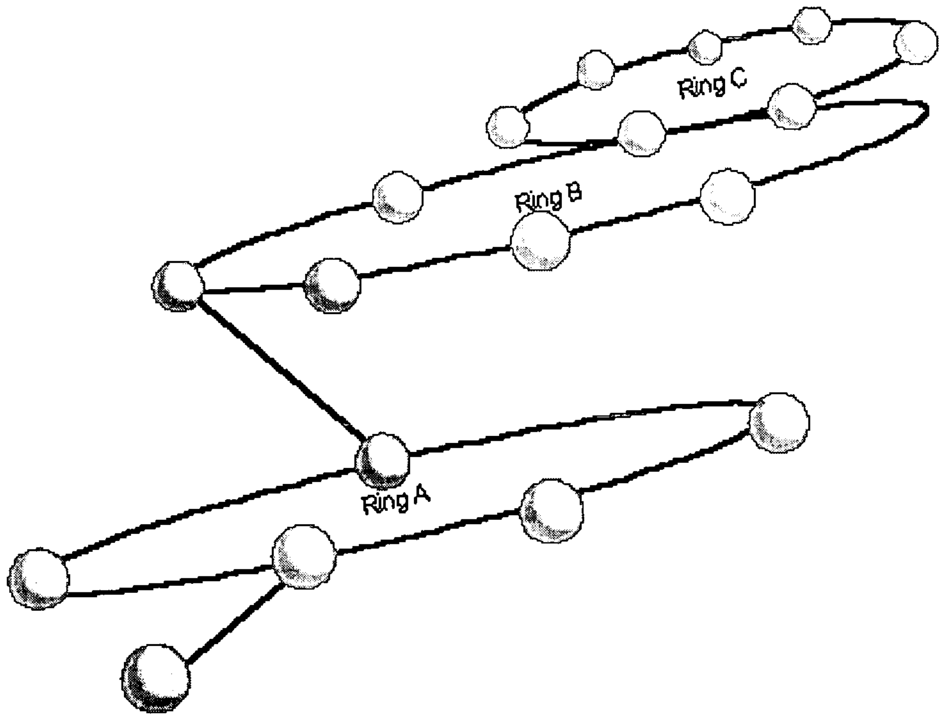
Submarine Cable Network -- Ring Configuration



Go Back

Figure 4

Submarine Cable System --Concatenated Ring Configuration



Go Back

Beating the Bandwidth Bottleneck -- How Subsea Cables can Support E-Commerce between Europe and Asia

Owen Best

Telstra Corporation Limited, Japan

ABSTRACT

The global expansion of the Internet is accelerating demand for data and voice communications between Asia and the rest of the world. Mr. Owen Best, Vice President Asia-Pacific – FLAG Telecom, explains how the latest generation of undersea cables can help the region satisfy its growing appetite for bandwidth.

View Full Text

Beating the Bandwidth Bottleneck: How subsea cables can support E-commerce between Asia and Europe

INTRODUCTION

The global expansion of the Internet is accelerating demand for data and voice communications between Asia and the rest of the world. Mr. Owen Best, Vice-President Asia-Pacific – FLAG Telecom, explains how the latest generation of undersea cables can help the region satisfy its growing appetite for bandwidth.

PAPER

The insatiable appetite for transmission capacity, driven by the explosive growth of the Internet, is revolutionising the way submarine cables are financed and operated.

Once owned exclusively by groups of international operators, who contributed a share of the cost and were entitled to capacity in proportion to their investment, today's cables are increasingly likely to be funded and managed by private or public companies supported by a broad industry scope of equity players.

They see construction of undersea cable not as part of the cost of doing business, but as an opportunity for profit. They are prepared to commit billions of dollars

of investment in the expectation of generating revenues by selling capacity both to international licensed operators seeking extra capacity, and to other emerging facilities licensed operators such as Internet Service Providers (ISPs).

FLAG is the first subsea cable project to be supported entirely by private investment. The FLAG system is also the world's longest subsea cable, at 27,300 kilometres. It links Japan to the UK via the South China Sea, Indian Ocean, Red Sea, Mediterranean Sea, and the Atlantic Ocean.

FLAG's largest shareholder is Bell Atlantic, with a 38% stake. The remaining shareholders are Dallah Albarakah Group of Saudi Arabia, GE Capital Corporation, Gulf Associates, Marubeni Corporation, Telecom Asia Corporation of Thailand, Hong Kong-based Asian Infrastructure Fund and AT&T Capital Corporation.

Construction of the FLAG cable system was performed by a consortium of AT&T Submarine Systems (now Tyco) and KDD Submarine Systems of Japan, which in turn appointed Cable & Wireless Global Marine as the principal cable-laying subcontractor.

The first cable lay began in November 1995, followed by the first deep lay in January 1996. The last segment was completed in May 1997, and the FLAG system entered service in November 1997. The FLAG system has 16 Landing Points in 13 countries or territories, of which 14 are operational.

Architecturally, the cable consists of two 5.3 Gbit/s optical fibre pairs, transporting a total of approximately 120,000 64 kbit/s channels, or 4 X STM-16s in SDH (Synchronous Digital Hierarchy) format. The system uses optical amplifiers with laser pumps to support its 27,300 kilometres of optical transmission and was designed to support a WDM (Wave Division Multiplexing) upgrade as demand requires.

Each Landing Point is equipped with STM-16 to STM-1 add/drop multiplexers that allow access to 155 Mbit/s STM-1 data streams; digital cross-connects to groom VC 12 and VC 3 traffic modules into the STM-1 frame structure; operations monitoring equipment; and a robust high voltage supply configuration which powers the system.

The emergence of this new generation of subsea cables coincides with growing recognition among Asian governments – including those of emerging economies -- that there is a direct correlation between teledensity and GNP.

Although teledensity rates across the region vary widely, Asia still lags Europe and the US, where the average rate is 50 per cent. However, the gap is closing and despite the current economic turmoil, Asian governments are committed to liberalizing and opening up their telecommunications industries, in line with the landmark WTO (World Trade Organization) Agreement of February 1997.

In view of these trends, there is significant potential for broadband communications growth in the region. According to Cambridge Strategic Management Group (CSMG) and Arthur D Little, annual incremental demand for telecommunications capacity between Asia, the Middle East and Europe is predicted to increase from US$676 million in 1998 to approximately US$2.7 billion in 2007. The volume of switched traffic is projected to grow at a similar rate through 2007.

Non-switched traffic (over owned and leased lines by resellers, end-users and Internet Service Providers) is projected by CSMG to grow at compound annual growth rates of 20 to 80 per cent for Internet traffic, and 10 to 30 per cent for other non-switched traffic through 2007.

A major challenge is predicting how demand for Internet services in the Asia Pacific and the rest of the world will evolve in the future. The demands of the

Internet are so intense and so unpredictable that operators are stockpiling capacity, rather than risk being unable to satisfy their customers.

But what is not in question is that today's largest demand is for data transmission – text, still and moving pictures, and high quality sound – of which the Internet is the biggest component. Across the Atlantic Ocean, for instance, the volume of data traffic already outstrips voice traffic.

In Asia, the penetration of personal computers (PCs) and the level of office automation for businesses will continue to grow strongly. This means that the use of Internet capacity will grow. Recent press reports indicate strong growth in Internet usage and the deployment of IP-based applications.

Taiwan's Industrial Development Bureau, for instance, estimates that the Internet and E-Commerce market will generate US$1.4 billion worth of business opportunities by the year 2002.

In Singapore, the government is making a sustained effort to develop the island into a global E-Commerce hub – one example being the NETS project, which will provide local and international businesses with the tools to perform online payment transactions and which will offer for the first time a city-wide E-Commerce infrastructure.

We believe that IP-based usage in Asia will move towards commercial applications. The best-effort World Wide Web traffic will continue to grow but it will not be so dominant compared to E-Commerce and industry-based IP applications such as Intranet and extranet.

This in turn will have two consequences. Firstly, bits will no longer be equal. An E-Commerce-declared bit, which is transaction time-sensitive, will cost an end-user more than the best-effort WWW-style bits.

Secondly, the centricity of the networks will gradually dilute away from the continental US – through which about two-thirds of international Internet traffic currently passes.

This will bring changes to network architecture, and it is this type of scenario which makes terminal point and drop/insert portability so important to the capacity planner. The FLAG cable was the first to offer this important feature to its product set, at a level which is useful to the network planner.

Thus the new breed of subsea cables is ideally suited to meet Asia's growing appetite for bandwidth, as well as the new telecommunications business model which is being driven by the rise of the Internet.

FLAG, for example, was conceived to provide a connection of the European end of the high-density trans-Atlantic crossings with the East Asian end of the trans-

Pacific crossings. Together with FLAG, these networks will achieve a 10 Gbit/s (Gigabits per second) SDH-based fibre link around the globe.

Much has been written about how satellite-based Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) systems can provide high-bandwidth applications.

While these systems will reach areas where it is not financially feasible to connect by cable, they use unproven technology and are not due to enter service until 2000 and beyond.

By contrast, the latest subsea cables use proven technology, and offer a long, consistent track record of high quality and incremental improvement. Compared to satellite, they:

Provide a superior medium for digital transmission.

Offer better data throughput.

Produce a lower error rate for point-to-point transmission.

Deliver better sound quality (less transmission delay and less echo) – a critical factor in interactive sessions.

Provide a more secure transmission path and increased privacy.

Are unaffected by weather conditions and electromagnetic interference.

In fairness to the satellite industry, however, satellite transmission does have its own list of unique competitive advantages – particularly for broadcast and remote area transmission applications – which will ensure that the transmission marketplace of the future will be a hybrid one where customers can take advantage of the attributes of both transmission mediums.

In Asia, the ratio of subsea to satellite communications currently favours the latter. This statistic will change as time and quality-sensitive applications such as E-Commerce drive the demand for very large pipes of intra-Asia transmission capacity and as new WDM technology drives the unit costs of fibre transmission ever downward.

Subsea cables are constantly improving their global reach. It is estimated that 312,788 kilometres of undersea cable had been installed by the end of 1996 – a figure that is expected to more than double by 2003.

And with the third generation of transoceanic optical-fibre cable, carriers benefit from the availability of a much larger volume of cost-effective bandwidth. The first two generations carried up to 280 and 560 Mb/s (Megabits per second) of data per pair of optical fibres, respectively. FLAG, being third generation, raises the

rate to 5.3 Gbit/s and is able to carry approximately 120,000 64-kb/s (kilobits per second) channels, on two fibre pairs.

In comparison, the first trans-Atlantic telephone copper cable in 1956 carried only 36 conversations, while the first optical-fibre cable installed across the Atlantic Ocean in 1988 carried 8,000 circuits, also as 64-kb/s channels on two fibre pairs.

As the latest subsea cables are built around SDH technology, they integrate seamlessly with other transmission technologies: past, present and future. Provided cable systems are designed to support it, WDM technology allows additional tranches of capacity to be added to the same fibre infrastructure as the cable fill rates dictate. The advantage to the cable system provider is the ability to move the unit costs of the system to a more competitive footing, and stage WDM upgrade investments to match projected take-up and thus revenue flow.

As well as offering advanced technology, the latest subsea cables are designed for the new era of deregulation and competition in global communications. Their privately financed structure relieves carriers of the need for long-term capital commitments – thereby allowing them to purchase capacity they need as and when they need it, thus freeing resources to develop new and profitable end-user applications.

The latest subsea cables are also designed to fit the business models of new carriers, such as ISPs, which need to react quickly to changes in end-user demand.

FLAG, for example, offers customers high performance capacity between any two points on the system, in 2Mbps Minimum Investment Units (MIUs) with minimum activation times.

MIUs can be acquired on an 'as-needed' basis, eliminating the need for significant up-front investment. Customers have the option to buy or lease capacity. They also have the freedom to change the destination points of their MIUs in response to variations in demand and thus their traffic patterns.

Connectivity is another plus. In the past, when a carrier needed a cable circuit from, say, Japan to Saudi Arabia, separate agreements had to be negotiated with multiple submarine, satellite or terrestrial systems. Today's subsea cable operators offer carriers a "one-stop-shop" approach.

For both carriers and end-users, reliability is another major concern. With SDH technology, subsea cables use pairs of cables connected into loop architecture to provide unprecedented quality and reliability.

•

If, for example, a trawl net or a ship's anchor damages one arm of the loop, the signal is automatically redirected over the other arm in millisecond time frames. Most higher-level protocols are quite tolerant of such interruptions, without degradation of service to the customer. It is these higher level protocols which will support E-Commerce applications.

In short, subsea cables will have a major role in supporting the evolution of E-Commerce in Asia well into the next century. By offering customers in the region ample bandwidth, advanced technology and the flexibility to meet changes in their respective markets, we are confident that subsea cables will play an important role in establishing Asia as a hub for the E-Commerce and multimedia platforms of the next century.

Return to Top View Full-screen

The Submarine Cable Networks Industry Shifts Gears

Jean Godeluck

Alcatel Submarine Networks, United Kingdom

ABSTRACT

The market for international submarine networks is currently experiencing a tremendous explosion in both technical capacity and kilometres of cables. A number of factors explain this acceleration, among which the take-off of the Internet, market globalisation and telecommunications deregulation. The combination of these drivers has generated radical changes in the marketplace, which not only affect the size of the market, but also modify the structure of the industry.

Considering the tremendous acceleration of technical progress and the rapidly changing market environment, long-term forecasts are increasingly difficult to produce and hence investment horizons tend to shorten. The combination of these factors is currently pushing the telecommunications industry into a whole new era.

In the submarine cable industry, this means that the relationships between the various players, operators, suppliers, banks, consultants, etc. are quickly evolving, leading to a redistribution of roles.

View Full Text

The Submarine Cable Networks Industry Shifts Gears

I. INTRODUCTION

The market for international submarine networks is currently experiencing a tremendous explosion in both technical capacity and kilometres of cables. A number of factors explain this acceleration, among which the take-off of the Internet, market globalisation and telecommunications deregulation. The combination of these drivers has generated radical changes in the marketplace, which not only affect the size of the market, but also modify the structure of the industry.

Considering the tremendous acceleration of technical progress and the rapidly changing market environment, long-term forecasts are increasingly difficult to produce and hence investment horizons tend to shorten. The combination of these factors is currently pushing the telecommunications industry into a whole new era.

In the submarine cable industry, this means that the relationships between the various players, operators, suppliers, banks, consultants, etc. are quickly evolving, leading to a redistribution of roles.

In the previous period, carriers planned new networks, chose the technical solutions, put their own money and operated the networks. Suppliers essentially had to comply with detailed specifications and implementation schedules.

Today suppliers are taking on much broader responsibilities, ranging from anticipating demand, designing networks, financing projects, implementing networks, in fact assuming a more and more global responsibility in the development of the global infrastructure. In short, the relations between carriers and network manufacturers are evolving from a strict customer-supplier arrangement towards a mutually beneficial partnership.

In the following, we highlight the main challenges facing the submarine cable industry in general, and system providers in particular, in the fast-moving world of telecommunications.

II. TECHNOLOGY AS A DRIVER

Arguably, technological progress is the foundation on which the modern telecommunications industry has been able to develop at an astonishing rate over the last half century. Twenty years ago, the advent of fibre optic transmission created the first breakthrough towards high bandwidth telecommunications.

More recently, at the beginning of the nineties, optical amplification really unleashed the true potential of the optical fibre medium, as it allowed transparent pipes to be designed, supporting in particular multi-channel transmission (WDM systems). Progress has been incredibly fast in this area, so that the capacity supported by optical fibre transmission systems has been multiplied by almost a thousand in just over twelve years.

Figure 1 illustrates the rapid increase in technical capacity for submarine systems over the last decade. A interesting fact is that technological progress has always been faster than predicted by the engineers themselves. Interestingly, the inaccuracy of technological forecasts is only matched by the inaccuracy of traffic forecasts over the same period, when operators have consistently underestimated demand and the growth of demand on international infrastructure networks.

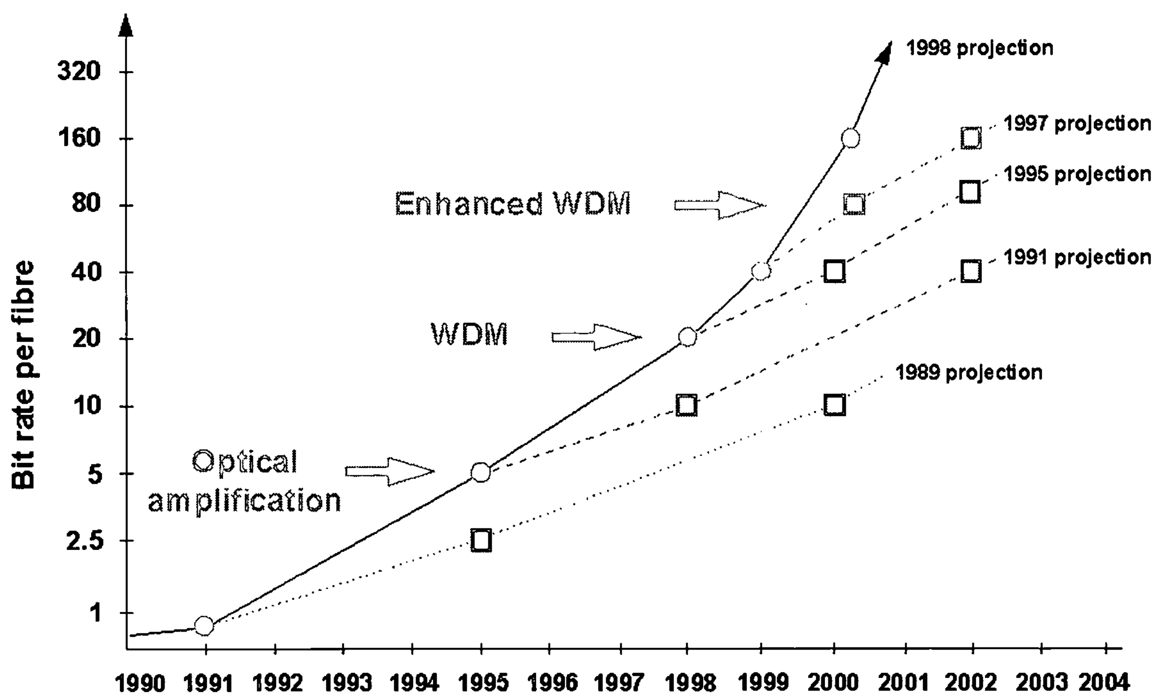


Figure 1. Transmission capacity for submarine systems

Anyhow, the major consequence of this impressive increase in transmission capacity is the rapid decline in the cost of international capacity. Indeed, as most of the costs of building a submarine network —cable, cableships, submerged equipment—, only evolve slowly with time, the transport cost of international telephone circuits is plummeting. Of course, this is not entirely carried through to end-users, as operating a network involves other costs than just transporting capacity, such as switching, management, etc. However the trend is sufficiently strong for new applications to be developed to benefit from the reduced cost of capacity.

Concurrently, computer technology has followed the same fast track of progress, when computer power (processing speed, memory capacity) has been multiplied a few hundred times over the same twelve years.

The combination of computer power and transmission capacity has allowed the Internet to develop at a steady pace. Targeted at first towards researchers and the military, the Internet —the network of networks— has evolved into an all-encompassing medium, widely used by corporations and residential users, for a large palette of services.

The rapid development of the Internet places a heavy demand on all existing network infrastructures, both in the trunk network and in the local loop. Traffic patterns are shifting from voice telephony to data/Internet services, if only because the bandwidth requirements of voice and Internet services differ by at least an order of magnitude.

This is very obvious on heavy routes converging towards the USA (the focal point of the Internet), such as Europe-USA, Asia-USA, and Australia-USA, where Internet traffic has surpassed or will surpass very soon switched voice traffic.

Given the extremely fast growth rates of the Internet, measured either in numbers of subscribers or volume of traffic, it becomes extremely difficult to forecast traffic patterns over the long-term. When voice telephony still grows at about 10% per annum, the Internet develops at a much faster rate ! Indeed, Internet traffic growth forecasts range from 100% per annum to 1500% per annum. Inaccuracies in forecasted Internet growth rates, which may come from inadequate base data or incorrectly assessed market drivers, can quickly lead to very large discrepancies over a five to ten year horizon. As the take-off of the Internet is a quite recent phenomenon, very little historical perspective is available and growth drivers have not really been tested against real facts and figures.

The extreme difficulty, or even impossibility, of the task awaiting the network planning groups at each carrier, who are responsible for launching new infrastructure developments, based on their assessment of future needs, is leading them to find partners who will take some of the responsibility for planning and deploying new networks, and assume the associated market risk if forecasts prove erroneous, either too low or too high, or if technology becomes outdated earlier than expected. Such partners can be financial investors, looking for high return investment opportunities, or system suppliers, moving towards a more global approach to network development.

III. MARKET GLOBALIZATION AND DEREGULATION

The world today is global, in many respects. Modern transportation systems have reduced effective distances between people and between countries or continents, and modern telecommunication systems have further contributed to bringing down barriers to free and fast circulation of goods and money. The consequence is that large corporations now address a global market —the world— and therefore require a global service from telecommunication operators and service providers.

Competition becomes global as well, and standards for excellence are spreading worldwide. Hence, international carriers have updated their requirements, towards an increased support from system suppliers.

Simultaneously, the general trend towards deregulation of telecommunications has given rise to a new breed of telecommunications operators. Besides the incumbent operators, strongly entrenched in their local market and expanding in new markets abroad, many smaller operators are developing their activity in newly deregulated markets. In general, they do not have the long historical technical and operational experience of established operators, and financial efficiency imposes streamlined teams. Hence they count on their suppliers to provide the complementary expertise and operational support.

In addition to these various types of operators, new players have appeared recently on the market of international network infrastructures. They propose carrier's carrier services, i.e. they finance and build network infrastructure —submarine or terrestrial transmission networks—, and they subsequently lease or sell the capacity on this infrastructure to operators. They do not target end-users; hence they don't really compete with traditional telecommunications operators. Often, these carrier's carriers have an entrepreneurial profile, and they are much more financially than technically inclined. Therefore they rely more than any other player does on their suppliers to accompany them in their development, both in planning phases and in operational aspects. A consequence of the closer relationship between these new players and their suppliers is the very limited recourse to call for bids, for projects of an entrepreneurial nature. Rather, these network providers make their own judgement on the preferred supplier, taking into account the specifics of the project being developed on technical, operational, financial or political grounds, and they directly negotiate supply contracts with the selected manufacturer. This allows them to deploy their infrastructure more quickly than through the traditional, time-consuming, tendering process.

At any rate, the coexistence of such diverse players has created a surge of activity in the submarine networks industry, as all these entities compete with each other. When there used to be only one transatlantic or transpacific cable system at a time (TAT-8 through to TAT-12/13, or TPC-3 through to TPC-5), there are now several parallel and competing networks: TAT-12/13 (to be followed by TAT-14), Gemini and AC-1 in the Atlantic; TPC-5, and soon China-US, Japan-US and PC-1 in the Pacific. These networks represent the three types of submarine networks currently present on the market. TAT-12/13, TAT-14, TPC-5, China-US or Japan-US are "club" systems, i.e. systems where several (usually incumbent) operators co-invest and share the property of the network on a consortium basis. Gemini is a private network jointly developed by WorldCom and Cable & Wireless, mostly for their own use. Atlantic Crossing 1 (AC-1) and Pacific Crossing 1 (PC-1) are the property of Global Crossing, an entrepreneurial venture, positioned as a pure carrier's carrier, and whose principals are primarily financial investors. A similar situation is also observed for terrestrial pan-European networks.

IV. PERSPECTIVES FOR THE FUTURE

The immediate consequence of this frantic development of network infrastructure is the surge of activity in the submarine networks industry, which is welcomed by all system suppliers, after a few years of relative slowdown.

However the big question today is: with all the network capacity being installed worldwide, how soon will the next market slowdown occur? In other terms, isn't installed capacity increasing faster than the market can absorb?

Opinions differ widely on this issue. Pessimists note the cyclical nature (see Figure 2) of the submarine networks industry, when each surge of activity —spurred by technical advances— has been followed by a strong slowdown, with a periodicity of 3 to 5 years. In 1997, the market reached unprecedented levels, at more than

$4.2 billion. For 1998, the total volume of orders is expected to approach or exceed $ 6 billion (low and high figures are indicated in Figure 2 for 1998). Hence the pessimists anticipate the next market slump to occur in 1999, or 2000 at the latest.

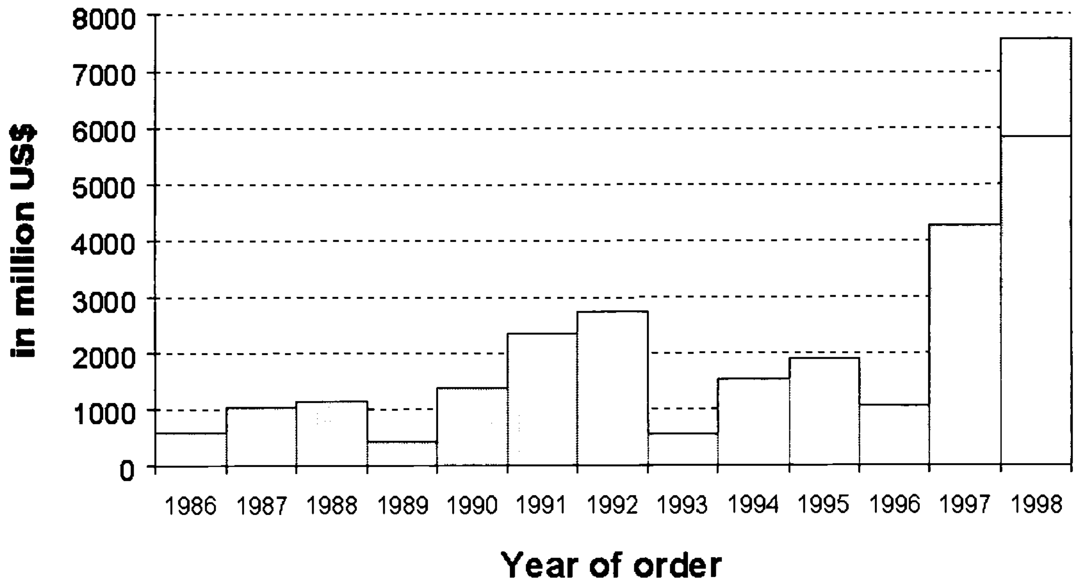


Figure 2. Worldwide market for submarine cable networks

On the other hand, optimists object that the current favourable market conditions have never been encountered. The conjunction of Internet development and market deregulation should maintain a high level of activity for an unbounded period. They argue that new services allowed by the large amounts of affordable capacity are only in their infancy. Indeed, who really uses today more than telephone, fax, email and basic Web services? When bandwidth-intensive services, such as remote networking or video-based communications, start spreading among the wider user base, demand for capacity will grow even faster than today. In addition, it has been proven historically that estimates of future demand for international capacity have always been too conservative.

V. WHO DRIVES THE MARKET?

In this uncertain environment, carriers are moving away from their old patterns of behaviour. They used to plan new networks according to their own assessment of future traffic needs, they chose the technical solutions to support the anticipated traffic, they directly invested their own money, and they owned and operated the networks. Correspondingly, suppliers only had to comply with detailed specifications and implementation schedules.

Today, because of the explosive and rather unpredictable growth of traffic, operators have reached a point where they have very little insight into their long-term traffic requirements, which makes it difficult to justify heavy, long-term capital investment in network infrastructure. The notions of market risk, return on investment, time-to-market and window of opportunity are becoming major factors in decisions leading to investing in a submarine cable system.

Implementation schedules for submarine systems are therefore becoming shorter and shorter, as no one wants to miss windows of opportunity in the chase between global traffic demand and global available capacity. Hence suppliers have to be able to anticipate demand for more capacity and more sophisticated services, which implies developing new technologies ahead of any specific customer request.

Besides taking over a high level of technical risk, suppliers may also have to assume part of the market risk for projects. This implies contributing to the definition of the scope of planned projects, to their specification (including upgrading capabilities), to their feasibility assessment studies, and more and more often to their financing packages.

In addition to their recognised expertise in system deployment, suppliers now face the challenge of developing a wider understanding of global issues concerning telecommunications projects in order to anticipate the demand. In other words, system suppliers, in their new role as active partners to telecommunications operators, will help in developing and expanding the markets for telecommunications services, which will eventually benefit the whole communications industry and more broadly, the whole information society.

Return to Top View Full-screen

Telecom Reform and the Resultant Evolution of New Product Offerings in the Undersea Cable Arena

Lisa S. Dadouris

Global Crossing Development Co., U.S.A

ABSTRACT

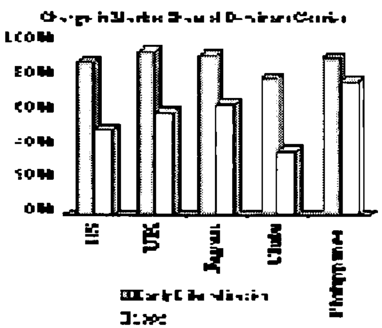
As telecommunications markets around the globe continue to open and broaden, there are a number of new international carriers entering the game, each with a new set of customer service offerings and a new set of facilities needs. Historically, the provision of international traffic was the realm of large, well-staffed government supported monopolies. Telecom deregulation and market liberalization have created an opportunity for new entrepreneurial start-ups, anxious to meet the growing needs of end-user-customers in a heavily competitive environment, yet more tightly resourced and frequently less experienced than the established providers. The emergence of new carriers has created an upsurge in new market entrants, focused in the areas of network and facilities planning and creatively providing new service offerings for undersea fiber optic cables. Moreover, the advent of these new carriers and the increasingly competitive and volatile nature of the industry have, caused the traditional players to re-evaluate resource priorities, carefully examine core business activities, and seek more flexible solutions.

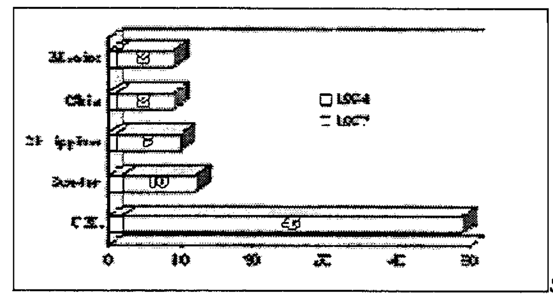
View Full Text

Telecom Reform and the Resultant Evolution of New Product Offerings in the Undersea Cable Arena

I. MARKET LIBERALIZATION AND PRIVATIZATION

Market liberalization and privatization have opened the door to hundreds of new service providers, each positioning to capture a share of the explosive growth in telecom. Today, there are more than 700 international telecommunications and Internet service providers worldwide, with more than 400 in the US alone.





Source: TeleGeography

These aggressive new players, both facilities and non-facilities based, have introduced a host of new services and new offerings to the marketplace. The established service providers have been forced to reevaluate strategies and priorities as they attempt to compete in this highly dynamic environment.

While these once-dominant service providers generally demonstrate continued strong performance because of the exponential growth in demand, there has been substantial market share erosion as new entrants continue to seize a piece of this growing pie.

Source: TeleGeography

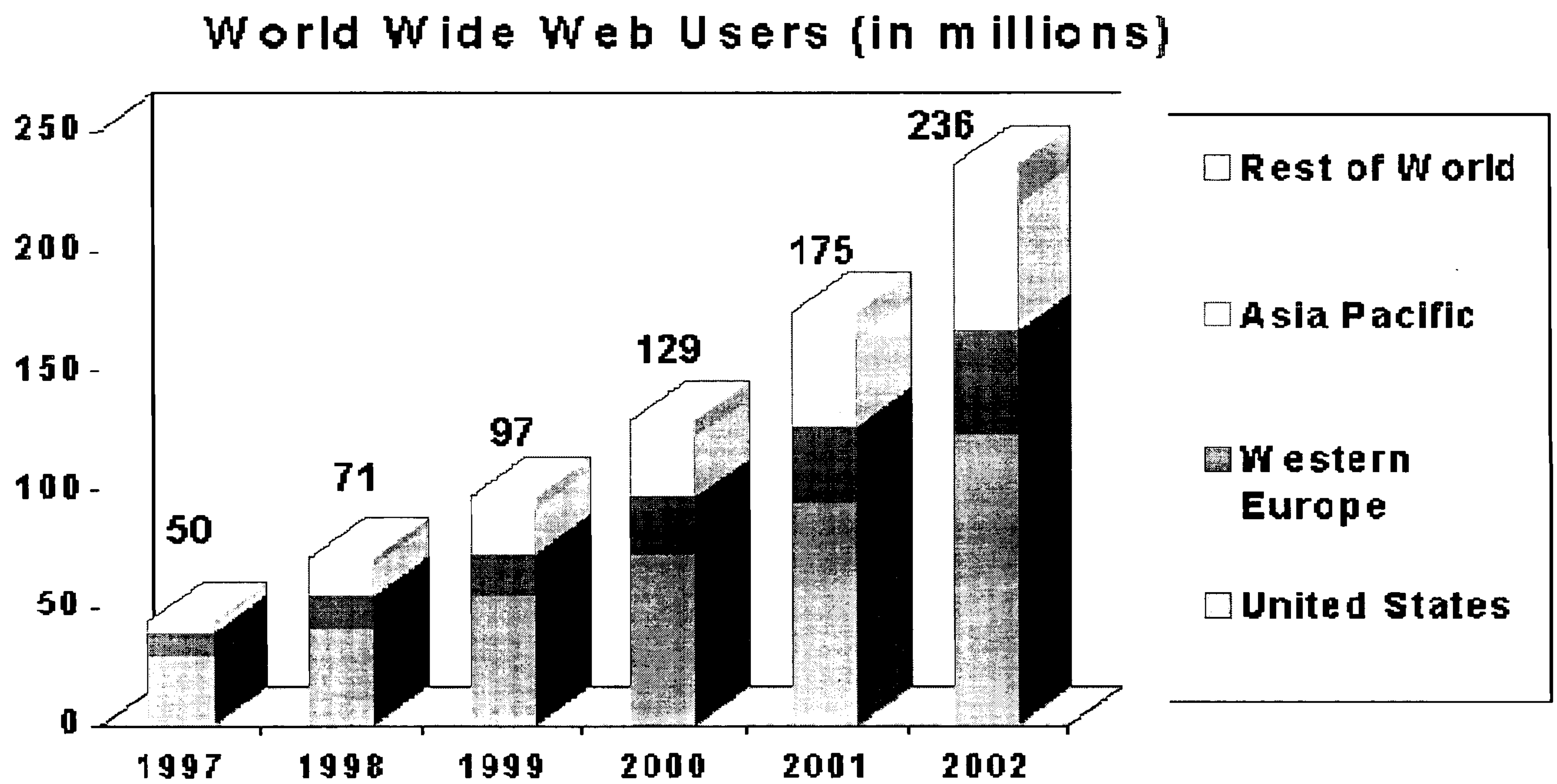
While this phenomenon has obviously impacted home market share, it has as well, caused chaos in the traditional correspondent environment. This erosion has greatly complicated correspondent relations and the determination of bilateral, bi-directional traffic over a multi-year planning horizon.

II. TREMENDOUS GROWTH AND SHIFTING DEMAND

While international voice traffic continues to increase at a healthy rate of 12 to 15 percent a year, international data traffic, including the Internet, has truly exploded – growing at more than ten times the rate of voice traffic. Given these growth rates, some industry experts predict that voice will fall to less than 1% of the total traffic by the year 2004.

Source: Tom Soja Associates

This shift has added further complexity to a forecasting process based on extrapolations of historical bi-directional voice traffic patterns. Data traffic, spurred by the Internet, the Intranet, and E-commerce, offers a new pattern. To date, this traffic has been rather US-centric. This factor, however, appears to be shifting toward a regional hub model and to be less focused on the US as a global center. In fact, international growth exceeds US growth (40% vs. 33% CAGR) and is led by the Asia Pacific region with a 51% CAGR.



Sources: IDC, Global Crossing

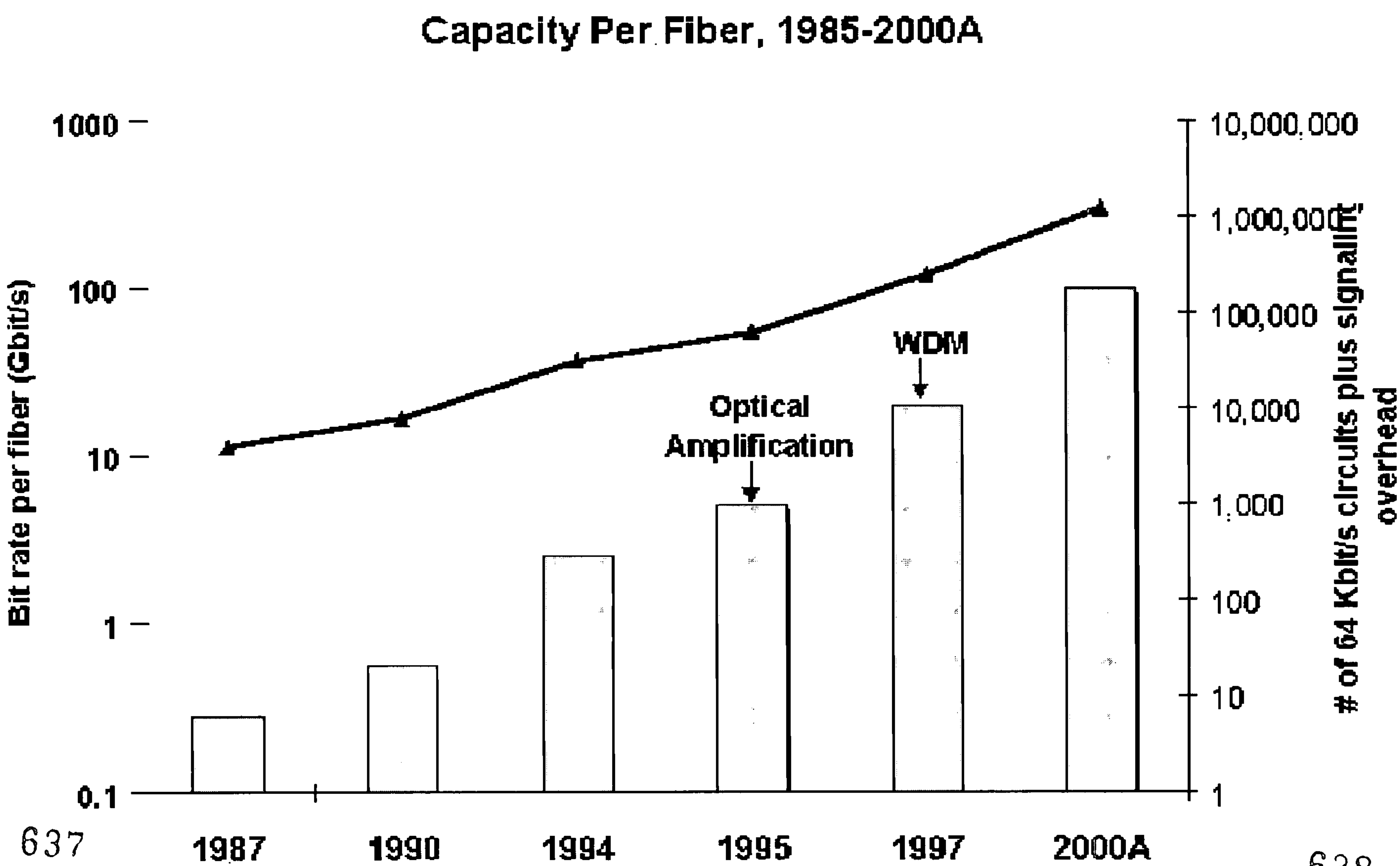
III. REDEFINING THE UNDERSEA CABLE BUSINESS

Historically, undersea cable projects have been developed, owned, and managed through a Consortium structure that provided cable station – to - cable station capacity on individual cable systems. Investments were made during system construction based upon 15-year traffic forecasts. Even in a more stable era, when this model proved highly successful for the major international carriers, forecasting was difficult.

Over time, this construct has become increasingly complex. As carriers face the multitude of new challenges in the industry, there has emerged a natural adaptation in the planning, procurement, and ownership models for undersea fiber optic facilities. With the shifting demand and emergence of new players it has been necessary to introduce new offerings based on new concepts into the undersea cable environment.

IV. ADDRESSING THE DYNAMIC ENVIRONMENT

Technological developments in the undersea cable arena have kept pace with these growing market needs. Previously unheard of transmission rates, on the order of 80 Gbit/s per fiber pair, permit a tremendous increase in call volume between points at a significantly lower cost per bit. Advances such as optical amplification and Wave Division Multiplexing (WDM) have not only facilitated greater transmission capacity and speed, but have enabled upgradeability of present and new cable systems to address the anticipated continuation of this exponential growth. Units of sale, once previously sold at the 2 Mbit/s level, are now commonly sold at the STM-1 (155 Mbit/s) level or even the STM-16 (2.5 Gbit/s) level. These technological advancements have helped to form the foundation for new offerings.



637 638

— Bit Rate per fiber (Gbit/s) —*— # of 64 Kbit/s circuits plus signaling overhead

Source: TeleGeography

New private developers have perhaps brought about the most significant changes. Clear of the Consortium paradigm, these new entrants have approached the market with an entrepreneurial spirit, truly revolutionizing the industry in terms of:

- Open access
- OA&M
- Routing flexibility
- City-to-City connectivity
- Financial flexibility

and most significantly,

- Network flexibility.

V. OPEN ACCESS

Traditionally, the dominant carrier at each cable landing point would own the station and allocate a portion of the cost to each purchaser in the cable system. All parties, including competitors to these dominant carriers were, therefore, required to land in these stations.

An independent 'carrier's carrier' system or network is not driven by the specific needs of one or a few large carriers. Open access to cable stations and systems has been established as the norm, further opening the marketplace to all carriers.

This helps to level the playing field from earlier structures that offered substantially more favorable offers to the initial investors, forcing new entrants to a higher-cost structure with fewer privileges.

Moreover, as independent providers, these projects have no hidden agendas and offer no competitive threats. Within this structure there is no direct competition between the facility provider and carriers to sell capacity to end-user customers.

VI. GLOBAL OPERATIONS, ADMINISTRATION & MAINTENANCE

Operations, Administration and Maintenance (OA&M) for undersea cables has typically been provided on a stand-alone system-by-system basis and billed as a cost incurred item. The standard arrangements within the cable maintenance agreements cover expenses associated with the stand-by charges for the vessels in each designated zone. Actual expenses in a given period can, however, be greatly impacted by the occurrence of a cable break or failure and the running charges associated with affecting the requisite repair.

The latest improvement in OA&M comes as an annual cap, not only at industry low rates, but also inclusive of all expenses. This new structure enables carriers to better predict operating expenses and maintain budgets.

639

Additionally, new undersea cable networks can support integrated OA&M. This promotes a 'one-stop-shopping' capability for activities related to operations, administration, and maintenance, including billing and fault location. This greatly simplifies this activity and reduces the resources required by the customer for oversight and management.

Moreover, the ability to improve efficiencies and to create network synergies in OA&M leads to cost savings which, in turn, are passed on to the customer.

VIII. OFFER FLEXIBILITY

As noted in the section on open access, cable stations were previously controlled and operated by the local dominant carrier. A further implication of this course was that each of these carriers had its own substantial domestic network and cable systems offered only cable station – to – cable station service. This proved a hardship for newer carriers needing full service to population centers.

Newer systems now offer flexible packages that can meet all of a carrier's needs. Offers can be more diverse and can be broadened to include far more than the traditional station-to-station offering. New offers include backhaul services from the cable station to population centers, or a more direct and simple city-to-city package which greatly reduces the complexity of negotiating with multiple parties and trying to secure competitive prices for what are often small volumes. Moreover, these broader offerings have introduced a further element of competition into the backhaul market and have helped to lower prices in this arena.

IX. ROUTING FLEXIBILITY

Perhaps one of the most compelling developments in the undersea cable industry has come in the area of routing flexibility. With the traditional drivers of traffic and correspondence changing at such incredible velocity, it is difficult to forecast facility needs far in advance. Offers that can include flexible network routing have, therefore, become very desirable to customers, particularly newer market entrants.

The advantages of more closely matching capacity purchases with capacity needs helps to mitigate the difficulties in forecasting and to assure the best return on the investment of each carrier.

X. FINANCIAL FLEXIBILITY

Carriers have the option to purchase reserved capacity or to purchase discrete amounts of capacity on demand. This is a major enhancement in the overall business proposition.

Given the size and scope of projects and the difficulty in pooling resources, market risk and ROI are becoming determining factors in submarine cable investment decisions. The flexibility offered by some of these new systems decreases the risk of directing today's investment dollars toward tomorrow's unknown needs.

Compared with traditional undersea cable systems, private systems offer more comprehensive, flexible, and low-cost purchasing alternatives. They are designed to meet current market requirements of international carriers, including direct city-to-city connectivity, the ability to purchase capacity annually, and discounts based upon aggregate volume purchased on the network.

Finally, and most importantly, are the changing views on the investment model in Consortium systems, and the trend toward deferring long term capital investment to further optimize resource utilization. Previous financial arrangements required full capital investment during the construction of the cables. Each owner invested an amount commensurate with its ownership share. With private systems, carriers can defer capital spending to be more commensurate with actual capacity utilization.

XI. AN INTEGRATED GLOBAL NETWORK

641 642

Private cable systems can offer a full array of global facility options and services. With a single party representing carriers, it is possible to develop holistic plans that address the full needs of end-user customers. This mitigates the need to work with numerous independent cable consortia to establish connectivity between points linked by diverse and unrelated systems. An additional benefit is derived from having this same network planner manage the operation and maintenance of the network instead of a number of parties. Not only does this help to establish a more efficient process from a network perspective, but there are also increased efficiencies from a carrier perspective in terms of management and oversight.

Carriers can focus on their core business issues, and allow the planning and management of global network facilities to be handled by those whose core business is network development and operations.

XII. CONCLUSIONS

The deregulation of worldwide markets and the explosion of global traffic have been critical drivers of change and growth in international telecommunications. In response, the undersea cable arena has expanded its customer offerings to better support the evolving needs of both established carriers and new market entrants.

While undersea cables have long been a source of reliable, high-quality, and cost-effective international capacity, the new private system entrepreneurs have truly revolutionized the industry. The ability to approach the telecommunications network holistically is a strong advantage for both established carriers and new market entrants. Shifting growth of market trends, unprecedented new services and new service providers, and unpredictable market share can make network planning a perilous task. Flexibility in the network and network offering reduces carrier's risk and provides the solutions required in the next millennium.

Return to Top View Full-screen

Southern Cross Cable Network – a Sponsor's perspective

Charles Jarvie,

International Business Development Manager,

Telecom Corporation of New Zealand Ltd.,

Wellington, New Zealand.

1. Abstract

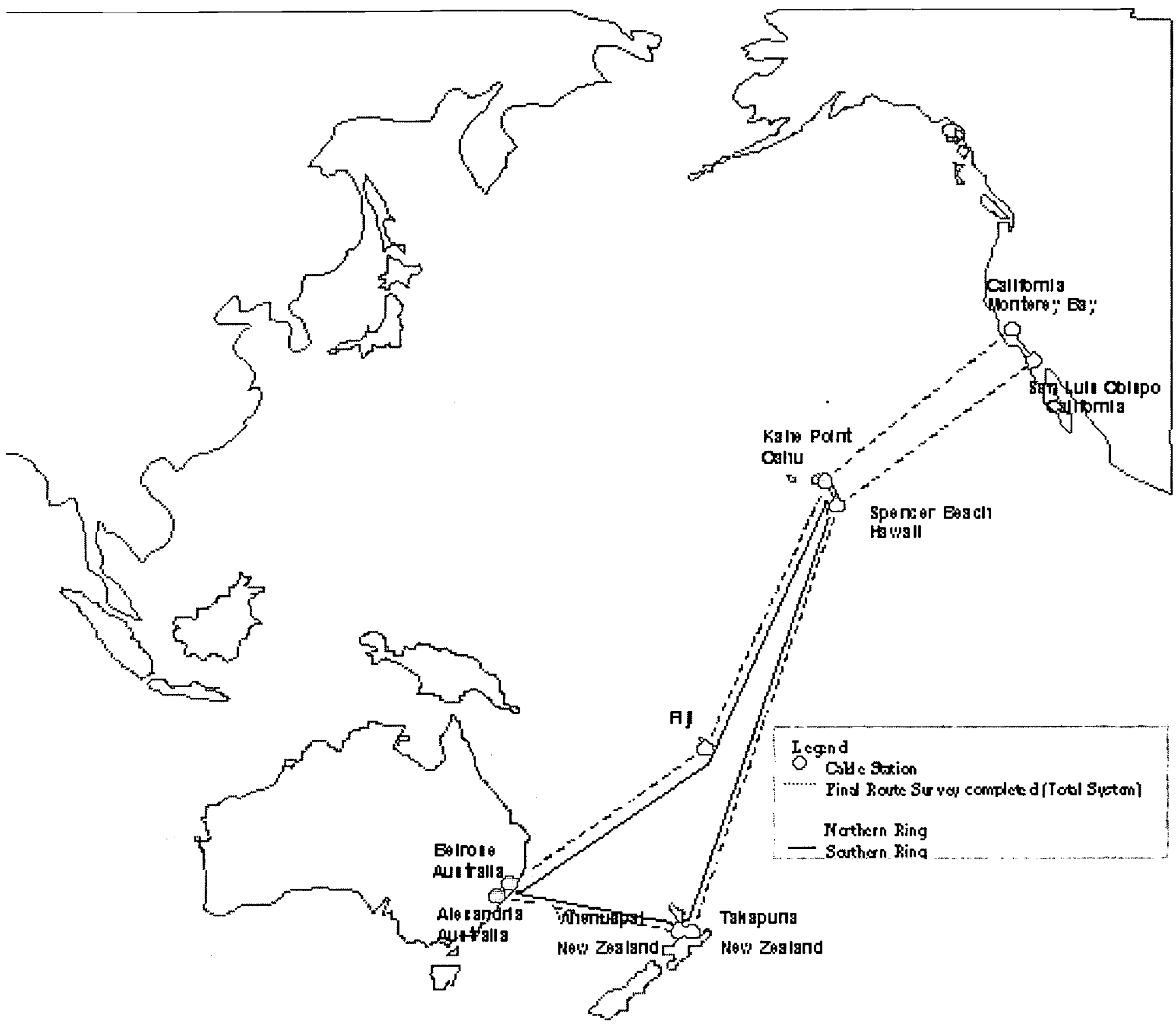
Telecom New Zealand is a 50% equity participant in the Southern Cross Cable Network (SCCN) now under construction. In early 1996 when Telecom New Zealand first examined the developing capacity situation in the Pacific Ocean, particularly between Australasia and North America, it was not contemplating a financial investment in international infrastructure. What ensued between then and October 1998 was the result of increasingly competitive regional markets, significant suppressed demand for international capacity, and the strong appetite of the financial markets to participate in international telecommunications projects. The final network design of the cable system and its financing structure was derived from a whole spectrum of potential approaches considered. This paper examines, from Telecom New Zealand's perspective, the environment, the alternatives arising along with some of the motivations that drove the Southern Cross project to its current manifestation. The paper also identifies issues dealt with by Southern Cross which are now increasingly of interest to the established consortium approach to pursuing submarine cable opportunities.

View Full-text

Southern Cross Cable Network – a Sponsor's perspective

1. Abstract

Telecom New Zealand is a 50% equity participant in the Southern Cross Cable Network (SCCN) now under construction. In early 1996 when Telecom New Zealand first examined the developing capacity situation in the Pacific Ocean, particularly between Australasia and North America, it was not contemplating a financial investment in international infrastructure. What ensued between then and October 1998 was the result of increasingly competitive regional markets, significant suppressed demand for international capacity, and the strong appetite of the financial markets to participate in international telecommunications projects. The final network design of the cable system and its financing structure was derived from a whole spectrum of potential approaches considered. This paper examines, from Telecom New Zealand's perspective, the environment, the alternatives arising along with some of the motivations that drove the Southern Cross project to its current manifestation. The paper also identifies issues dealt with by Southern Cross which are now increasingly of interest to the established consortium approach to pursuing submarine cable opportunities.



Pacific, New Zealand, Auckland, Australia, Fiji, Oahu, Hawaii, San Luis Opisbo, Monterey Bay

2. In the beginning..

Early in 1996 Telecom New Zealand became increasingly aware of the likely impact that non-voice services demand for bandwidth was going to have on the capacity remaining on submarine cable systems connecting New Zealand, Australia and North America. The key cables in the South Pacific were PacRimEast, PacRimWest and Tasman 2.

In addition to the projected capacity shortfall Telecom New Zealand had become frustrated by the governance arrangements, and their interpretation, for the existing systems on which much of its international business was dependent. The Construction & Maintenance

Agreements (C&MAs) of the PacRim and Tasman 2 cables were drafted in a previous era, understandably, without any prior knowledge of the needs of an increasingly competitive and deregulated market. The New Zealand market was completely deregulated and hence open to any international operator. Several multinational operators then enjoyed the advantages of wholly owned capacity into New Zealand – whereas the reciprocal arrangements were not available to New Zealand operators because of self-serving C&MA interpretations. Telecom New Zealand was not keen to be bound up by inflexible C&MA arrangements compounding the impact of varying degrees of market deregulation in the region.

Cable & Wireless Optus (Optus) enthusiastically agreed to work with Telecom New Zealand to consider arrangements that would better serve the market we both saw developing in our region.

3. Market Needs

1. *Market Axis*

The obvious impact of the Internet and other wide bandwidth non-voice applications was driving demand for network designs that were quite different from those optimised for transmission of switched voice calls. North America was driving innovation in the new, on-line, markets and was likely to remain the main focus for content and application developers.

With FLAG, APCN and SMW-3 either underway or in final stages of planning, the prime market remaining clearly not well served was between Australasia and North America. In particular the East Coast of Australia was remote from the above cables. With the Australian market further deregulating in July 1997 closer and more economic connection with the Sydney, Melbourne and Brisbane locations became attractive to new overseas and local entrants.

2. *Architectural Options*

With no indication of an economic network solution (or just capacity) being provided by other parties it appeared that an infrastructure solution was inevitable. A number of options were considered including an overlay of the existing PacRim network. Each option had its own cost, restoration and completion risk issues to be considered. For estimation purposes the cost of a submarine cable is proportional to distance laid - the capacity can be considered as a second order impact. So any long cable option needed some significant offsetting benefits to justify its relative higher cost.

For example shorter options that did not independently solve the end-to-end connection problem and were dependent on existing or proposed cables to reach North America were not attractive. These options had no satisfactory way of managing completion risk as they were dependent on the timing, designs and commercial arrangements of different parties with different objectives and exposed to different regulatory constraints. This aspect, for instance, became central when examining options that terminated in Guam and Hawaii.

Superior restoration arrangements were also essential. The new market required seamless restoration of end to end service which was something the existing cables (and even the new cables landing in Western Australia) could not support either due to their bandwidth, interconnection topology or support processes.

4. Testing the Market

1. Early Promotion

Through late 1996 and 1997 Telecom New Zealand and Optus presented architectural options, market projections and financing proposals to established operators in Australasia, North America and Europe. Both Telecom New Zealand and Optus had signed a development agreement and were keen to bring additional regional parties into the planning process.

North American operators showed very strong interest in the capacity the project would provide into the Australasian market. But, because that market constitutes probably less than 2% of the North American international demand, it did not justify them diverting any of their limited resources being deployed on the very competitive North Pacific and Atlantic routes.

It was during the early stages of promotion that MFS International agreed to sign the development agreement. MFS had just begun its Gemini project in the Atlantic driven by similar motivations to Telecom New Zealand. Soon after signing MFS was acquired by WorldCom. MCI WorldCom became the anchor partner in North America.

2. ***Structure Options***

Given the extent of interest in the proposal the partners felt that there was strong support for some form of end-to-end solution. However it was clear that the lower financial risk consortium approach to the preferred architecture could not be pulled together in the required time frame.

The project team recognised that consortium model cables are funded predominantly from the respective partners' capital program managed by network planning groups. Examining and executing on an equity opportunity is not something that is easily handled within the existing processes of network planners. It requires additional internal disciplines to participate and approve so becomes unattractively complex even if it potentially makes more efficient use of capital.

The sponsors selected a project-financed approach using senior debt facilities after considering various innovative hybrid approaches.

The hybrid approaches attempted to preserve the traditional appeal of virtual cable ownership by all capacity purchasers while using debt to top up the equity financing. However the commercial implementation of such structures presented major challenges to make them attractive to the bank markets while still maintaining the interest of the potential investor customers. We simply did not have the time for the development and selling process that was required. However the approach probably deserves further consideration in other situations.

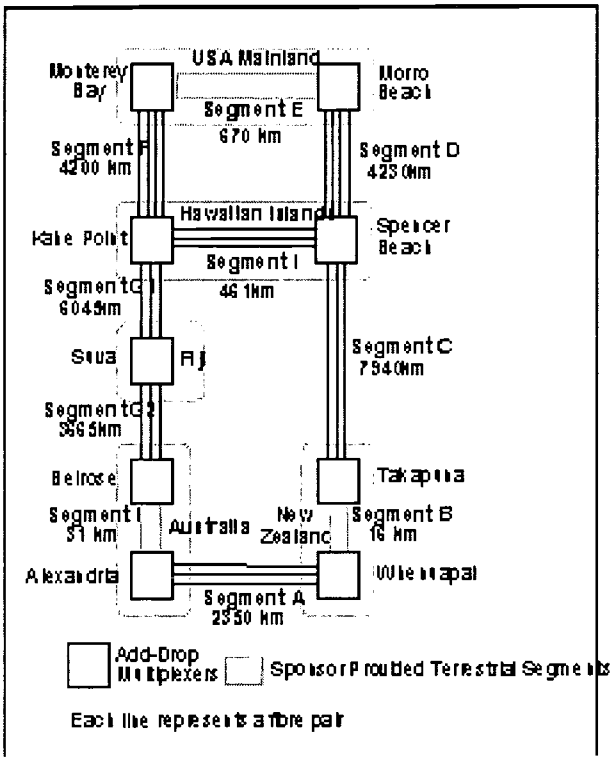
3. *Architecture and RFQ*

Several factors favoured a direct, self-protecting, end-to-end solution:

- The target market required much higher availability than current protection arrangements could provide
- The flexible use of capacity that was demanded by customers
- The lower latency was needed for many wideband applications working from Australasia to US East Coast and beyond to Europe. This could not be guaranteed by a daisy chain of Asian and North Pacific cables.
- The "grand plan" approach to Asian and Pacific cable projects appealed from an engineering point of view but had no timing guarantee and was unrealistic commercially
- Forecast costs of restoration via other systems over the life of the cable justified the additional cost of a loop
- Timing and completion risk was more manageable by the sponsors and suppliers so was more attractive to the banks

An RFQ for the system was released mid-October 1997 reflecting the current topology. Tenders closed in January 1998. Following extensive dialogue with the respondents and a comprehensive evaluation process the successful tenderer (a joint bid from Alcatel Submarine Networks and Fujitsu) was identified at the end of March 1998.

Between the time of preparing the RFQ and finalising the contract the technology of submarine cables had inexorably moved on. This enabled the sponsors to increase the system capacity within the original budget. In particular Segment A between New Zealand and Australia was designed to take advantage of much higher bandwidth per wavelength.



4. ***Data Gathering Meeting (DGM)***

The traditional litmus test of a cable proposal is the DGM. For Southern Cross the final decision to pursue a project financed structure placed more emphasis on accurately measuring the immediate demand for capacity. It also meant that potential customers had to be comfortable about the proposed project structure and their reduced roles when compared with the consortium model.

This meant the sponsors needed to pitch the final proposal to the widest audience with the expectation that there was little likelihood of getting a second chance. While earlier dates were considered the project team felt that the target market needed a final and comprehensive statement on the proposal if it was to be expected to make early commitments to sales. However moving the DGM back also ran the risk that the project could become frustrated by competitors.

The DGM was held in Sydney in mid-November 1997. The event was an outstanding success for the sponsors with a very high attendance and, more importantly, sales indications at least 60% higher than our most optimistic expectations.

After the DGM there was increased interest in equity positions. However project funding was substantially set and the banks had developed strong preferences on sources of additional or alternative equity participation.

5. Consolidating the Proposal

Capacity sales

Southern Cross entered into capacity Sales Agreements (CUAs) with its customers. This formal agreement provided essential security for some of the debt being raised. Where the customers did not have investment grade credit ratings (BBB- or better) letters of credit or deposits were also required. This aspect, as might be expected, presented some marketing challenges. In the telecommunications and on-line markets it was the new players that were making much of the front running through their innovation and speed and so represented the fastest growing sector of the market. Yet it was almost certain those same companies, in their start up phase, had either significant debt or, to the bank markets, unattractive credit ratings, irrespective of their stock market capitalisation.

It is interesting to note that consortium cable projects are now suffering increasingly from unexpected partner defections, late payments and payment default. The strong balance sheets of the central billing party (usually a major established telco) are being exploited surreptitiously to provide interest free working capital to some companies. They are testing the tolerance limits of the traditional model's blunt teeth and dependence on collective commitment. It may be that application of some of the commercial rigour found in the project-financing model would appeal to consortium cable sponsors keen to manage these risks in the future.

6. Financial Close

Once the level of CUAs had reached the required $ level in March 1998 and the system costs had been established with sufficient accuracy in late May 1998 the project, and particularly the process of achieving financial close, moved into its final and most intensive phase.

The sponsors selected three banks to be joint lead arrangers – ABN AMRO, Barclays Capital and Deutsche Bank. The banks, and their advisers, undertook due diligence and obtained their respective credit committee approvals to underwrite the US$920M debt syndication. In August 1998 the Joint Lead Arrangers approached six banks with a view to appointing a group of sub-underwriting banks. Subsequently the Australia and New Zealand Banking Group, Banque Nationale de Paris, NationsBank, Royal Bank of Canada (Asia), Toronto Dominion (Australia) and Westpac were appointed as Lead Underwriters in conjunction with the Joint Lead Arrangers.

All aspects of the project were examined and in some cases contracts revisited to meet additional requirements. The process, while following an apparently quite normal bank project financing timetable, consumed much more of the sponsors' (and their advisers) time and resources than had been originally contemplated - the price of using someone else's money!

To ensure that the original RFPA dates remained intact in the work plan Intention to Proceed (ITP) agreements were executed with the key suppliers.

1. ***Deal Structure***

The sponsors committed to US$150M of equity (Telecom New Zealand 50%, Optus 40% and WorldCom 10%).

The senior debt facility consisted of three tranches supported to varying degrees by capacity sales totalling US$640M:

- Tranche A US$480M fully supported by investment grade capacity sales. The margin is 75bp over LIBOR and the commitment fee is 25bp.
- Tranche B US$420M is for residual funding. The margin is 190bp and the commitment fee 56.25bp
- Working capital facility of US$20M. The margin is 190bp and the commitment fee 56.25bp
- The tenor of all three tranches is 6.25 years including 2.25 years construction.

2. ***Syndication***

The syndication officially closed on 27th November 1998 and was a resounding success. The Joint Lead Arrangers identified structure and sponsor participation as the key reasons for the success. They achieved the important following objectives:

- Strong bank group
- Sponsor relationship banks
- Geographic spread
- Positive market perception
- Lead Underwriters' exposure reduced to preferred hold levels
- Timely completion

- Minimum disruption to sponsors and Southern Cross management

Comparisons with recent project cables (some values estimated) show the bank market's apparent increasing comfort with various well-structured proposals:

US $M	Southern Cross	MAC (estimate)	AC-1	Gemini (estimate)	FLAG (initial est.)
Initial Sales	640	Nil	Nil	120	300
Equity	150	90	325	150	600
Debt	920	260	410	320	950
Total capital	1070	350	735	470	1550

7. Summary

From Telecom New Zealand's point of view the Southern Cross Cable Network is a means to an end. Other groups will propose, some will implement, and Telecom New Zealand may participate in other arrangements in other time frames with different motivations, better technologies, alternative topologies, and structuring. But the final form of this solution was unquestionably the best for the conditions that prevailed.

This international infrastructure project was never going to be straightforward but in hindsight the following points helped:

- A critical business need will produce the strongest motivation to find a solution
- Self motivated people will achieve amazing things in tight, focussed teams
- A small (by international standards) company can drive big change if strategy, motivations, and competencies are aligned.
- A small number of closely aligned partners can work effectively together
- A complete solution was very attractive to the market.
- A comprehensive review of the target market's needs, both top down and bottom up, under-pinned both the debt and equity financial assessments
- The international capacity markets and submarine cable community were broad minded enough to embrace new approaches to this business which now offers increasing choice to its wider-ranging customers and new opportunities for its participants

The joint venture company, Southern Cross Cables Limited, now has the responsibility to complete the construction phase, begin operation of the network and ensure that its service offerings remain attractive to its target market.

In that regard it has a focus of purpose somewhat different from the more traditional models. From Telecom New Zealand's perspective the regional market now has at least one alternative to the traditional approach to the distance problem that has always be-devilled us.

Return to Top View Full-screen

Terabit / sec Undersea Fiber Optic Cable Networks

Patrick R. Trischitta

Tyco Submarine Systems Ltd. Laboratories, U.S.A

ABSTRACT

The first transpacific undersea fiber optic cable network, TPC-3, represented a breakthrough at the end of 1989 when it began carrying 560 megabits per second of capacity across the Pacific. Now, just a decade latter, construction is underway on a new generation of undersea fiber optic networks that will provide capacities several thousand times larger. Transpacific undersea cable networks such as Pacific Crossing and Japan - US, will use wavelength division multiplexing (WDM) technology to provide unprecedented capacity and capabilities. These networks will be used to provide the new high capacity Internet services across the Pacific beginning in the middle of the year 2000. Advances in technology will allow multi-terabit per second capacities in the early years of the new millenium.

This paper will describe the evolution and capabilities of transpacific networks that will become operational by the end of the decade, including WDM networks such as China - US. Then we will present a description of the advanced technology that will be used to realize the multi-terabit per second transpacific undersea networks beginning in 2001.

View Full Text

Terabit / sec Undersea

Fiber Optic Cable Networks

I. INTRODUCTION

The number of new undersea fiber optic cable networks in the Pacific region is growing at an astonishing rate as extraordinary demand for Internet services push the limits of manufacturing capacity and technology development. In 1999 alone, more than 40,000 km of new undersea fiberoptic cable networks will be installed, another 100,000 km will likely be contractually committed, and another 150,000 to 200,000 km are in the planning stages. The networks going into service in 1999 will have capacity capabilities of as high as 40 Gb/s per fiber pair on each of four fiber pairs for a total transport capacity of 160 Gb/s per cable. These networks will use erbium doped fiber amplifiers (EDFAs) and sixteen channel wavelength division multiplexing (WDM) at 2.5 Gb/s per channel over distances of up to 12,000 km. This generation of undersea technology will use 1480 nm pumped EDFAs, broadband WDM components, and gain equalization in the undersea system, and incorporate high performance optical terminating equipment and SDH transport equipment at the shore based cable stations. The next generation of undersea systems, now in construction, will quadruple the capacity to 160 Gb/s carried on each fiber pair, thereby, continuing the trend of doubling the transport capacity of transoceanic systems every year.

Undersea networks have evolved from simple point-to-point to more complex topologies and configurations taking advantage of the networking concepts that have been deployed in terrestrial networks. With cable cross-sectional transport capacities approaching a terabit/sec, topologies such as rings that provide in-network restoration are essential. As these networks become more complex, the transmission topology is overlaid with a Network Management System (NMS) structure that provides the overall management features necessary in today's undersea networks.

In this paper, we cover several major aspects of undersea fiber optic networks. These include reviewing the networks and technology that are currently being deployed, the technologies that will be used in next generation undersea networks, and finally, illustrate the impact that new networks will have on the global undersea fiber optic network infrastructure.

In 1995, the initial segments of the first transpacific ring networks, TPC-5, was installed operating with a single 5 Gb/s channel on each of two fiber pairs. The full ring network was completed in 1996, and is now in full operation with fully subscribed capacity. TPC-5 was recently upgraded with a second 5 Gb/s channel added to each fiber pair.

Today, WDM networks are being built that will allow a capacity of 40 Gb/s (16 channels at 2.5 Gb/s) carried on each fiber pair. In 2000, undersea systems such as Pacific Crossing and Japan -US will be installed that will increase the traffic carrying capacity by another 4-fold, resulting in networks that will carry 160 Gb/s per fiber pair (16 channels at 10 Gb/s). Figure 1 shows the ten year trend of doubling of transpacific capacity every year. It also shows that the feasibility experiments predate installed networks by about three years. The latest TSSL laboratory results show that 320 Gb/s on a transoceanic fiber is possible and shows that network capacity is likely to continue to advance.

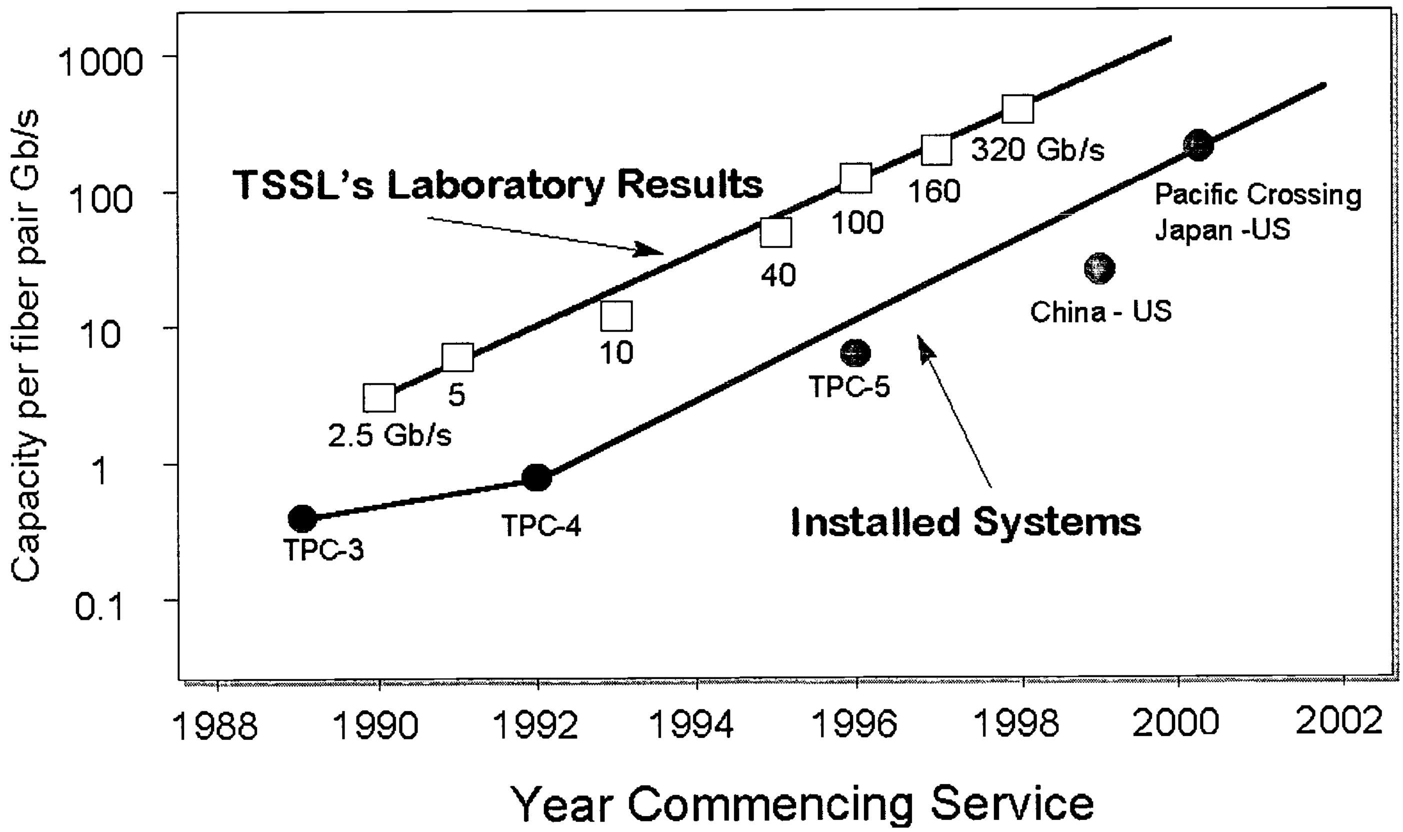


Figure 1 Comparison of TSSL Laboratory results with capabilities of installed systems

II. CURRENT GENERATION OF UNDERSEA NETWORKS

The current generation of undersea fiberoptic networks are the first undersea networks designed specifically for WDM applications. These networks are characterized by a number of unique attributes, including:

a. Undersea repeaters that support up to 4 fiber pairs using EDFAs that are pumped with 1480 nm lasers.

b. 10 nm usable optical bandwidths over transoceanic distances using gain equalization filters along the transmission path allowing these systems support up to sixteen channels on each fiber with each channel operating at 2.5 Gb/s over distances as long as 12,000 km.

c. High performance terminal equipment specifically designed for transmitting and receiving WDM channels over transoceanic distances. Included in this terminal equipment are features such as Forward Error Correction (FEC), synchronous polarization scrambling, signal preemphasis and dispersion compensation.

d. Undersea branching units that support fiber routing by splitting fiber connectivity between the main undersea fiber optic trunk cable and a branch cable terminating at a landing site along the cable route, or branching units that use wavelength selective filtering to split the capacity between the main trunk cable and the branch cable.

e. Networks that support protection against any single failure using equipment redundancy, facility protection (span and/or ring switching), or a combination of both. Many of the networking features are created by using standard terrestrial Add/Drop multiplexing equipment configured for the required application, such as self-healing rings.

f. A transmission topology which is overlaid by a NMS providing configuration, fault, performance and security management features.

III. WDM NETWORKS

The first of these transpacific undersea WDM networks is China -US. By the end of 1999 the China - US ring will be completed linking the US, Japan, Korea, and China. The China - US ring network is shown in Figure 2.

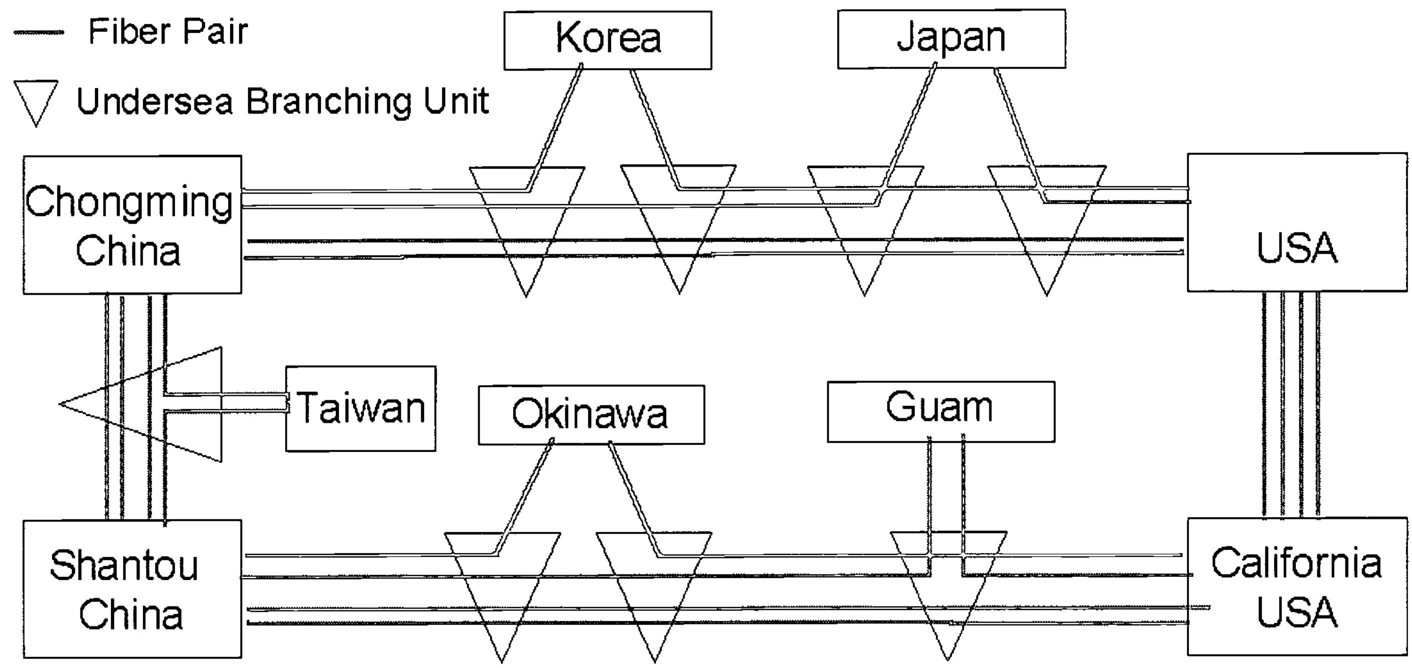


Figure 2 The China - US Undersea Cable Network

Each fiber pair in the network will carry eight wavelength channels at 2.5 Gb/s.

Other undersea WDM systems scheduled for service in 1998 and 1999 include:

a. Sea-Me-We 3, a 25,000 km trunk and branch system stretching from Europe to Japan via the Mediterranean Sea, Red Sea, Indian Ocean and Pacific Ocean

b. Columbus III, a 13,000 km network which is has a trunk and branch topology and is configured as a collapsed ring (fibers configured as a ring in a linear cable). This network connects Florida, the Azores, Portugal, Spain and Italy

c. Americas-2, another 11,000 km network which is a trunk and branch collapsed ring. The network connects Florida, Puerto Rico, St. Croix, Martinique, Caracao, Venezuela, Guyana, Trinidad and Brazil.

Current generation systems are also being constructed with a Network Management System (NMS) overlaying the basic transport network. As transmission capacities continue to grow, there is greater emphasis on the need for centralized management. Network Operations Centers (NOCs) are now being requested for most new cable projects.

NOCs or their centralized equivalent (this could be a complex of computer based servers at a cable station landing site) allow for rapid identification of faults, monitor the performance of each undersea segment in a network, ensure security and possibly the most important, allow for rapid configuration of traffic circuits. Many of the current generation systems are providing this functionality at the Element Management Level (EML) of the NMS. A further discussion of this topic is provided below under Next Generation of Undersea Networks.

IV. NEXT GENERATION OF UNDERSEA NETWORKS

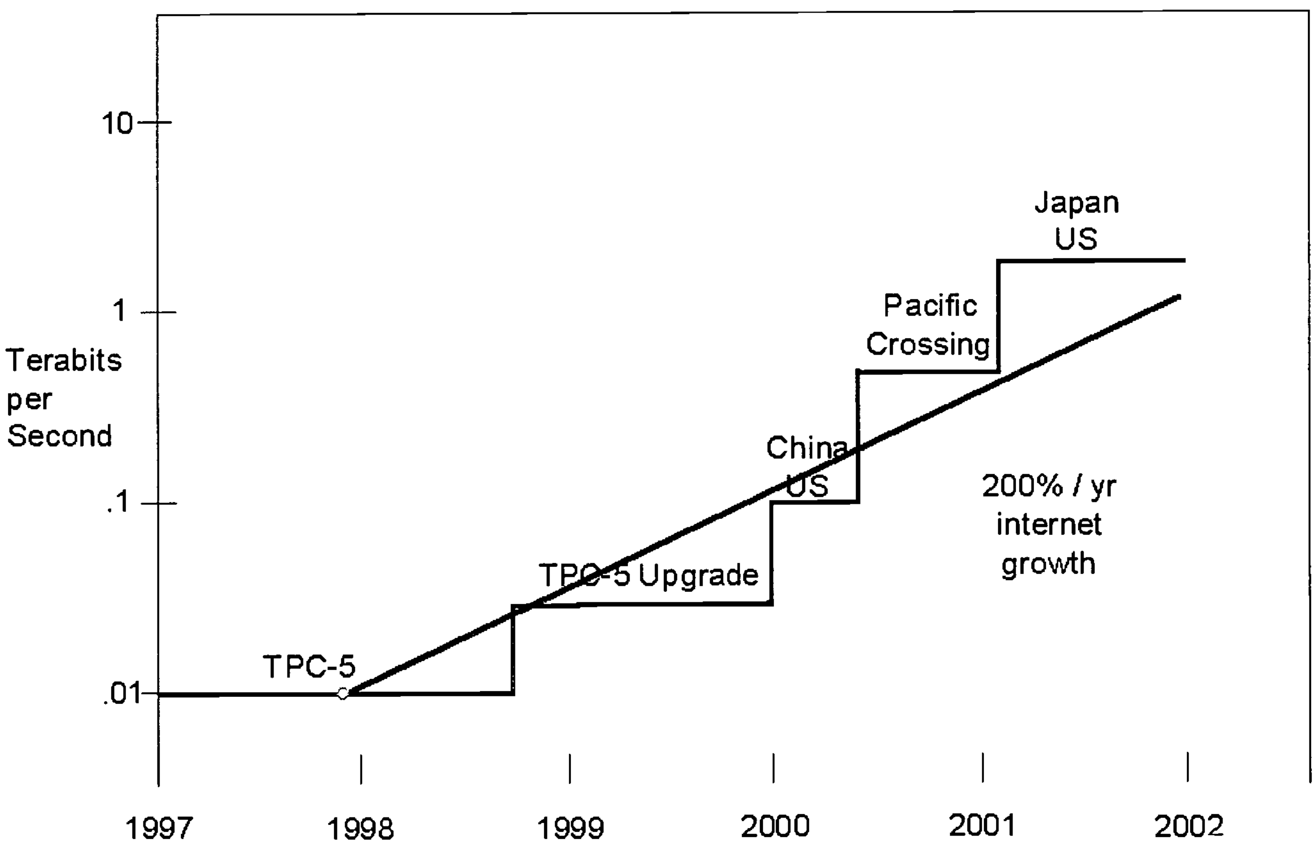


Figure 3. Growth in Transpacific Capacity Through 2001 (System Dates for Illustration Only)

Even though undersea cables are being deployed at a rate that is historically unparalleled, transmission demand continues to outpace cable availability. One of the most significant driving forces is the traffic growth resulting from internet services.

Figure 3 illustrates the projected 200 percent per year growth of internet traffic on transpacific capacity. The stepped lines represent the expected transpacific accumulated capacity that will be available over time. This includes EDFA single channel networks, their upgraded capacity using WDM, the current generation of WDM networks and the next generation of undersea networks. As seen in Figure 3, if capacity planning is sized relative to internet host growth (200%), then the current plans for installing undersea cables matches well with planned capacity. Given the demand for undersea cables, it is more likely that telecommunication carriers believe internet traffic will be even greater than 200%/yr. At this rate, the ability to provide undersea cable capacity will not keep pace with traffic growth. By the year 2003, demand will exceed availability.

This next generation of undersea fiberoptic networks will include technology that will expand the traffic carrying capacity on each fiber pair to 160 Gb/s. With up to six fiber pairs in the undersea cable the cross-sectional cable capacities will reach 960 Gb/s. The next generation technologies differ from the current technologies in a number of ways, these are:

a. Undersea repeater technology that support up to 6 fiber pairs using EDFAs being pumped with 980 nm lasers. The 980 nm pumps allow EDFAs to be reliably built with higher output power, lower noise figure and wider optical bandwidth than those using 1480 nm pumps.

b. Optical bandwidths around 14 nm wide are maintained over transoceanic distances by periodically deploying gain equalization flattening along the fiber path. These systems support 16 channels per fiber pair, each channel operating at 10 Gb/s over distances of 10,000 km.

c. Large Mode Fiber (LMF) embedded in undersea cable. The LMF minimizes the impairments that fiber nonlinearites has on 10 Gb/s channel by increasing the effective area of the fiber. As before, the mix of fibers is also used to create a dispersion map.

d. High performance terminal equipment specifically designed for transmitting and receiving DWDM carrier channels 10 Gb/s for undersea transmission. The functions embedded in the terminal equipment are similar to those used in the 2.5 Gb/s equipment.

The next generation of networks will continue the trend of using ring topologies and relying on embedded SDH standard protocols for controlling fast restoration. Some networks will also offer ATM capabilities at the customer interface of their networks to offer bandwidth on demand independent of the type of service carried.

Bandwidth on demand does not come without a very sophisticated embedded NMS hierarchy which is just as important a technology as that set by the transport layer of the network. Like current generation systems, tomorrow's networks will include NOCs supporting advanced NMS features. Configuration of services will move to the Network Management Layer (NML). NOCs will in all likelihood also support a Services/Business Management Layer (SML) and a complex of undersea networks. A conceptual view of this hierarchy is shown in Figure 4.

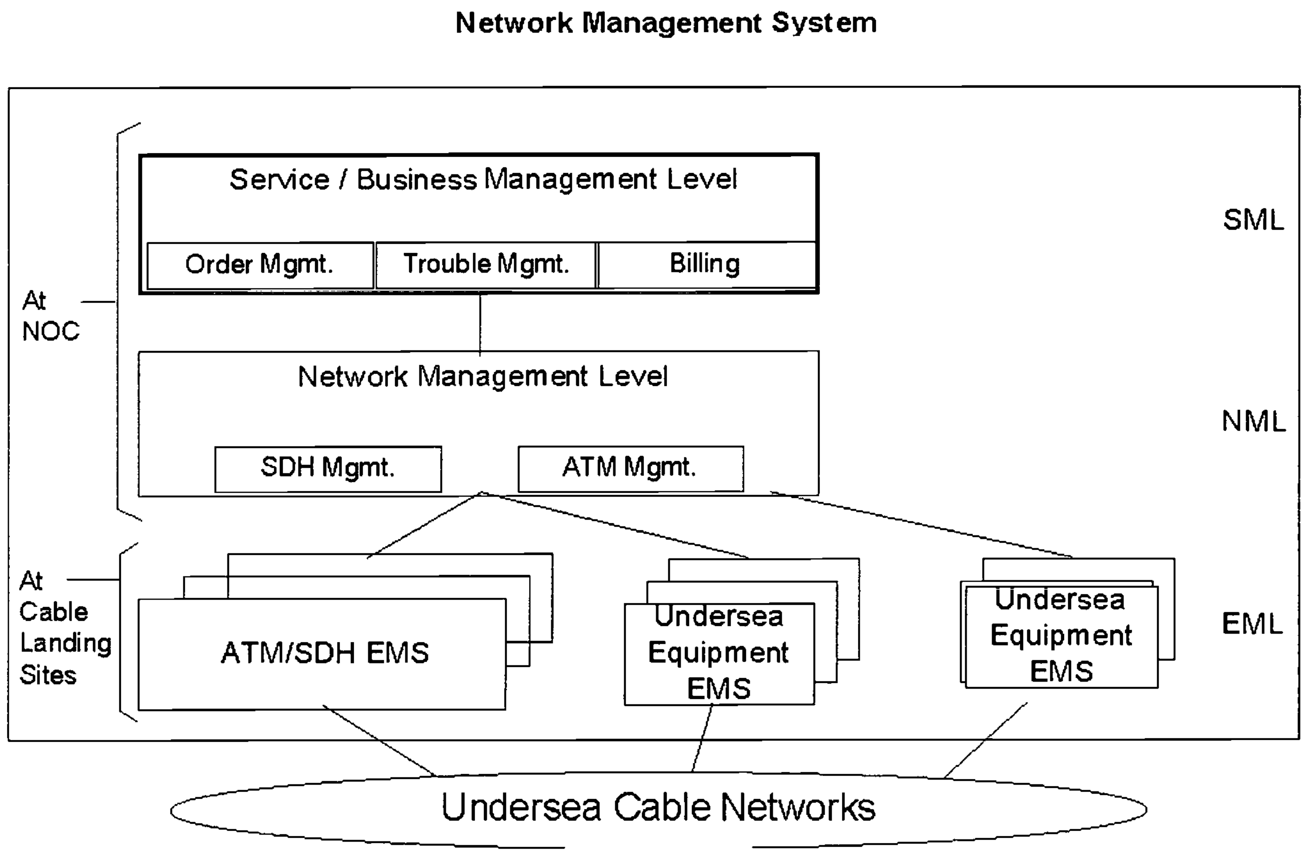


Figure 6: NMS Overview That Will Support Future Undersea Cable Networks

At the highest level, a SML will be responsible for customer care related services such as billing, trouble management and provide the interface for ordering new services. The NML will have a total and integrated view of all management features necessary to operate the complex of systems. These will include: configuration, security, fault, performance features. It will be necessary for the NML to interface to the element management layer (EML). In most cases, this will include element managers from a number of different equipment vendors, each managing a different piece of the network(s). Management of the wet-plant portion of the undersea network will be needed as well as management of the transport layer. As mentioned previously both ATM and SDH managed features will be a necessity.

Even as current generation networks are still being installed, next generation networks having at least a subset of features described above, are being planned for service in 2000 and 2001 and some are already under contract. Sample networks include:

- PC-1 (Pacific Crossing-1): This transpacific ring network will carry advanced services between Japan and the US. The network includes approximately 25,000 km of undersea cable
- Japan - US: A transpacific ring network providing services between the US mainland, Hawaii and Japan. This system includes approximately 27,000 km of undersea cable

The next generation systems will terminate up to 640 Gb/s of cross-sectional traffic capacity for each cable that lands at a given site. This creates space and power issues for existing cable stations where space is already at a premium. The current traditional inland interface between the cable network and the terrestrial network has been at the STM-1 level. For any of the new systems at least two new cables will terminate in a station and if all the traffic is terminated, the capacity is well in excess of a 1 Tb/s. Although the physical equipment is being consolidated into smaller bay arrangements, this reduction in size will not keep pace with the capacity growth trends in the undersea cable. There are several consequences:

a. Interfaces to the inland terrestrial network will move first to STM-16 then to STM-64. This may require new infrastructure development and new fiber in the ground for inland carriers globally

b. New cable stations will be needed and sized more appropriately to handle the large termination capacities. Existing stations will retire existing cables more readily than in the past to make space for the more cost effective new technology systems

c. Given these trends, cable station owners may wish to extend the termination of the cable system inland, to the gateway switch

V. FUTURE SYSTEMS

Undersea technologies are focused on achieving capacities that will on the average double each year; that trend is expected to continue. As shown in Figure 1, laboratory experiments in 1998 have already shown that 320 Gb/s on a single fiber over transoceanic distances are achievable. Based on the trends shown, 640 Gb/s on a single fiber should be reported this year (1999). Since the market is driving STM-64 channel based DWDM systems, cables that support 64 channels at 10 Gb/s per channel on each fiber pair will be the likely candidate technologies for installed systems in the 2001 timeframe. These systems will require new technology enablers in several key areas including:

a. Broader and flatter amplifier designs which are capable of meeting the stringent requirements of undersea applications

b. Dispersion slope compensation to counter the dispersion slope in the transmission fiber. For 10 Gb/s carrier channels this causes severe pulse distortion in the carrier channels when combined with the Kerr effect nonlinearity in the transmission fiber

c. NRZ signaling formats which are altered by the use of synchronous amplitude, phase and polarization modulation to improve system performance

d. Improved narrow band filters for use in terminal and/or branching unit designs

VI. CONCLUSIONS

In this paper we have reviewed the current state of undersea fiberoptic networks. Included is a review of the technology enablers that are being used in these systems. The demand for these networks is at an all time high and we have discussed the capacity and network trends for current generation, next generation and future generation undersea fiberoptic networks. The trends are clear: increased capacity, a growing need for integrated network management systems, enhanced services and fast restoration. Finally, we have shown that one of the most significant driving forces is the need to meet the capacity demands driven by internet use and that even with the rapid proliferation of undersea cable systems, demand may exceed availability.

Return to Top View Full-screen

Meeting the Challenge - the Installation, Repair and Maintenance of Undersea Fibre Optic Systems

Malcolm Johnston

Cable & Wireless Marine, United Kingdom

ABSTRACT

Malcolm Johnston, *Cable & Wireless Global Marine*, looks at the challenges of laying submarine cable on the ocean floor, and the creative ways in which this industry is meeting the needs of its customers and end-users. Recent trends in telecommunications resulting from deregulation and increased competition in domestic and international markets have driven improvements in quality and reduced unit cost in the industry. The submarine cable industry has responded to these market changes with innovative solutions, exploiting advances in technology and network design for the latest systems and projects.

View Full Text

Meeting the Challenge - the Installation, Repair and Maintenance of Undersea Fibre Optic Systems

I. INTRODUCTION

Somebody once likened the problems involved in laying communication cables on the sea bed to those of a helicopter trying to string a line along the best possible route through the Himalayas, while flying in fog.

Even if you dismiss such a comparison as exaggeration, plotting a secure route under the sea is no easy task. Although some areas of the sea floor have been surveyed and mapped in detail, more is known about the surface of the moon than the deep ocean bed. The ocean covers approximately 70 per cent of the planet's surface with over 80 per cent of it being more than 3,000 metres deep. Aside from innumerable man-made hazards in shallower waters, deep ocean terrain has a surprising share of 'Grand Canyons' and Himalayan-scale mountain ranges, not to mention hundreds of volcanoes and regions where devastating earthquakes are common. If cables are to survive, all of these features need to be avoided. This all goes to make marine route engineering and cable installation a challenging and technical business, highly reliant on accurate surveying, navigation and seamanship.

II. TELECOMS INDUSTRY -- TODAY AND FUTURE

In today's fast moving and competitive telecoms market cable operators require virtually 100 per cent network availability. Many operators are now paying more attention to both the initial planning stages of a project and the lifetime implications of a system in a bid to reduce the likelihood of future breaks and subsequent expensive 'downtime'.

With cables currently carrying as many as 1.5 million simultaneous phone calls, the financial risk attached to their resilience has increased. This surge in capacity is set to increase still further in the next three years.

As the telecoms market becomes more competitive, the requirement for sound relationships has never been greater. To meet the changing needs of its customers the industry needs to update its working practises and form stronger alliances. To improve the service we are able to offer our customers, Cable & Wireless Global Marine has strengthened its account management approach and formed alliances with several key players within the industry. The closer a supplier is to a customer the better we can anticipate your needs.

III. ADVANCES IN MARINE TECHNOLOGY BY CABLE & WIRELESS GLOBAL MARINE

Deregulation and increased competition, in both the domestic and international markets, has brought about radical changes in the telecoms market over the past few years. For example, deregulation has enabled KDD of Japan to invest in an unique domestic solution, the Japan Information Highway (JIH), a 10,600 km submarine cable network which will operate as the backbone for KDD's domestic communications infrastructure.

The submarine cable industry has responded to the changing market place with innovative solutions and made significant advances in technology and network design to meet today's demands for reliability. The high level of availability demanded by today's end user requires network resilience, and protecting cables from external damage is a major factor in achieving this. We are acutely aware of the huge potential revenue losses and large costs of re-routing traffic that can result from a fault in a high capacity system.

Expert route engineering has always been critical to the integrity of the system, but now even more so due to changes in fishing and shipping activities. For example, trawlers are being forced to go to deeper waters in search of viable sources of fish as the world's fishing stocks become depleted. On a recent project our remote cameras detected trawl scars at 1,300m. As a result, we are being requested to take cable burial to even greater water depths. Ships are also generally getting larger, with heavier anchors that can easily dredge up cables, which means we are now having to protect cables in some shallow water areas by burying cable to three metres or more, compared to the 0.6 metres required to protect against most fishing gear. In the North Sea virtually all cables are now buried along their full length due to the intensive shipping and fishing activities in the area.

Burial becomes even more significant as the industry moves to slimmer, lighter cable designs, in search of cost benefits. At the planning stage, a cable route will be selected by using geographic and oceanographic information. The route selected will offer the best compromise between cable security and cost, a major part of which is the installation. Cable & Wireless Global Marine's recent alliance with C&C Technologies and the EGS Group will provide the industry with a complete turnkey solution to cable planning. Where possible routes will avoid hazardous areas, surface and deep sea currents, seismic activity, military activity, offshore exploration and fishing, particularly trawling. Where hazards cannot be avoided, the cable is protected by armouring and/or burial. If burial is required then an assessment of the soil strength of the sea bed must be made, in order to specify the burial method to be used.

Burial assessment and cable route engineering are paramount to the security of a submarine cable system. Given the importance attached to this initial stage of the project, these highly skilled procedures are best carried out by organisations with experience in the laying and maintenance of submarine systems.

The Cable Burial Assessment Survey System (C-BASS™) is able to obtain far more detailed information of the soil strength of the first two metres of the sea bed than has previously been possible, and at a much lower cost than the traditional method of towing a test plough. C-BASS™ incorporates a sea bed towed sledge with an array of sophisticated equipment. It uses burial assessment software, which is based on extensive records of ploughing and post lay burial Remotely Operated Vehicle (ROV) operations, to predict burial equipment behaviour in the widest range of sea bed conditions.

To meet the need for deeper burial in soft soil, technology such as Vari-Plough has developed. This new plough is capable of burying to almost three metres in very soft soils without reducing shallow burial depth performance in harder soils. The geometry required to achieve this wide range of burial depths can be altered without recovery of the plough to the ship. Furthermore, the Vari-Plough is no larger, and only about one tonne heavier, than a standard one metre plough, enabling it to be deployed from an existing platform.

For well over a hundred years, the question of how best to lay a cable onto the surface of the sea bed has been pondered and debated. For the marine installer, the cable and route have already been determined and the only variables under his control are vessel speed, vessel path and cable payout rate. The objective is clear - to ensure that the cable system is as resilient to faults as possible - therefore it needs to be laid evenly so as to conform to changes in sea bed elevation as closely as possible, without loops, excess tension or suspensions.

A new PC-based programme called the Cable Lay Planner (CLP) has been developed to assist the cable installation process. Once the input data has been entered, the CLP permits the full planning of a major transoceanic lay within a working day. Because it is a standardised process, results are repeatable and auditable. The CLP has been developed to fit in with enhancements in digital reporting to make the transfer of data even quicker; for instance the data can be fed from the CLP into the vessel cable lay management system. In fact, the most time consuming aspect is inputting data in the first place.

Technology such as CASCADE™ is fast becoming an industry standard. The **C**omputer **A**ssisted **S**lack **C**ontrol **A**nd cable **DE**ployment System assists the route planning and laying operation in deeper waters beyond the need for cable burial. Capable of predicting touch-down conditions in real-time, CASCADE™ reports on the exact placement of the cable on the sea bed, including the distribution of slack.

IV. FIBRE OPTIC TECHNOLOGY AND SYSTEM ARCHITECTURE

Fibre optic technology itself continues to develop rapidly. Five years ago, optical regenerators were being used to boost weakening signals; today these have been replaced by optical amplifiers. TAT 12/13 saw the first trans-oceanic use of erbium doped optical amplifiers, which boost the light signal at intervals on its journey down the cable, thus removing the need for electro-optic regeneration on the sea bed. Within the next five years, we may see the use of solitons to give a more stable pulse and allow greater spaces between repeaters.

Traditionally fibre optic cables were extremely costly to repair - with cable owners being forced to return to a specific manufacturer to obtain replacement or extra cable. The introduction of the Universal Joint - a system for joining cables from any qualified manufacturer - has provided the opportunity for cable owners to seek competitive tenders for both new and replacement cable systems.

Close alliances between maintenance authorities and suppliers are helping to improve the process of repairs, including jointing, reducing timescales and improving the quality and reliability of joints on the sea bed. Cable owners able to demonstrate a clear maintenance strategy will have a competitive edge when seeking investors and customers who demand high reliability and responsive maintenance to ensure that systems operate at optimum levels and cost.

A recognised world leader in the development of the Universal Joint, Cable & Wireless Global Marine continues to initiate enhancements designed to meet the growing demands of the market, addressing issues such as hydrogen ingress.

In today's telecoms market, customer demand for reliability requires a continuous drive for increased quality and performance. To meet this, the architecture of fibre optic systems has moved world-wide from relatively simple point-to-point systems from one country to another, to the ring structures now being installed. Ring switching allows traffic to be routed in the opposite direction around the ring in the event of a fault. As well as offering route diversity, this architecture gives essential improvements in cable operation, by allowing marine repairs to be carried out without loss of traffic. TAT 12/13 represented a quantum leap in capacity when it was laid across the Atlantic. It was also the first undersea cable with built in resilience due to its ring structure.

Notably, Gemini was the first cable system designed to provide 100 per cent restoration back-up. Installed in 1997/98 between the UK and USA, it comprises two completely separate cables, known as Gemini North and Gemini South. These have been laid approximately 740 km apart and have separate landing points. This technique, providing cable-on-cable restoration capability, is being used where high volumes of traffic demand total diversity. Gemini behaves like a normal self-healing SDH (synchronous digital hierarchy) loop, operating 60 Gbit/s.

Networks such as FLAG and APCN use the SDH protocol and achieve a degree of restoration capability. APCN, a regional network that also acts as a feeder network to FLAG and TPC 5, has nine landing points connected by submarine cables and branching units. Increasingly complex multi-branched systems can retain a growing proportion of traffic in the event of a fault and offer an opportunity to tailor the system configuration to a customer's specific needs. On APCN the main trunk is designed to be self-healing. SEA-ME-WE 3 has over 30 landing points and more than 20 branching units. The use of ring topologies and branching units has introduced some flexibility in when and how repairs are carried out.

However, as systems become larger and technology facilitates even greater increases in capacity, customer applications drive the need for higher reliability. This demand highlights the need for cable-on-cable restoration that is supported by a responsive and effective maintenance capability.

With the biggest global reach in the marine cable communications arena, Cable & Wireless Global Marine is well placed to provide the full range of marine services, from desk studies, cable services and installation to maintenance and Universal Joints. We have a fleet of 12 ships, as well as specially chartered vessels, and an extensive range of submersible equipment working throughout the world laying new cables and maintaining existing networks. The company provides maintenance services to seven agreements world-wide, tailoring its services to meet customers' needs. However, even we are unable to mobilise a ship instantaneously and the system itself must now have some built in resilience.

For the future, systems with cable-on-cable restoration are on the horizon, and the new millennium will see mesh networks, an inter-link of multiple point-to-point systems, being installed to offer even greater diversity and routing opportunities.

V. FLEXIBLE APPROACH

Cable & Wireless Global Marine has adopted a flexible approach to every part of its business, since the industry is no longer dominated by the major PTTs but has many new entrants who are looking for different kinds of alliances and relationships. Countries with improving economies are investing in cable systems to improve their infrastructures and there is more private finance entering the market. Examples of the privately funded cable systems include PTAT, FLAG, Gemini, AC1, PC1, PAC1, MAC1 and Oxygen.

There is now a dynamic, fast-changing market with many players seeking a competitive edge. Differentiating themselves in the market place demands sophisticated solutions, which continually increase system reliability and drive down costs.

The same factors that are driving the telecoms industry as a whole are also driving the submarine cable market. The pressure is on to increase the capacity available in the market place and system suppliers have responded to this with technology, which offers greater and greater capacity. KMI estimate that to meet this unprecedented demand, up to 658,375 km of submarine cable will need to be deployed by the year 2003, and there is the potential risk of demand exceeding manufacturing and installation resources world-wide. In order to ensure the availability of this capacity, resilient networks are now being built and the submarine cable industry is developing more sophisticated techniques to plan and lay systems, in order to further improve the security and ultimately, the resilience of networks for the customer. I am proud to say that Cable & Wireless Global Marine is taking a leading role in this area.

Return to Top View Full-screen

Biography

Eshwar Pittampalli

Lucent Technologies
67 Whippany Road
Whippany, NJ 07891

View Abstract

Third Generation Partnership Project 2

Eshwar Pittampalli

Lucent Technologies
67 Whippany Road
Whippany, NJ 07891

Abstract:

Not available

View Full Text

Third Generation Partnership Project 2

The Third Generation (3G) Partnership Project 2 is an organization with a membership of a small group of standard development organizations (SDO) that develop technical specifications for the wireless communication products in the United States and around the world. There are several standards institutes around the world developing voluntary industry standards for a wide variety of telecommunications products. These standards provide a means to compare various vendor products on a common platform in terms of supported features and/or performance attributes. The standards compliance of a product facilitates a potential buyer with an option to select a vendor or mix and match components or sub-systems for a targeted system from several vendors for optimal performance, price and delivery terms.

Mission of Third Generation Partnership Project 2

Standards organizations, such as ARIB, TIA, TTC, and TTA, and other related bodies have agreed to cooperate for the production of a complete set of globally applicable Technical Specifications for a 3rd Generation Mobile System based on the evolved ANSI-41 core networks (CN) and the radio access technologies supported by the 3rd Generation Partnership Project Partners. The project is entitled "Third Generation Partnership Project 2" hereafter referred to by the acronym "3GPP2."

3GPP2 has been established for the preparation and maintenance of the specifications. It is a non-profit making organization and is not a legal entity. This memorandum provides a current snapshot of overview, definition, scope and objectives, characteristics, and partnership/ membership details along with responsibilities of 3GPP2. It also provides an insight into the 3GPP2 working procedures. Additionally, this paper also provides an overview of internal structure and external interfaces along with the technical specifications that are to be covered by the partnership project. It concludes with the policy on Intellectual Property Rights (IPRs) and the target schedule for the creation of 3GPP2.

Definition of the Third Generation Partnership Project 2

3GPP2 will provide globally applicable Technical Specifications for a 3rd Generation Mobile System based on the evolved ANSI-41 core networks, and the relevant Radio Access Network (RAN) technologies to be transposed by relevant standardization bodies into appropriate deliverables such as standards.

Steering Committee (SC)

The Steering Committee is responsible for setting the objectives for the Technical Specification Groups (TSGs), resolving high level organizational and leadership issues as well as the coordination of the project. The Steering Committee is also responsible for the specification development in the TSGs. In support of this role, the Steering Committee will be responsible for resolving any procedural issues as well as ensuring that the work is well coordinated among the TSGs. It may create new Technical Specification Groups when need is recognized and agreed by membership, as well as the dissolution of a TSG when it is recognized and agreed that it is no longer necessary. It is envisioned that the Chairs of each of the TSGs will routinely report on the progress and activities of their groups at the Steering Committee meetings.

The Steering Committee consists of the representative members of the 3GPP2. There are two categories of participants in the steering committee, officers and the other representatives. Officer positions are a Chair and several Vice Chairs representing the Organizational Partners, e.g. Japan and Korea. The Chair and Vice Chair positions will be filled by appointment determined by the Organizational Partners of the region/nation. Each position will have a two-year term. The Chair position will rotate between the regions/nations every two years. The Steering Committee will decide the order of rotation of the Chair position between the regions/nations.

The Steering Committee is chartered to set the objectives, including schedules, for the Technical Specification Groups. In general, all activities that are needed to guide the TSGs are in the domain of the steering committee. The Steering Committee ensures that the working procedures are followed in the 3GPP2 and it has the authority to approve the Technical Specifications created by the TSGs. Approval of technical documents by the Steering Committee is based not only on the technical content of the document, but also on conformance to the agreed process and goals of the 3GPP2.

Technical specification Group (TSG)

Technical Specification Group is an entity for technical specification development such as Air Interface, Network Evolution, or A-Interface, etc. The number of Technical Specification Groups (TSGs) and their terms of reference will be decided at the first Steering Committee meeting.

Each Technical Specification Group may organize its work structure at the discretion of the members of the TSG. The structure may include Working Groups and Sub-working Groups as needed. An election is held by the participants of the TSG to select a candidate for the Chair and a candidate for the Vice Chair positions. The Chair and Vice Chairs of the TSGs will be confirmed by consensus of the Chair and Vice Chairs of the Steering Committee. They will serve a two year term with a two term limit. The Chair and Vice Chair shall not be from the same Organizational Partner.

A TSG can establish working groups when there is a consensus opinion within the TSG that a working group is needed. The TSG Chair will appoint the Working Group (WG) Chair and Vice Chair with consensus approval of the TSG members. Like the TSG Chair and Vice Chair positions, these WG positions will also have two year term limits with two term limits. The Chair and Vice Chair for a WG shall not be from the same Organizational Partner.

Working Groups are established by the TSG to perform a subset of the technical work of the TSG. Membership of the working group (WG) is open to all members of the TSG. Sub-Working Group (SWG)s are established by a working group to perform a subset of the technical work of the working group. Membership is open to all working group or TSG members.

Technical Specifications

The Technical Specifications are developed in view of global roaming and circulation of terminals. The results of the 3GPP2 work will form the basis of member contributions to the ITU in accordance with the existing procedures. 3GPP2 will take account of emerging ITU recommendations on the inter-working between the IMT-2000 family members. In the framework of agreed relationships, 3GPP2 will elaborate Technical Specifications that will form the basis of standards, or parts of standards. Variations imposed by national/regional regulatory requirements may be identified and included in the Technical Specifications at the discretion of the Technical Specification Groups.

Partnership and Membership

Partnership and Membership of 3GPP2 is open to all standards organizations irrespective of the geographical location. Membership consists of both Partners and Individual Members

The Partners can be sub-divided into two categories:

- Organizational Partner
- Market Representation Partner

Organizational Partner

An Organizational Partner is an open standards organization with a national, regional or other officially recognized status (in their country or region) that has the capability and authority to define, publish and set standards nationally or regionally and has signed the Partnership Project Agreement (PPA). The PPA is a concise legal document signed by the participating partners.

The Organizational Partners of 3GPP2 will have the joint ownership (including the copyright) of the Technical Specifications and the right to change the 3GPP2 Partnership Project Agreement (PPA). These partners will also have the right to dissolve the 3G Partnership Project 2, the right to admit new Organization Partners to 3GPP2, and authority to approve the Organization Partner funding requirements.

Market Representation Partner

Market Representation Partner is an organization invited to participate by the Organizational Partners to offer market advice to the 3GPP2 and to bring into 3GPP2 a consensus view of market requirements (e.g. services, features and functionality) falling within the 3GPP2 scope. However, a Market Representation Partner does not have the capability and authority to define, publish and set standards nationally or regionally.

Individual Member

Individual Member is an Organizational Partner and the membership is committed to contribute technically or otherwise to one or more of the TSGs within the 3GPP2 scope. All entities registered as members of an Organizational Partner and eligible for participation in the technical work of the partner, can become Individual Members of 3GPP2. An Individual Member residing in a country/region without an Organizational Partner can apply for membership to an Organizational Partner.

The Technical Specifications for the 3rd generation mobile system and its capabilities will be developed in a phased approach. 3GPP2 will elaborate, approve and maintain the necessary set of Technical Specifications for a 3rd generation mobile system including:

- cdma2000 Radio Access Network (RAN)
- 3G Core Network evolved from ANSI-41 with Wireless Intelligent Network (WIN)
- A-Interface
- Wireless Packet Data Networking
- Interface of WP-CDMA /User Terrestrial Radio Access Network (UTRAN) to evolved ANSI-41 core network, and
- Services and Systems.

Work areas to be covered by the cdma2000 TSG are:

- Radio Interface

- Layer 1 Physical
- Layer 2 (Medium Access Control / Link Access Control)
- Layer 3 Signaling

- Mobile Station / Base Station Radio Performance Specifications
- Radio Link Protocol
- Enhanced Privacy, Authentication, and Encryption
- Digital Speech Coders

Work areas to be covered by the ANSI-41/WIN are:

- Evolution of Core Network for Inter-System operation within the ANSI-41 Family,
- User Identity Module (UIM) support (Detachable and Integrated),
- Enhancement of Information Flows,
- Security Aspects (implementation and usage),
- Numbering, Routing, and Supplemental Services for International Roamers,
- Virtual Home Environment (VHE).

Work areas to be covered by the A-Interface are:

- Radio Network to Core Network Interface,
- Physical Data Link, Signaling,
- Support for Access Network Mobility (Hard handoff and soft handoff support),
- High Speed data Support,
- Support for Multiple Air Interfaces

Work areas to be covered by the Packet Data Networking are:

- Wireless IP Services Based on IETF Protocols,
- Secure Private Network Access,
- Packet Data Accounting,
- Multimedia Support,
- Quality of Service (QoS) Support
- CN-CN Network to Network Interface (NNI) for Packet data

Work areas to be covered by the WP-CDMA/UTRAN are:

- Interoperability with ANSI-41/WIN Core Network
- Interface Specification of UTRAN to Evolved ANSI-41 Core Network

Work areas to be covered by the Services and System are:

- Generate stage 1 descriptions and liaison with other TSGs and SC under the assumption that service and system requirements to support 3G market needs are based on regional and international considerations.

Intellectual Property Rights (IPR)

The Individual Members of 3GPP2 are bound by the IPR policies of their respective Organizational Partners. The Individual Members are encouraged to declare at the earliest opportunity, any IPRs which they may have and believe to be essential, or potentially essential, to any work ongoing within the 3GPP2. After comparing their respective IPR policies, ARIB, TIA, TTA and TTC have agreed that their IPR policies share common priciples and have agreed on the following additional principles to maximize the success of 3GPP2:

- to encourage their respective members' declaration of willingness to grant licenses on fair, reasonanble terms and conditions on a non-discriminatory basis and consistent with the respective Organizational Partners' IPR policies,
- to encourage their respective members' who may have IPR which they believe to be essential, and are unwilling to license such IPR, that early indication of such unwillingness be provided to their respective Organizational partners, and
- to understand that "essential IPRs" mean essential IPRs relative to any or all parts of the content of the 3GPP2 technical specifications.

Target Schedule

Based on the current planning, the approval of the 3GPP2 project documentation, creation of Steering Committee and Technical Specification Groups along with appointment of convenors and proposal for work program is scheduled to take place during the week of January 25, 1999.

Return to Top   View Full-screen

Multimedia for the Mass Market ADSL Technology ... Maximizing the Existing Infrastructure

Jeff Waldhuter
Director Technology & Engineering
Bell Atlantic

Abstract:

Not available

View Full-text

Multimedia for the Mass Market

ADSL Technology

... Maximizing the Existing Infrastructure

Need for Speed! (VG#2&3) There is a tremendous market pull for high speed access for the mass market. Applications range from telecommuting, surfing the net, entertainment and distance learning to name a few. "Multimedia for the Mass Market" is economical by leveraging ADSL technology to maximize the existing copper infrastructure.

Imagine having the same high speed access at home as in your office, surfing the net at speeds 10 to 100 times faster than dialup modems; imagine accessing entertainment on demand; imagine attending any class in any university around the world. This is not fiction, no new technology needs to be invented to create this network for the 21st century. Combining ADSL with recent technology advances in ATM, SONET and Router technologies a network has already been assembled by Bell Atlantic to provide multimedia for the mass market.

What are the network requirements for high speed access (VG#4)? First this network operates at higher bit rates and at higher usage and longer hold times. Matter of fact I want to introduce the concept of "always on", never turn your computer off, on-line 24 hours, 7 days a week, 365 days a year. Plus, all traffic is data oriented. Customers will also demand no delays and a secure connection. To effectively meet these requirements for the mass market will take a different kind of network than we know today. The Public Switched Telephone Network (PSTN) is a circuit switched architecture designed 100 years ago to meet the demands of voice traffic. These requirements are more efficiently implemented with a packet oriented architecture. High speed access will require an overlay to PSTN as we know it today.

It is worth noting that the business community for the last 25 years has had two networks for communications, a circuit switched network for voice and a LAN network for data. The challenge to the industry is to build this second network for the mass market. ADSL is the missing link to provide low cost high speed access. By integrating ADSL with ATM, SONET and fast packet Router technologies an overlay network can be assembled quickly and the techno-economics make it affordable to all.

Evolution verse Revolution (VG#5)? ADSL is an evolutionary approach to creating high speed access. ADSL technology builds off the existing copper infrastructure that is already in place. Our industry has made multiple attempts in the past using a revolutionary approach, such as fiber to the curb (FTTC) and hybrid fiber coax (HFC). These are good technologies but the market place cannot wait until the existing infrastructure is replaced, estimated to take 20 years and cost $200 billion dollars for the United States. Another fact that supports an evolutionary approach is deregulation of the US telecommunications industry with the passage of the Telecommunications Act of 1996. There is no longer any guarantee if a service provider deploys a new infrastructure that they will own the customer. The new economic model is "just in time capital deployment", that is a network architecture that is very low cost per home passed and with a majority of the capital investment spent per home served. ADSL is a just in time capital type technology, an investment is made only when the customer requests high speed access on there existing phone line.

Assuming an evolutionary approach to high speed access, what is the reality (VG#6)? The good news is, copper terminates in every home and office in the USA. There is a total of 180 million access lines providing serve to 100 million households and 25 million businesses today. The backbone of the PSTN is already fiberized, capable of supporting high speed traffic. Note, ADSL requires the placement of technology at both ends of the subscriber loop, CPE in the home as well as an ADSL line card in the telephone central office (CO). Again the good news is that the existing COs (estimated at approximately 15K offices) have the necessary additional real estate to house the ADSL equipment, as well as power it and provide environmentals .

$200 billion (VG#7,8&9) represented the imbedded investment of the copper network, 180 million access lines in the USA today. There is a misconception that the copper network is the bottleneck to the Information Super Highway. It is a lie! Telephony uses less than 1% of the transport capability of the copper network. The other 99% of the carrying capacity of the copper loop has been idle for the last 100 years. Actually the copper loop to every home and office has the ability to carry 250 simultaneous voice conversations. I rather have one voice conversation and high speed data. In technical terms, voice uses 4 kHz of spectrum, the lower 4 kHz of the copper spectrum while the copper loop has the ability to support approximately 1 MHz of bandwidth. So ADSL technology mines the other 99% of the copper bandwidth.

Well if the copper loop is not the bottleneck in the PSTN where has it been all this time (VG#10)? To answer this question it is worth taking a moment to go back in history, to the Telecommunications Act in 1934 in the USA. In exchange for the Bell System to operate as a sole monopoly for telephone service, MaBell agreed to provide Universal Service, telephone service to all at an affordable rate. Now in 1934 you need to remember that fiber technology did not exist and the only medium to interconnect central offices was copper or coax. Matter of fact the most expense part of completing a telephone call between two locations (say two cities) was the interoffice facilities Hence, to minimize costs, it was determined that the minimum amount of spectrum necessary for audible speech was 4 kHz and the voice network was limited to 4kHz to make telephone service affordable to all. Then along came digital switching technology converting 4 kHz analog to 64 kbits digital voice, in a time slot design. This is the information super highway bottleneck not the copper. The good news is that we have fiber today for interoffice transport and ATM switch technology to overlay to support a packet based network design. ADSL mines the other 99% of transport capacity on the existing copper that has always been there, ever since the network was built.

What is ADSL's secret (VG#11&12)? There is no secret! ADSL technology builds off all the good work of analog modem technology for the last 25 years. Now when I started in this business 22 years ago as a researcher at Bell Laboratories I was given a 300 baud modem, today I use a 56K baud modem. Guess what the PSTN did not provide the modem manufactures any more spectrum to operate over, it is still only 4 kHz. The dramatic increase in speed is due mainly to the price performance of semiconductor technology. Utilizing very fast digital signal processing (DSP) technology, the industry has been able to process multiple bits per Hz. Well ADSL is like a analog modem processing multiple bits per Hz , but rather than maximizing 4 kHz of spectrum, ADSL maximizes 100 % of the copper bandwidth (approximately 1 MHz) to delivery up to 7.0 Mbps downstream.

What are some of the other key features of ADSL technology (VG#13)? First the transmission is asymmetrical, higher speed downstream (up to 7.0 Mbps), to rapidly paint the computer screen. The upstream is slower because in most applications an individual is just typing on a keyboard, so why waste the bandwidth. Next, the technology is rate adaptive, the ADSL modem automatically negotiates the highest transmission rate depending on the performance of the individual loop. This technique is similar to dial-up modem technology. ADSL is a data over voice technology, it operates on the customer's primary line, no second line is required. Someone can be on the phone in the kitchen and someone can be surfing the net in the den. The consumer retains all their existing voice services. The system will always fail safe to POTS. In other words if you loose commercial power your computer stops, your ADSL goes off, but your telephony service continues to operate.

Are there ADSL standards that have been adopted (VG#14)? There are three major forms of ADSL that are either standards based or industry defacto. DMT-Heavy, T1E1 4.3 issue 2 is the official standard in the USA. A long time competitor is CAP technology, it was used in many early USA trials. Matter of fact Bell Atlantic's initial commercial deployment is CAP based. Most recently a new World standard for ADSL was adopted in the ITU. G.Lite as it is called is a subset of DMT-Heavy technology. The ITU in its October '98 meeting declared the G.Lite standard "stable", the final vote is to take place at the June '99 meeting.

How is a customer hooked up to ADSL in the central office (CO) (VG#16,17&18)? All telephone customer circuits that enter the CO are first terminated on the vertical side of the main distribution frame (MDF). Then via a short jumper are connected to a voice line card terminated on the horizontal side of the MDF. The installation of ADSL is a three step process, first, removal of the original voice jumper between vertical and horizontal MDF. Second, the addition of a new jumper from vertical MDF to ADSL line card presence on horizontal MFD and thirdly, the addition a second new jumper to route the filtered voice traffic from ADSL line card to the existing voice line card on the PSTN local switch (this connection is made on the horizontal side of the MDF).

What is the backbone infrastructure that is required to support multimedia traffic (VG#19)? The main backbone component is cell based ATM. ATM has been in search of a low cost access technology. ADSL and ATM are a perfect marriage. ADSL is the line card technology for ATM. With the addition of a Router, equal access is provided to ISPs IXCs and Corporate Networks. The ADSL line card in the CO first filters and hands off the telephony traffic to the existing voice line card on the PSTN local circuit switch. The data traffic is then connected to the DSLAM (digital subscriber line access multiplexer) where many data circuits are merged into a single OC3 SONET pipe (155 Mbps). The OC3 pipe is connected to the ATM switch, multiplexing multiple OC3 pipes. The ATM switch is then connected to the Router to distribute traffic to different ISPs or Corp. facilities.

What is Bell Atlantic's ADSL Service (VG#20&21)? BA filed and received FCC Tariff approval on Sept. '98 and began commercial service offering Oct.'98 in four major markets, Pittsburgh, Philadelphia, Washington Metro area and Northern NJ. BA is using DSC Litespan CO based equipment with CAP technology and Westell CAP CPE. BA will enter the New York, Boston and other markets with DMT technology starting the first quarter of '99.

The basic offering is Personal Infospeed "always on" 640Kbps down 90Kbps up for $59.95. Professional Infospeed "always on" up to 1.6 Mbps down and 90K bps up for $109.95. Lastly Power Infospeed "always on" up to 7.1 Mbps down 680 kbps up for $189.95. Visit our website for more information, www.bellatlantic.com/infospeed.

This paper just touches the surface of ADSL technology. I personally believe that ADSL technology will explode in '99 and will become as popular as touch-tone in the coming years!

Return to Top   View Full-screen   View Presentation

Perspectives on the Communication Network for the ITS Services

Yeongkwun Kim and Soong-Bok Lee

Korea Telecom, Republic of Korea

ABSTRACT

The goal of ITS services is to provide users, especially drivers on the roads with traffic related information reliably, accurately and in a timely manner, resulting in improved mobility, safety, air quality, and productivity. To deal with this goal, ITS is comprised of a number of technologies such as information processing, communications (wireline and/or wireless), control and electronics.

In this paper, we would like propose a new architectural model, two-level architecture, that is a kind of mixture type of centralized and distributed system to provide users with traffic and non-traffic information efficiently.

View Full Text

Perspectives on the Communication Network for the ITS Services

I. INTRODUCTION

ITS (Intelligent Transportation Systems) is gradually getting popular jargon nowadays as traffic congestion, traffic accident, air pollution and etc. are becoming serious problems and critical issues to the modern societies. The goal of the ITS services is to deliver information about the state of the road network to the appropriate people reliably, accurately and in a timely manner, resulting in improved mobility, safety, air quality, and productivity [1]. To deal with this goal, ITS is comprised of a number of technologies such as information processing, communications, control and electronics. Especially, data communications play a very important role for efficiently providing users, those private and commercial drivers on the roads, with ITS services.

In this paper, we would like to describe a new system architecture for the development of the data communications network for supporting ITS services. In these efforts, we will discuss some pros and cons of the centralized system and the distributed system as an architectural issue. Centralized system collects traffic information at a single point and distributes traffic-related and other information such as weather, stock, and etc. to on-vehicle terminal or directly to the drivers. But centralized system has many limitations because of potential operational bottlenecks, error escalation and difficulties of system extension. Distributed system could be recommended as an alternative choice to cope with some limitations mentioned in centralized system. But we still could find some questions such as how we could effectively distribute local traffic information to neighbor processing nodes and how we could efficiently connect multiple information (traffic and non-traffic) sources to each processing node.

So we would like to propose a new architectural model, two-level architecture, that is a kind of mixture type of centralized and distributed system. With this architecture, we could eliminate limitations of centralized system and provide an approach to solve the above mentioned questions in distributed system.

II. INTELLIGENT TRANSPORTATION SYSTEMS

As mentioned earlier, the object of the ITS is to apply modern computer and communications technologies in transportation systems in order to improve mobility on roads, traffic safety, environmental quality, and productivity. In other words, ITS services hope to reduce traffic congestion by using modern technologies to make more efficient use of the road network that already exists. So ITS enables people and goods to move more safely and efficiently through advanced, intermodal transportation system.

In the compliance of the goal of ITS, ITS services 1) collect and distribute information on traffic conditions and travel schedules for travelers before and during their trips, 2) decrease congestion by reducing the number of traffic incidents, clearing them more quickly when they occur, rerouting traffic flow around them, and etc., 3) assist drivers in reaching their desired destination with pathfinding or dynamic route guidance. These are just a few of the services that are available. The complete list is lengthy and growing every day [2].

ITS service can be categorized into five functional areas [3] and their candidate service types are as follows:

- **Advanced Traffic Management System (ATMS)**

  Advanced Traffic Control

  Advanced Incident management

  Automatic Traffic Enforcement

  Electronic Toll Collection

  Heavy Vehicle Monitoring

- **Advanced Traveler Information System (ATIS)**

  Traffic and Road information services

  Traveler Guide Service

  Route Guidance Service

- **Advanced Public Transportation Systems (APT)**

  Public Transportation System

  Public Transportation Management

- **Commercial Vehicle Operation (CVO)**

  Freight and Fleet Management

  Hazardous Material Monitoring

- **Advanced Vehicle and Highway System (AVHS)**

  Accident Prevention and Avoidance

  Automated Vehicle Control

II. TRADITIONAL ARCHITECTURES

In the early attempt to provide ITS services, system was mainly organized in centralized system architecture. We could find only a few centralized systems such as the Santa Monica Smart Corridor Project, the Ali-Scout project, and the Nynext project [4]. In Europe, Gotherburg traffic information system was constructed in centralized scheme [1]. In general, centralized system collects and distributes traffic information to the on-vehicle terminal or driver at a single point. So there are several disadvantages such as:

- **Easy Error Escalation**: Central server problem may be escalated into whole network problem (High possibility of system bottleneck)
- **Poor Extensibility**: It is very hard to develop a database that can handle

various types of data that can be expected to provide in the ITS services

- **Low Flexibility**

The application of the centralized system architecture is restricted to a local region [4]. In recent period of time, a few system architectures based on distributed system technology are proposed to come up with some limitations of centralized system architecture. DICAF (Distributed Scalable Architecture for IVHS using a continuous function congestion measure) [4] and TRENDS (Traffic Engineering Network Data Services) technology [1] are examples of distributed system architecture.

TRENDS is developed with real-time distributed database system architecture and is based on the Internet and CORBA object request brokering. Its structure is as follows; various database nodes are located over the network. Each node has its own copy of the data. Data changing in one node will be reflected on the ones in the other databases in real time.

In this system, every single database node could hold different data such as one node may have traffic related information and another has incident data and etc. Figure 1 shows the TRENDS architecture that is applied for the UK Design Build Finance and Operate (Adopted from Reynolds, 1998, p. 36)

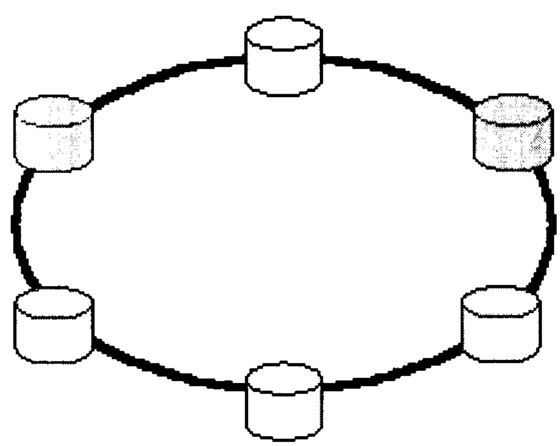


Figure 1 An example of the TRENDS architecture

DICAF was developed for collecting congestion data and then for distributing it to on-vehicle navigation system. In DICAF, nation-widely distributed DTMC (Distributed Traffic Management Center) collects some data such as the number of vehicles, average speed, and etc. in its segment. These data would be propagated to the DTMCS that are neighbored with. The amount of computation is relatively low because DTMC collects traffic information, computes the level of congestion, propagates it to other DTMCS, and distribute traffic information to the drivers. So it requires small computational facilities just like a microprocessor such as the Intel 8086 or Motorola 6809 [4]. Figure 2 shows DICAF architecture (Adopted from Utamaphethai & Ghosh, 1998).

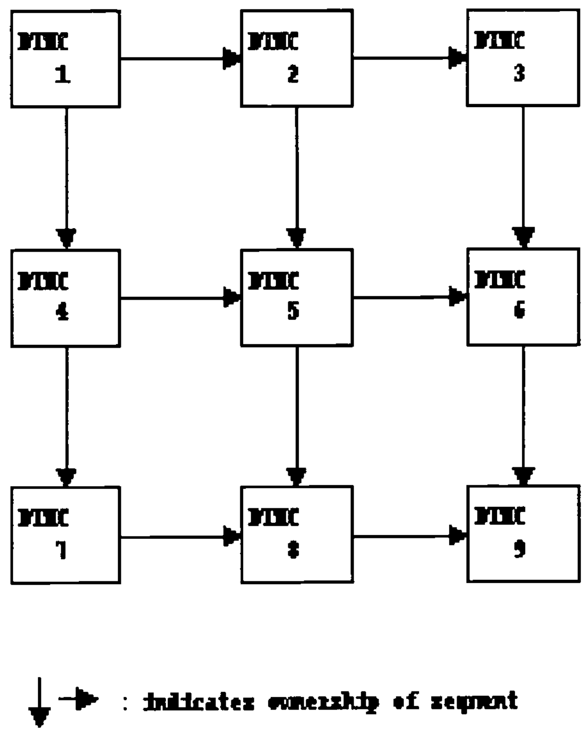


Figure 2 DICAF Architecture

III. TWO LEVEL ARCHITECTURE

As we mentioned earlier, distributed system architecture could come up with some limitations of centralized system architecture. Distributed system architecture, in general, has some advantages such as:

- **Error Isolation**: Even if one database node or processing node is failed, error is very hard to be escalated to the whole network

- **High Extensibility and Scalability**: New nodes can be easily added to come up with increasing user's demand because the number of vehicles is growing rapidly. Also can it come up with increasing information sources and development of different applications.

Like the TRENDS system, ITS services system has many information sources from the outside network. Each database node needs to be connected to at least one information source such as traffic-related information, weather, stock, and etc. and its own copy of the data, mainly local traffic information, as well. Each database node is responsible for taking care of information requests from other database nodes and local drivers in its own segment. In here, we define segment as an area where each database node covers. The zone is defined as a group of segments. Distributed system architecture is still vulnerable to system bottleneck and pressure of high level of information requests because every single database system needs to communicate with information sources in outside network to get newly updated data and needs to process information requests from other database systems and/or drivers in its own segment. So we propose new system architecture, two-level architecture, as shown in figure 3. In this architecture, database systems in the first level are responsible for communication with information sources in outside network and also are responsible for processing information requests from other database systems on the network and/or database systems in its own zone. Databases in the first level keep a copy of local traffic information in its own zone. Database systems in the second level are basically responsible for processing requests from its own segment. When traffic

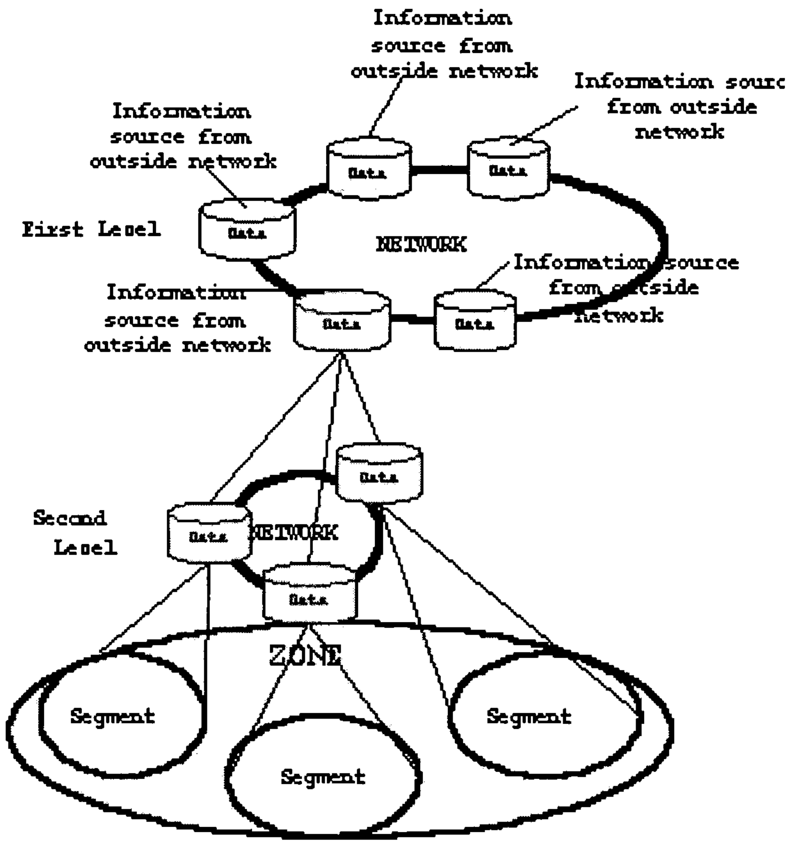


Figure 3 Two-level Architecture

information about different segment but still in the same zone is needed, database system can get these information by communicate with database systems in one level up because first level database system keeps a copy of all traffic information in its own zone. Database systems in the second level also maintain minimum level of data communication channels for the back-up purpose. When traffic information about other zone is needed, database system is also needed to communicate with database systems in one level up because first level database system is capable of communicating with other database system on the same level. These capabilities could be support with real-time distributed database system. Various database nodes could be located at appropriate locations depending on the traffic density.

This database network will be connected to road-side units, something like base stations in wireless network that has 100 m coverage in radius. A network that connects between database network and road-side units could be PSTN, leased line network and even ATM network. Drivers on streets could communicate to road-side unit to request some information through the on-vehicle terminal. On-vehicle terminal has functions for information requests and information receiving through wireless interfacing to road-side unit. It has also information display functions. Figure 4 shows over all system structure.

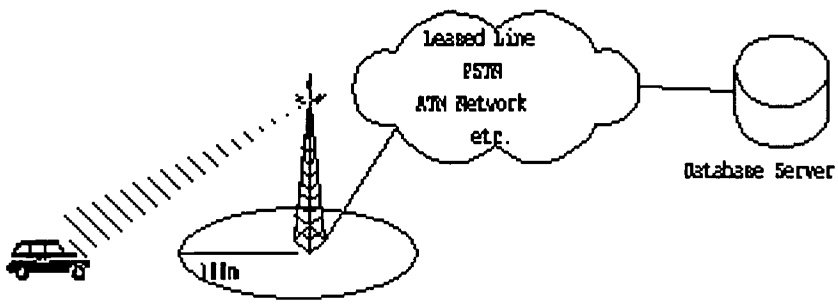


Figure 4. System structure

IV. CONCLUSION

Recently, a few distributed system architecture for ITS services are announcing. These new approaches in ITS world are to overcome some disadvantages of centralized systems. We think distributed system architecture is still vulnerable to system bottleneck and pressure of high level of information requests. And it is also true that the demands on traffic information are growing very fast as the number of car is exploding. This means we need more robust and efficient system architecture to provide drivers on the road in everyday life with traffic related or non-traffic information such as weather, stock, and etc. more effectively. So we proposed the two-level architecture based on the distributed system architecture. This new architecture provides us with high level of reliability, extensibility and scalability. It is very easy to add new database system node depending on the amount of traffic/non-traffic information. It is very flexible to introduce new service application with this kind of architecture.

V. REFERENCES

Reynolds, Stuart, "Architectural Trends: A real-time distributed database for Europe", *Traffic Technology International*, Feb/Mar 1998

ITSA, "What is ITS?", *ITS America On-line Document*, 1998

Drane, Chris, Rizos, Chris, "*Positioning Systems in Intelligent Transportation systems*", Artech House, Boston, 1998

Utamaphethai, Noppanunt, Ghosh, Sumit, Dicaf: A Distributed Architecture for Intelligent Transportation, *IEEE Computer*, March 1998.

Kim, Sung-Soo, Kim, Hyoung-Wook, "Selection of Modern Telecommunication Media and Dynamic Route Guidence System for ITS", *Proceedings of the 20th Annual PTC Conference*, Honolulu, Hawaii, 1998

Return to Top View Full-screen

B-ISDN Field Trial In Thailand

PANSAK ARPAKAJORN

TELEPHONE ORGANIZATION OF THAILAND

ABSTRACT

The use of information and communication technologies (ICTs) is now growing very rapidly, and these technologies affect the lives of people all over the world. In developing countries, there is an intention to close the gap between them and the developed nations in the implementation and use of these technologies, as well as to provide efficient services for people throughout these countries. One such service is B-ISDN. In support of the intention described above, the Telephone Organization of Thailand (TOT) has embarked upon a pilot project to test the reliability of B-ISDN in Thailand both from a technical and a marketing standpoint.

This paper describes the field trial being undertaken by TOT with regard to the implementation of B-ISDN in Thailand. Initial project objectives and the work stages are introduced. The network configured and installed throughout the whole of Thailand is described along with experiment objectives. Applications installed on the network for test or demonstration purposes are also described. They concern data applications for high speed transfer between LAN as well as voice and video applications. The experiences gained from the implementation of 64 kbits/s based ISDN are also described in this paper.

View Full Text

B-ISDN Field Trial In Thailand

I. INTRODUCTION

Situated between the Equator and the Tropic of Cancer, (5° and 21° North latitude, 97° and 106° East longitude) and serving as a land bond between the Pacific and Indian Ocean, Thailand is a part of the Indochinese Peninsula, South-East Asia. With a total land area of 513,956 square kilometers (197,455 square miles), Thailand has a total population of about 60 million people.

Geographically, the country is divided into four regions; the northern, the northeastern, the central and the southern regions. Due to the richness of natural resource and the appropriate climate, about 80% of the Thai population is engaged in agriculture.

The country embarked on economic and social development planning thirty-five years ago. Five consecutive National Economic and Social Development Plans were drawn up to be used as guidelines for the mobilization and allocation of economic, financial and human resources for the well being of its people.

The country has also transformed from a solely agriculture base to a semi-industrialized country. Major exports from the agriculture sector are paddy, rubber, tapioca, maize, sugar cane, beans and prawns. From the mineral resource sector, tin, tungsten, fluorite, barrite are exported. Exports from the manufacturing sector include textiles, jewelry, canned food, wood products and automobiles.

II. TELECOMMUNICATIONS DEVELOPMENT

Thailand's rapid economic growth during the late 1980's was underpinned by the vigorous expansion of the industrial sector as direct foreign investment capital poured into the country to take advantage of its competitive labor costs. This picture has changed slightly in the 1990s as investors recognized that in addition to an export or re-export base, with a growing per capita GDP and middle class, Thailand was emerging as an attractive national economy. However, this position is being affected by the economic crisis which spread all over Asian countries. The economic crisis has also affected the investment of telecommunication infrastructure.

The telecommunication infrastructure development policy proposed for the National Economic and Social Development Plan emphasizes an expansion of investment in the provision of basic services. The objective of this investment is to subsequently ensure that there is an adequate supply of high quality lines to address the demand from the industrial sector, the business sector and the residential sector. The objective of the plan are to:

- Expand telephony services to satisfy all requests for service
- Increase the line penetration to at least 10 per 100 population
- Upgrade the quality of national and international communications services to international standard
- Exploit the features and facilities offered by digital technologies to response to the business community needs and support the enhancement of the international competitiveness of the Thai economy.
- ISDN service is one of the features which the government intends to use to fulfill this objective.

III. EMERGENCE OF ISDN SERVICES

ISDN national plans were set up in 1989. The first project dealt with a trial of a 64 kbits/s service. This project was initiated by the Telephone Organization of Thailand (TOT) in 1993 with both Basic Rate and Primary Rate Interface. Initially, the overlay strategy was employed with intention of moving to an upgraded strategy when both the market and the network seem to be stable. The future investment of thirty million dollar is envisaged for initial upgrading existing exchanges.

Since ISDN is new to the people, even though it has been emerging for years. There are problems that must be overcome before it is well accepted. There seem to be four major causes of this lack of acceptance]:

- It is difficult to explain in a simple way all the possibilities and advantages of ISDN. There is no single answer to meet the needs of different customers
- There is still lack of well-established applications that translate potential benefit into tangible products and services
- The question of transition from applications based on the existing networks to those based on ISDN must be considered
- ISDN terminals are still relatively expensive

Because of the above, the take up of ISDN services did not meet TOT's expectation.

To promote ISDN services in Thailand, various methods are being used e.g. advertising the benefits of ISDN to the public, demonstration of ISDN equipment and services as well as invitation to customers to participate in seminars arranged by TOT. A low tariff rate policy is also being used for ISDN promotion.

In accordance with the ISDN national plan, not only N-ISDN was set up. B-ISDN was also foreseen as supporting the requirements of users. The plan is also intended to improve network capability providing users with innovative applications as well as supporting a high speed data communication infrastructure.

B-ISDN was announced by TOT in the middle of 1997 to qualified Bidders who wished to participate in this project. There were six Bidders who offered technical proposals together with price proposals. After technical evaluation, qualified equipment from three Bidders was selected for price evaluation. Finally, the equipment offered by a European telecommunication company and bidded by a local telecommunication company in Thailand was selected for implementation in this project. The project is now in progress by the successful Bidder under the management of TOT.

IV. OBJECTIVES OF THE B-ISDN FIELD TRIAL

The promise of Broadband communications is to turn the telephone network from being primarily a medium for voice communication into a multimedia network, able to carry video and other image-based services, high speed data communications and other computer-to-computer traffic as well as voice and text communications[3]. The network supporting Broadband communication is known as a Broadband ISDN (B-ISDN). This network will require a telecommunication infrastructure targeting high speed data communication such as LAN interconnection, bulky data communications such as file transfer and cable television, but not limited to these services[4].

Since B-ISDN is new to the telecommunication environment in this country, it is essential to carry out the field trial before introduction of commercial services. The main objectives of the B-ISDN field trial in Thailand are :

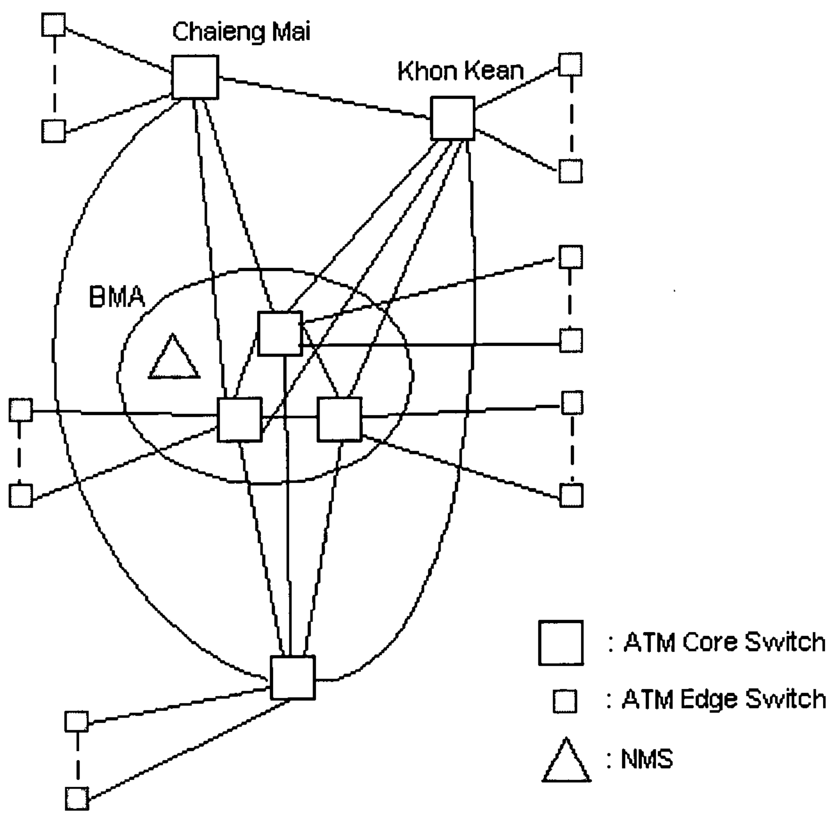
- To trial the support of services in a Broadband ISDN environment.
- To confirm technical-compatibility between ATM switches as well as access capability between user and network and user and applications.
- To evaluate user response to B-ISDN services
- To provide TOT's staff with skills training on Broadband technology

V. NETWORK CONFIGURATION

The B-ISDN trial network configuration consists of Core Switches, Edge Switches, Network Management System (NMS) and also various type of terminal equipment. The ATM Core Switches are located in six major areas of the country, the first three in the Bangkok Metropolitan Area and the others in the provinces. The ATM Core Switches will be connected through a 155 Mbits/s SDH transmission backbone and connected to a user access node called an Edge Switch. The forty-five Edge Switches are located in the areas in which the users need to be served. One NMS is also required in this project. At each end point, customer terminal equipment e.g. router, work stations etc. may be connected, so that the widest variety of customer applications can gain access.

The network configuration of the B-ISDN field trial is shown in Figure 1.

Figure 1. Network Configuration of B-ISDN Field Trial



VI. SYSTEM EQUIPMENT DESCRIPTIONS

B-ISDN supports many services and applications, it needs various types of equipment which are different from POTS and N-ISDN.

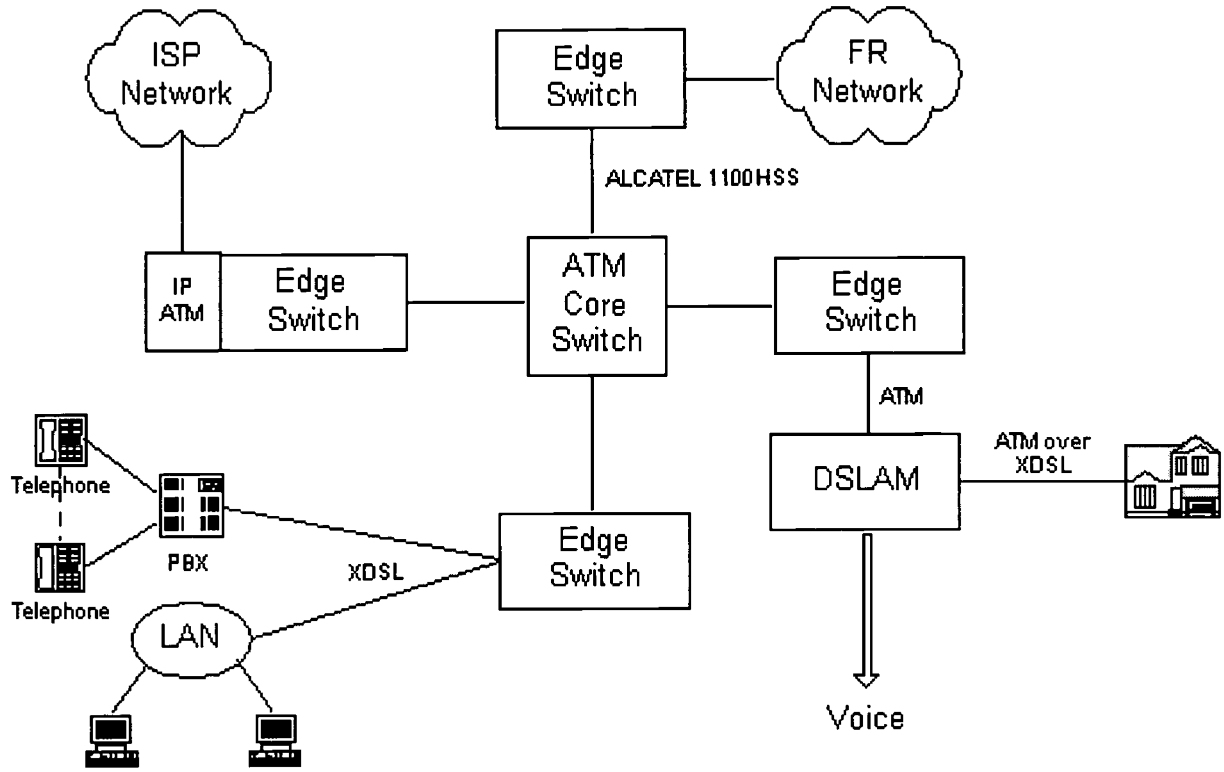
1. *ATM Core Switch*

The ATM Core Switch used in this project is a high speed data communication platform that supports multiple data link technologies including Asynchronous Transfer Mode (ATM), Circuit Emulation services and Frame Relay. This Core Switch can be used in a wide range of applications such as an access node or backbone switch for public or private Frame Relay and ATM services.

2. *ATM Edge Switch*

The Edge Switch is the ATM switch located at the edge of the network. Conceptually equivalent to a Central Office in the voice world, and Edge Switch is the first point of user access for a broadband network. Edge Switches are interconnected by ATM Core Switches which are functional equivalents of Tandem Switches in the circuit-switched voice world [5]. The ATM Edge Switch offered to TOT is called a Multi Service Switch. This Edge Switch uses the same common elements as the ATM Core Switch. The services provided by the Edge Switches are the same as Core Switches except for B-ISUP, which is used as a public network interworking protocol and is not included in the Edge Switches. The Edge Switches can also provide non-ATM service e.g. Circuit Emulation service, support of digital voice and video access, Frame Relay and legacy protocol handling services. The typical configuration of ATM Core Switches and Edge Switches with the associated terminal equipment is shown in Figure 2.

Figure 2. Typical configuration of ATM Core Switches and Edge Switches



VII. INTERFACES

The interface between the Core Switch and the Edge Switch complies with the ATM Forum standards IISP (Interim Inter Switch Protocol) and P-NNI (Private-Network Node Interface) protocol , as specified in the ATM Forum B-ISDN network model.

The interface between the Core Switches is based on the ATM Forum Standard P-NNI v.1.0. However, as stated in the technical proposal of the supplier, the Network Node Interface (NNI) based on the ITU-T B-ISUP protocol will be made available by the end of 1998. The exchanges between the NMS and the Core Switches and Edge Switches are performed in TCP/IP SNMP mode for fault management aspects and in TCP/IP RTD for the configuration management aspects.

VIII. Applications

The development of telecommunication infrastructures varies widely from country to country in the developing nations. There is insufficient infrastructure penetration to give access to the basic telecommunication services required by the users with adequate quality, efficiency and reliability. There is increasing pressure on developing countries to

- provide specialized telecommunication and information services to the health, education, banking and industrial sectors, as well as to expand service availability for the general population. New technologies also challenge the efficacy of traditional network plans that rely on a single type or service delivery[3]. However, the telecommunication business in Thailand is expected to slow down as a result of the economic crisis in the country.

Rural and remote areas of most developing countries have less population density and suffer from an almost complete lack of telecommunication infrastructures. Telecommunication and information technologies are very powerful media for providing education and training. They are also a means to accelerate the growth of the rural economy which subsequently helps to alleviate poverty and to improve living conditions in rural areas.

Access to telecommunication services in rural areas is essential to sustain life and services not only as a means of public communications but also as comprehensive communication facilities for relaying information on medical treatment, disaster relief, and administrative and other matters[3].

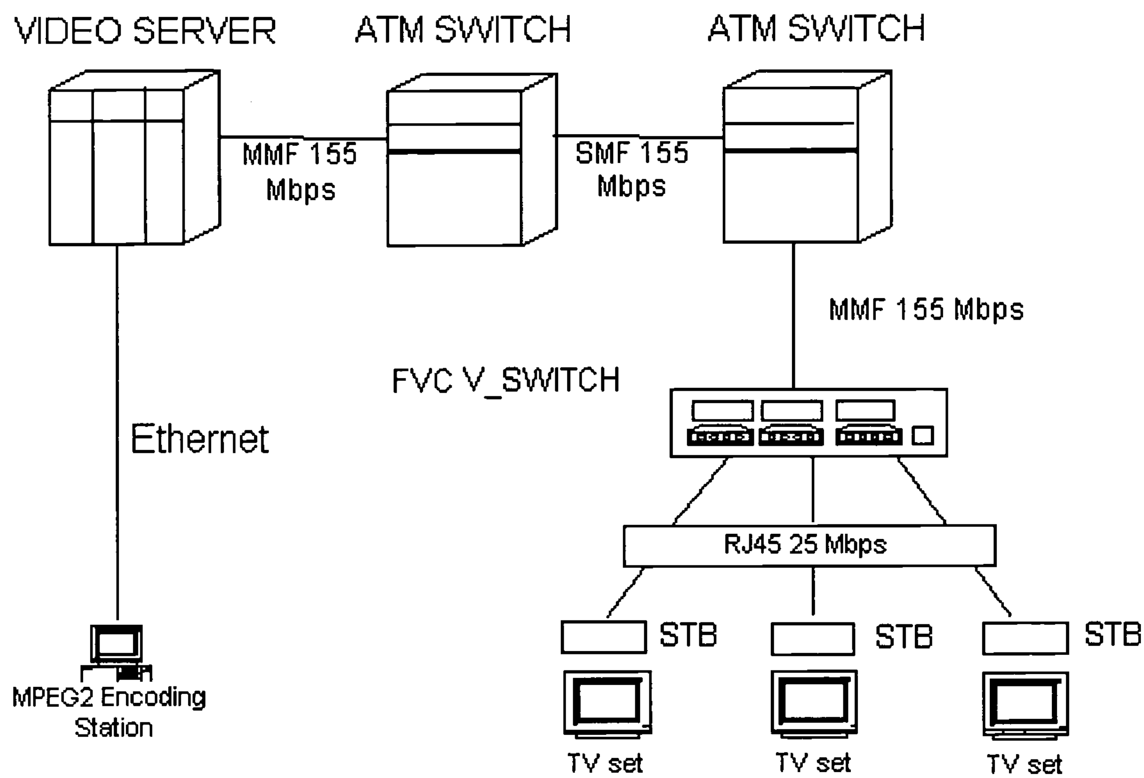
Before any introduction of B-ISDN services, it is essential to estimate the market demand for the services and applications which B-ISDN will support. To achieve the objective of the B-ISDN field trial as well as to provide the users with new technologies and to improve their living conditions the following applications are required initially:

1. *Video On Demand*

Video On Demand (VOD) is one of the most attractive services in B-ISDN. The objective of VOD the trial is to invite user participation in the entertainment business. However, the deployment of VOD requires a B-ISDN network that can transport and switch large amounts of information and that offers some form of interactivity. It appears that demand for VOD would be high. It is one of the top services requested by consumers in market surveys.

VOD provides the users with menus to select video as well as audio services from B-ISDN applications e.g. movies or other video-based services. The VOD configuration in Thailand in the trial project consists mainly of the components shown in Figure 3.

Figure 3. Video On Demand Configuration



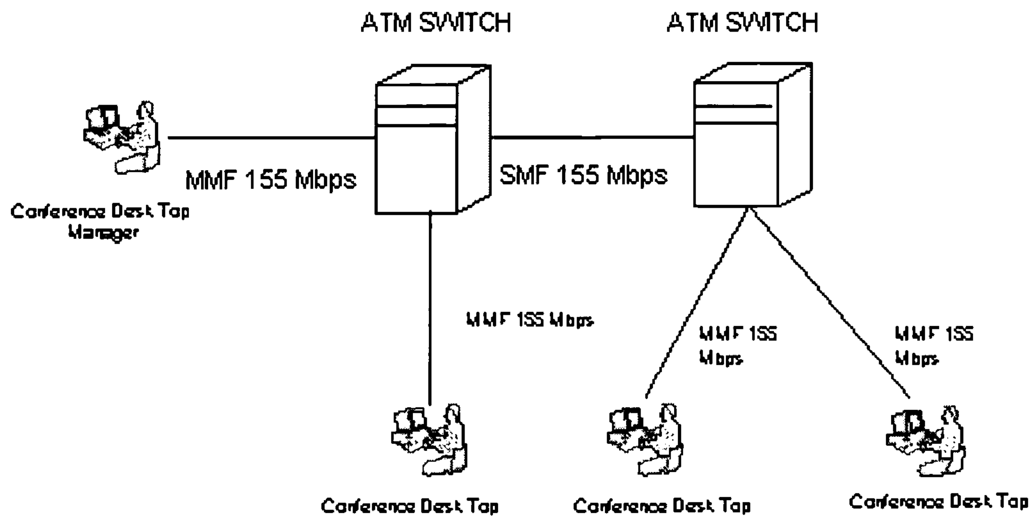
2. *Video conferencing*

The following major components are provided for Video conferencing:

- Edge Switch equipped with three STM-1 155 Mbps interfaces, one single mode fiber optic connection is extended between nodes and two multimode fiber optic connection are extended between nodes and conference desk top
- Conference Desk top, this consists of components such as camera, microphone, speakers, video monitor etc.

The configuration of Video conferencing is shown in Figure 4

Figure 4. Video Conferencing Configuration



3. *Telemedicine*

Applications in areas such as telemedicine and teleeducation create some of the most postive impressions of the benefits of information infrastructures. These public services, along with the delivery of government electronic services, promise to improve the welfare of people in the country .

Telemedicine is one of the application to be provided as public services. This applications intends to provide medical assistance to hospital in remote areas the opportunity to observing, learning and attempt to make their own diagnoses from the medical center in the central area.

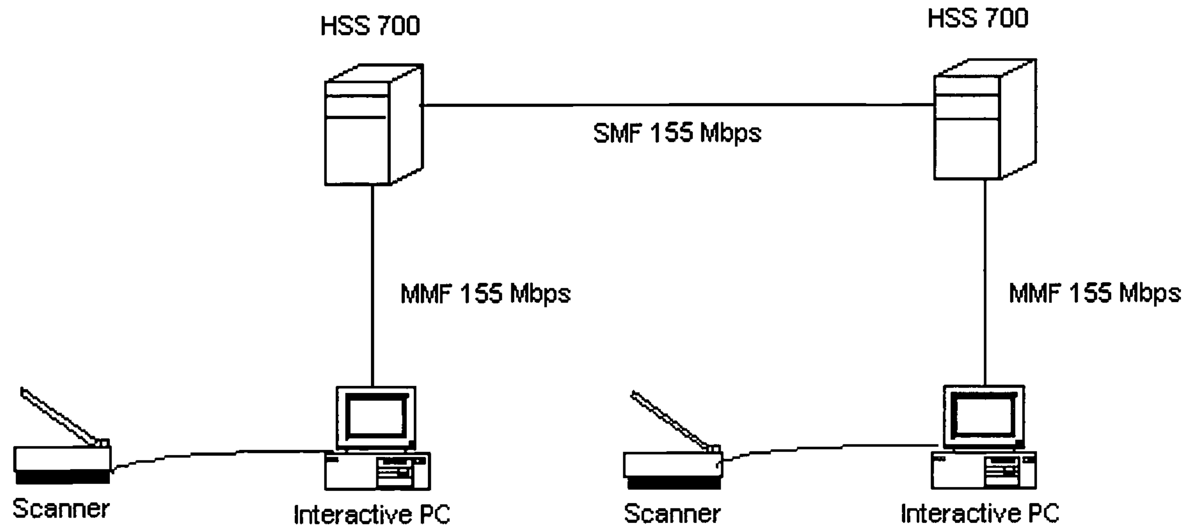
Most telemedicine applications fell into one of three categories : transmission of medical images; computerization of patient records; online access to medical records and experts .

The Telemedicine application in the trial project consists mainly of:

- Edge Switch equipped with two STM-1 155 Mbps, one single mode fiber optic is extended between nodes and one multimode fibre optic is extended between node and desk top

- Desk top consists of components such as camera, microphone, speaker, video monitor and scanner etc.

Figure 5. Telemedicine configuration



4. *Integrated Data Access*

The business market is a very sensitive area for the telecommunication operations.

Businesses generate proportionally higher revenues per subscriber than the residential market in developed countries [6]. One of the main sources of business for telecommunications operators is data transmission [6] Therefore, high speed data transmission is introduced to serve the market demand in the future.

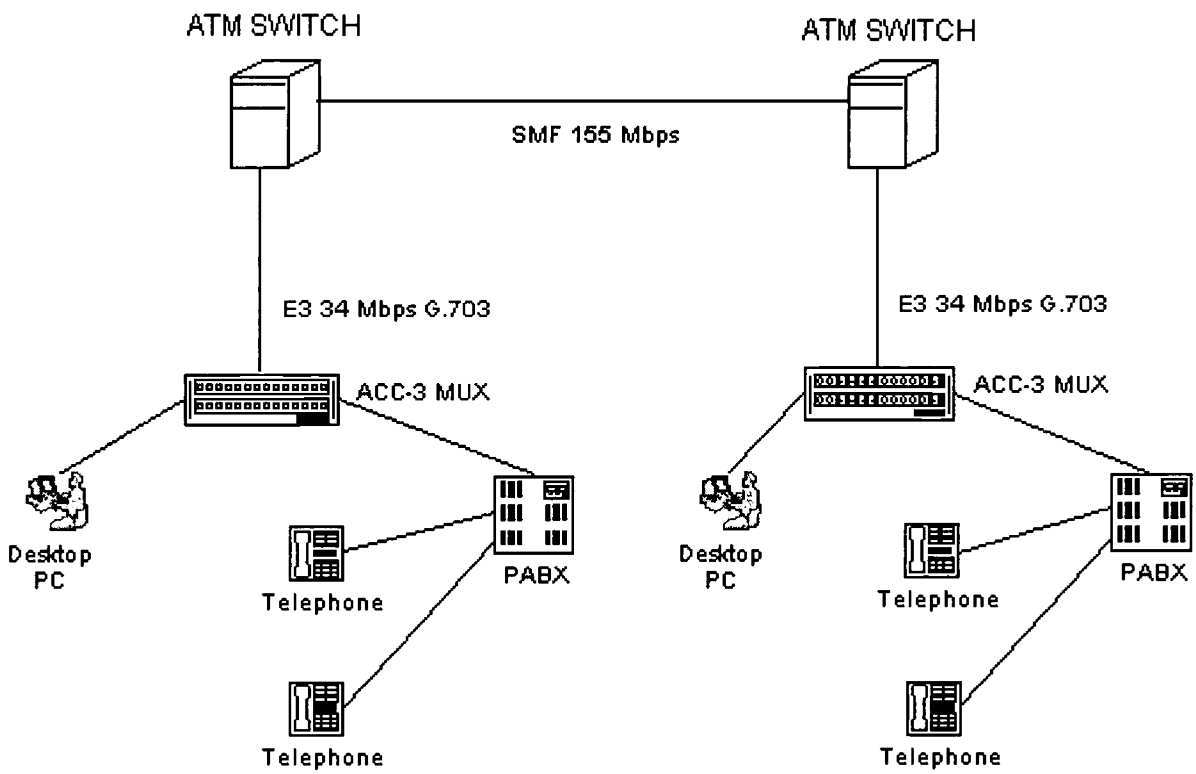
The Integrated Data Access application in this project intends to demonstrate various high speed data transfer capabilities between Local Area Network (LAN), workstations, voice and video applications over the B-ISDN network. An example of a trial Integrated Data Access application is shown in Figure 6.

The following components are required for Integrated Data Access applications:

- Private Automatic Branch Exchange (PABX)
- ATM multiplexer with 1E3 network ATM port, 1E1 Circuit Emulation Card;
- Ethernet interface
- Edge Switch with one ATM 155 Mbps STM-1, single mode fibre optic connection extends between nodes and ATM 34 Mbps electrical interface (G.703) extended between node and ATM Multiplexer;

- Desk top PC

Figure 6. Integrated Data Access Application



IX. *IMPACT OF B-ISBN ON THE TELECOMMUNICATION OPERATOR*

Since B-ISDN is a new experience for this country, in principle it is important to establish a clear policy on the introduction of B-ISDN based on careful study of its impact on the administration.

Unlike traditional telephone service, B-ISDN has more applications and more equipment to be provided at the customer premises. No one really knows which B-ISDN service will prove popular and which will prove unpopular. This caused problem for the telecommunication operators in the developing countries trying to introduce new technologies into their network.

The experience gained from the implementation of 64 Kbits/s based ISDN (N-ISDN) in the country during a period lasting almost five years shows apparent dissatisfaction on both TOT's and customer's part. However, implementation of N-ISDN is still going ahead to support the demand of customers. Based on these experiences, it is difficult to predict the take-up of B-ISDN in Thailand. However, B-ISDN is a strategic global technology and is the basis for access to many infrastructure in the telecommunication environment locally, regionally and globally.

X. CONCLUSION

The B-ISDN field trial is a major step by TOT towards providing broadband capabilities needed by users. Evolution of network capabilities is also required to support applications in the information age. The services offer by the B-ISDN field trial were selected based on market expectation as well as ISDN national plans. Since the project has just been initiated, this paper describes only general information i.e. background, objectives, network configuration, system equipment description and applications to be initially provided. Further details of this trial will be presented at a later date. TOT must analyze the results of the trial, and these, too, will be presented after TOT has coherent and meaningful set of data to present.

XI. REFERENCES

[1] *"Thailand Telecommunication Restructuring and Privatization Study"*, 22 March 1994

[2] GAS9 *"Case Studies on the Progressive Introduction of ISDN in a National Network"*, Geneva 1992

[3] ITU, "World Telecommunication Development Report" 1994

[4] ITU-T, "Introduction of New Technologies in Local Network", Geneva, 1993, P.40

[5] Henry Newton, Newton's Telecom Dictionary 12th Edition, A Flatiron Publishing, Inc. Book, February 1997, P.231

[6] ITU "World Telecommunication Development Report," 1995

Return to Top View Full-screen

Next Generation Networks

A Practical View of Communications Network Evolution

Grant Lenahan

Executive Director, NGN Solutions

Bellcore

Abstract:

Not available

View Full-text

Next Generation Networks

A Practical View of Communications Network Evolution

"Next Generation Networks".

What on earth does that mean?

We all heard about the broadband ISDN future. Then about the "information superhighway". We've heard about Internet II. And most recently, we've heard how the Internet will make the telecommunications infrastructure obsolete. Yet, so far, none of these have really come to pass. So is Next Generation Networking just another futuristic concept that will, like all the others, fade away?

In a word, no, because of three major changes:

1. Increased market demand for data, LAN and Internet services provides a revenue opportunity
2. The explosion of data in the core network offers the opportunity for cost savings by migrating to a data network infrastructure, and
3. The recent maturity of IP, ATM and voice-over packet technology

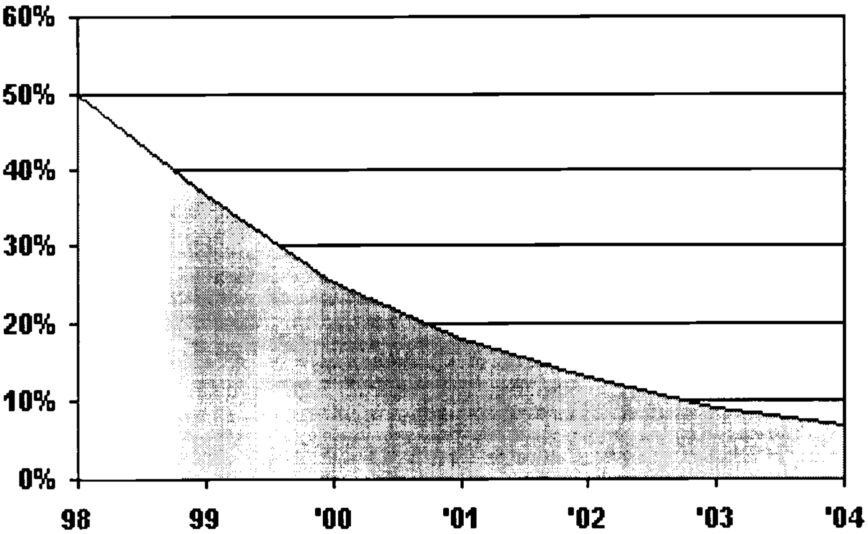
Bellcore is convinced that Next Generation Networks ("NGNs") are upon us. Yet we also realize that, for communications carriers, there must be a gradual evolution from today's PSTN and Internet to an NGN future, and that this evolution must be based on sound business drivers and economic feasibility.

Underlying all successful technology revolutions is a business opportunity framed in terms of demand for products and services. And today's communications marketplace illustrates robust demand for services that will drive change in the communications infrastructure. It is up to those of us in the market to determine who will benefit – telecommunications carriers, data carriers, or both.

Figure #1 illustrates a consensus forecast for data and voice bandwidth on public networks between 1998 and 2005. In the USA, data traffic surpassed voice traffic on public networks nearly a year ago, and by 2005, voice is expected to represent only a tiny fraction of total network traffic. Given the rapid growth in Internet and web use, along with electronic commerce, this is not surprising. And this trend is moving quickly throughout the world. Just months ago, it was announced that data traffic overtook voice in BT's network.

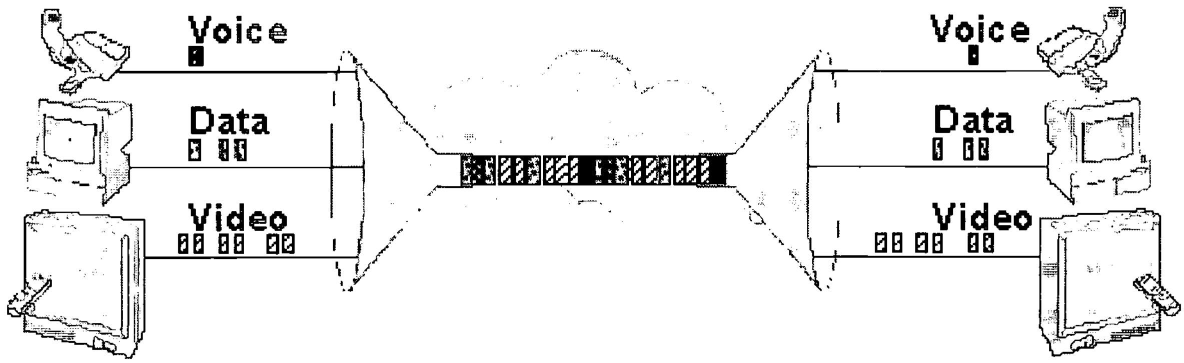
Fig #1: Data Traffic is Growing to Dominate all Public Network Traffic

(shaded = data component of total PSTN traffic)



Historically, the telecommunications industry has had two methods for dealing with the rise of data, which is predominantly packet, frame, or cell traffic. The first approach has been to carry data on the analog and TDM networks designed and optimized for voice. Examples are DDS circuits, Internet access by modem, and dedicated 56k & T1/E1 lines. The second approach – growing more recently -- has been to build and operate separate, parallel networks for high capacity data traffic. Wherever possible, telecom carriers have used common fiber media and SONET / SDH transmission equipment for the lowest layers of transport.

Fig #2: A Single Common Packet Network (NGN)



Not long ago, when voice traffic dominated the network, this approach made sense. Packet switching technology was still immature and costly, and most traffic could be handled well by modems and dedicated lines. And certainly, 10 years ago, neither the quality nor the cost of packet networks made them practical for handling voice traffic.

Today, all that has changed. The cost of packet and cell routing technology has fallen dramatically, and continues to fall with the declining cost of processing power (Gordon Moore's Law). High quality optical transmission has reduced the need to verify packet integrity at each intermediate hop (as was done with previous generation, X.25 packet switching), and thus reduced latency, making packet-based voice possible. Further advances in packet technology, in particular ATM cell switching technology makes a data infrastructure all the more voice-friendly. Given all these changes, it will make increasing commercial and economic sense to reverse the pattern of the past. In the future, when data is the dominant component of traffic demand, it will be more practical to carry voice over data networks, than to force-fit data into voice networks. And certainly it is not economic to continue to build, operate and provision separate voice and data networks.

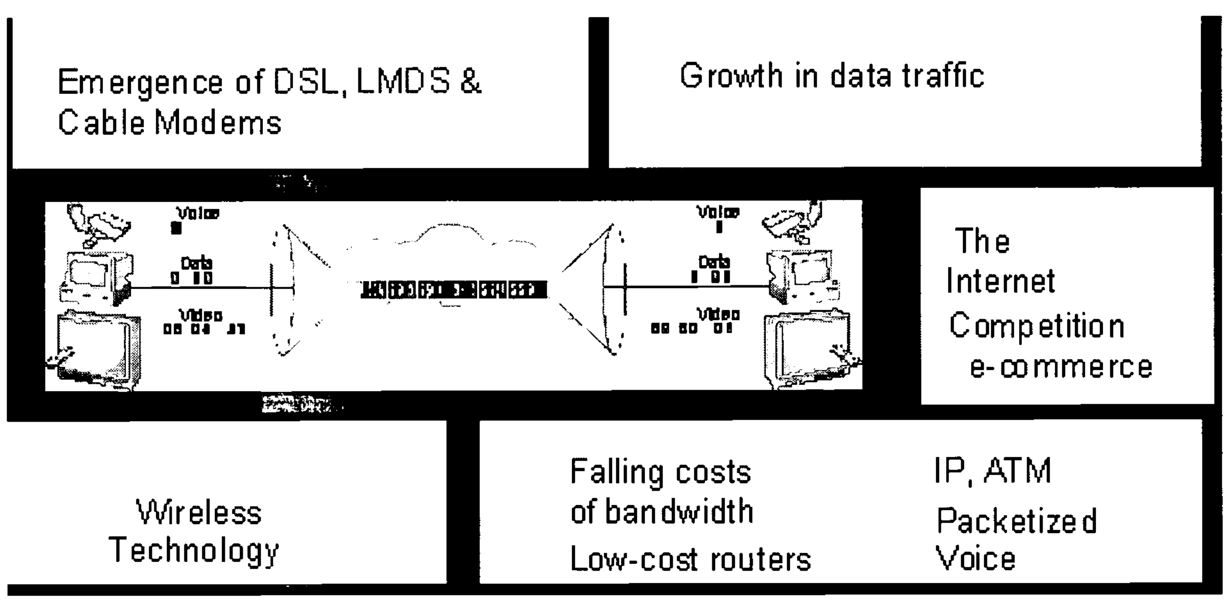


Fig #3: Many factors are converging to make NGNs realistic today

So, does this mean that data networks are the answer? Or that the Internet may truly subsume traditional telephone networks? Not really. There are at least two major challenges that those solutions don't address; the continued demand for traditional voice communications, and the need for high quality of service.

While data will emerge as the dominant form of traffic over the next few years, there is no indication that voice traffic will decline, either in quantity or in importance. In fact, voice traffic continues to grow each year, by 6-9%, and the usefulness of the lowly telephone call is still relatively high. Data networks do not yet offer the combination of quality and features that have become essential ingredients in our private lives and in commerce. The Next Generation Network must offer parity – at least – in terms of voice quality, ease of dialing, and convenience features such as call waiting, Emergency 911, free phone ("800" service in the USA), and the myriad of capabilities offered by Centrex and PBXs that power most businesses today.

Likewise the Internet has evolved as a free for all, without the robust availability, security, consistent performance or high levels of quality required for commerce. This is especially critical for "mission critical" applications like real-time commerce, finance and interactive engineering. The market demand for these, and customers' willingness to pay a premium for quality and security, are demonstrated by the variety of "service level agreements" (SLAs) offered by IP data carriers, and the continued demand for semi-private and private data networks by business. Possibly the most dramatic example is the emergence of the Automotive Network Exchange (ANX). ANX is a managed, high security and high performance IP extranet conceived by the Automotive Industry Action Group, backed by GM, Ford and Chrysler, engineered and managed by Bellcore, and being adopted by the major automotive manufacturers and their partners and suppliers. ANX is built on the belief that security and performance translate directly into competitive advantage and cost savings for the ANX participants, and results in business process savings that greatly exceed the premium price of ANX Internet Protocol (IP) service.

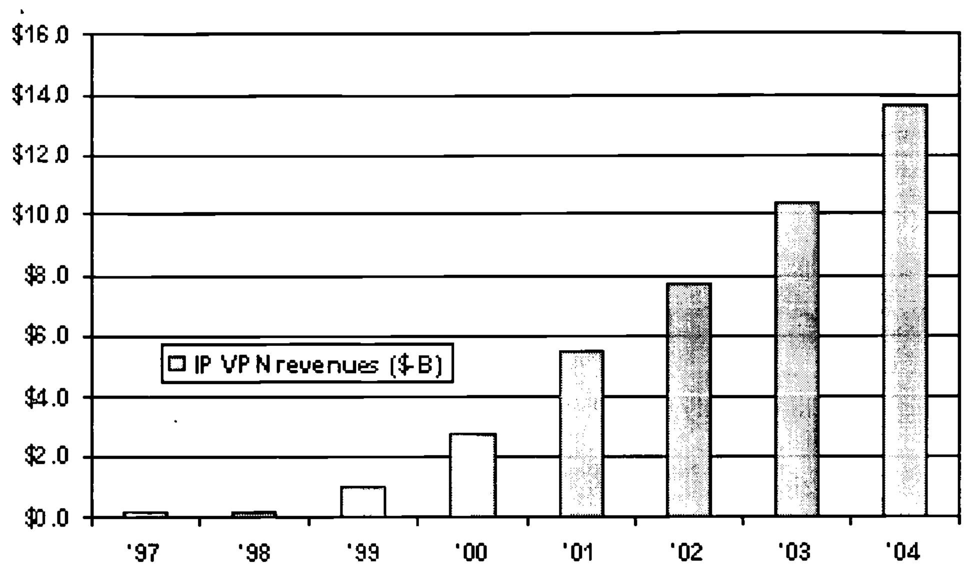


Fig #4: Revenue Forecast for IP-VPNs, USA, 1997-2004, USD$-Billions

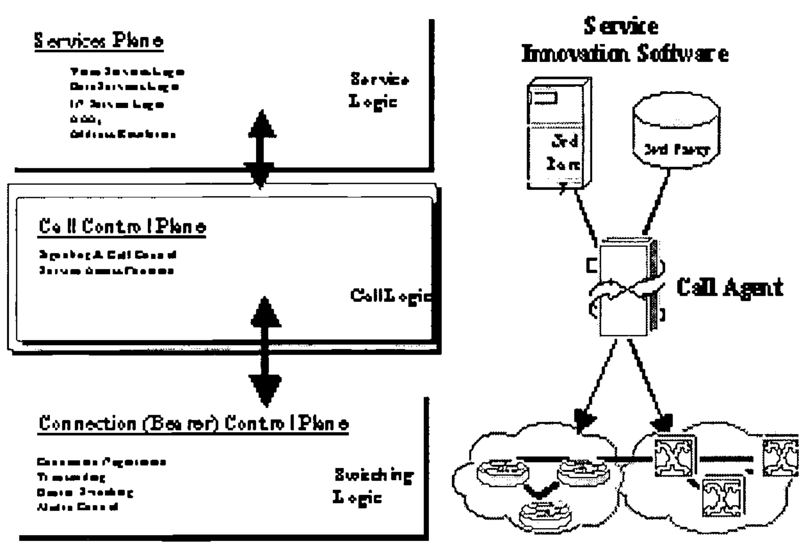
ANX demonstrates another concept -- data transport is not necessarily a commodity. The Internet treats all data, all users, and all sessions alike, without priority in terms of performance, latency, security, or reliability. Yet in reality, users place significantly different value on an interbank settlement, for instance, than on access to an entertainment Web site. Likewise, the latency requirement for a real-time transaction is far more stringent than that for most electronic mail messages. This defines a new dimension in network treatment of data, voice and mixed messaging. It also defines a revenue opportunity, given that things of added value can command a higher price. Next Generation Networks will fail to realize their commercial advantage – to say nothing of their usefulness – unless they provide for the differentiation of future data and mixed-message services.

In summary so far, an NGN must meet the following characteristics:

1. One common network capable of handling data, voice and video communications
2. "Data friendly" or data-native packet (or cell) transport and switching infrastructure
3. Flexible services control elements to enable voice communications and support data and QoS in the future
4. Voice parity with the PSTN in terms of features and quality

For many reasons, the evolution of the PSTN into an NGN must – of practical necessity – be conceived and achieved in separable tasks. The investment in fiber cable, SONET and SDH transmission equipment, undersea facilities, cooper loops etc is an enormous asset and unlikely to be replaced wholesale. Even if it were financially possible to replace all the existing PSTN infrastructure, the practical task of installing new equipment, testing it, and migrating today's customers and traffic would be an impossible task to complete in a short period of time. Finally, a plurality of residential customers worldwide will not require advanced data and video services, or at least they will be unwilling or unable to pay the increased cost of high speed connectivity to their homes. Bellcore's research indicates that only between 10% and 30% of residential customers will be likely prospects for NGN services and NGN serving transmission architectures in the current planning timeframe.

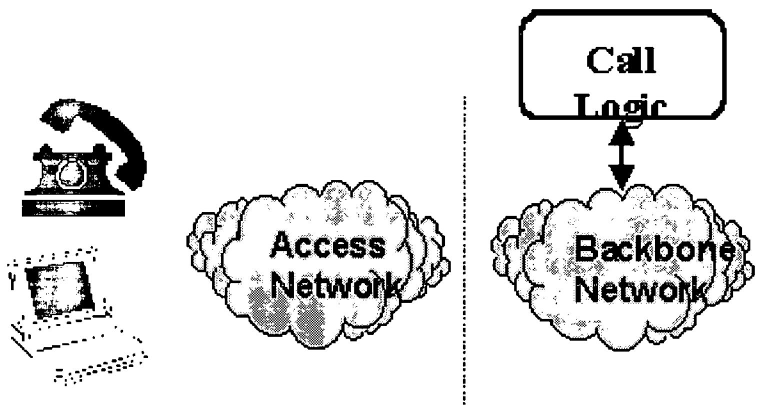
Fig #5: Call Control Logic can be separated from the underlying router hardware



Consequently, it will be essential for carriers to plan migration strategies to NGNs that protects their PSTN investments, re-uses as much of the PSTN infrastructure as is practical, enables seamless interoperability between PSTN and NGN services, and incrementally follows profitable demand for NGN services. Bellcore's approach is to divide PSTN -> NGN evolution into three tasks, which can be planned for and treated separately. Each task has its own set of business drivers and can be justified independently of the others.

1. Creation of a consolidated, packet transport and switching infrastructure, likely based on either IP, ATM, or both
2. Gradual migration of the analog copper loop plant to a packet access technology capable of transporting data, voice and video services over the "last kilometer" to customers
3. Development of a flexible, open, hardware independent services control and services development layers to handle voice telephony, as well as new data and mixed media services in the future

Fig #6: Simple Definition of Access, Backbone and Call Control in the NGN



We will discuss each of these in order.

Creation of a consolidated, packet transport and switching infrastructure

While data traffic is beginning to dominate the network today in aggregate, most individual (residential) loops carry only analog voice (or, in a small but significant number of instances, 64 kb/s ISDN). Thus it is more practical to convert the backbone network (historically the "trunk" network) to a packet infrastructure than it is to convert every local loop. It is practical today to carry trunk traffic within a packet connection. In fact, many carriers use ATM for this purpose today. Yet the vast majority of trunks traffic remains in dedicated E-0 TDM format, and the vast majority of those TDM channels are carried today on traditional TDM multiplexed facilities. This has several disadvantages:

- No bandwidth sharing takes place between voice and data traffic
- Idle time on E-Os and DS-Os is wasted (no packet "compression")
- TDM trunks require individual provisioning
- OSS are optimized for TDM and voice provisioning and are inefficient at data provisioning
- Engineering and forecasting must be performed separately for data and voice

With data traffic at 50% or more of total traffic and rising, it is reasonable to begin converting to a single, consolidated packet backbone infrastructure today. Such a conversion can re-use much of the most costly network infrastructure, from placed fiber cables and radio facilities, to SONET or SDH transmission equipment. Yet, over a reasonably brief period of time, backbone facilities could be transporting all traffic as packet data, yielding a single network to administer, shared facilities, shared bandwidth and a much more efficient growth platform for the future.

Once a widespread and common data backbone is in place, it becomes faster and cheaper to provision data services, re-route traffic if needed, install sophisticated provisioning and fault monitoring systems, and generally compete effectively for the fast growing data market. To illustrate the business opportunity, refer to the previous bar chart, which shows the forecast growth in IP-extranet (VPN) revenues in the USA, and consider the advantage gained by carriers with data-native backbones. MCI/WorldCom, BT-AT&T (global), Level3 and Quest are all building (or have announced that they will migrate to) such a common data backbone architecture, using either ATM or IP technology.

A critical factor is that once the backbone network is migrated to a data architecture, routers or ATM switches can begin to perform the functions of a voice circuit switch. Below, we will illustrate Bellcore's vision of the software call-control capability that enables routers and ATM switches to augment and perform the functions of an end-office (or a tandem) telephone switch, including complete seamless interoperability with the CCS#7 signaling network, the AIN network, and legacy switches. This is not wishful thinking, Bellcore intends to deploy initial versions of this call processing software in the networks of key clients during the first quarter of this year.

Gradual migration of the analog copper "loop" plant to a packet access technology

The "last kilometer" loop remains the most challenging aspect of migration to NGN. Technically, the options are well understood and pose no huge difficulties. But the local loop remains the most costly portion of most networks, for the reason that it is generally a dedicated facility. In some architectures, such as traditional coaxial CATV plant, much of the access network is shared media. However, for the 100s of millions of copper loops around the world, the upgrade economics are entirely dependent on the revenues that can be obtained from the end customer.

Medium and large size business are often served by E-1 or SDH facilities even today, and therefore have a fairly broad-band digital capability between the end customer and the backbone network. Smaller businesses and residential customers however, are generally served by analog copper loops. More to the point, residential and small business customers traditionally require only one – or at most a few – POTS telephone lines. In most cases the revenues from POTS lines are insufficient to justify broadband digital plant.

But increasingly small businesses and high-end residential customers also demand data connectivity. This may be as simple as dial-up Internet access today, or simple web-hosting for smaller business customers. In addition, in many parts of the world, there is a strong and growing demand for entertainment video, mainly "Cable Television". The NGN opportunity in the access plant is to serve customers with bundles of voice, data and possibly video services over an integrated digital facility at a lower cost than would be possible with individual facilities. For somewhere between 5% and 30% of small business and residential customers, this opportunity is becoming economically feasible, and NGN architectures help make it affordable.

The bandwidth required depends, of course, on the service bundle desired. Bellcore's work indicates that an attractive bundle includes 2-4 voice lines plus "high speed" Internet /LAN access, and a minimum bandwidth of approximately 1 Mb/s or higher downstream, and approximately half that (384 kb/s – 512 kb/s) upstream. The bandwidth requirement increases dramatically if entertainment digital video capability is part of the desired services bundle.

Many transport technologies are capable of providing this level of performance, at reasonable costs. And the costs of these access technologies is falling every year. The most likely contenders are:

1. ADSL (and variants)
2. VDSL (for very data-intensive applications or where video demand is high)
3. HFC (coaxial) plant with Cable Modem technology
4. LMDS or other variants of high-speed wireless access

Bellcore believes that the access network will migrate slowly, beginning with "high end" customers. This allows NGN access technology to be deployed only where it is profitable, and where it provides a competitive advantage to keep important clients and grow new revenue sources. One important implication is that between 70% and 95% of all customers (representing the low end of the market, and consequently a much smaller proportion of total revenues and profits) will remain on analog POTS service. Thus, NGN-PSTN interoperability and coexistence will be of paramount importance. As Samuel Clemens (Mark Twain) once quipped "the reports of my demise are greatly exaggerated". Likewise, the reports of the PSTN's demise, and replacement by the Internet, overlooks the economics of serving the majority of POTS customers.

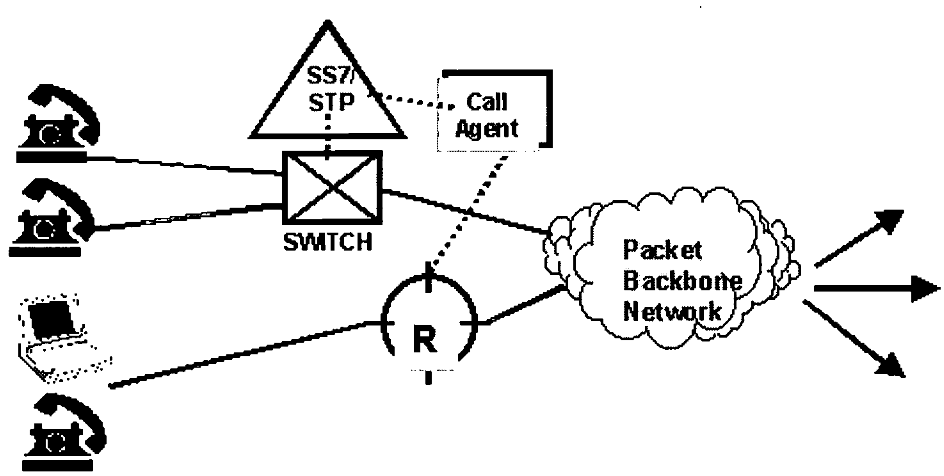


Fig #7: NGNs and Traditional Circuit Switches will Coexist for years

Next Generation Call Processing & Services Development Environments

The backbone and access evolutions involve challenging network engineering and economic optimization trade-offs, but no new technology. ATM, TCP/IP, SONET/SDH, ADSL, and HFC all exist. However, the call processing and services development environment will be entirely new, and will define the intelligence, the flexibility and the PSTN interoperability that will drive services, reliability, and thus revenues over the next decades.

For as long as there have been telephone switches, the features (services) have been linked directly to the switch. Only recently, with the invention and deployment of AIN, have carriers had the tools to develop services independently of switch manufacturers and provide differentiated services. Likewise, the call control logic (switching logic, signaling logic, call models) have been integral to the hardware, making telephone switches highly integrated and proprietary devices.

This architecture has benefits and disadvantages. The benefits have been the high reliability associated with PSTN switching. While loops may occasionally suffer damage from back-hoes or water, telephone exchanges have proven tremendously reliable, as well they should as the emergency nerve-centers of our society. Among the disadvantages have been high cost and slow feature introduction, when compared to "open systems" industries like computing.

Bellcore's vision of NGNs is one where the underlying packet-switching hardware (switches, routers) is independent of the call control logic. Likewise, the call control logic is highly flexible and provides open interfaces that enable the development of services. The call control logic and its APIs must be flexible enough to support services in the near future that transcend voice telephony and encompass data, unified messaging, and other mixed-media services.

This architecture has several advantages:

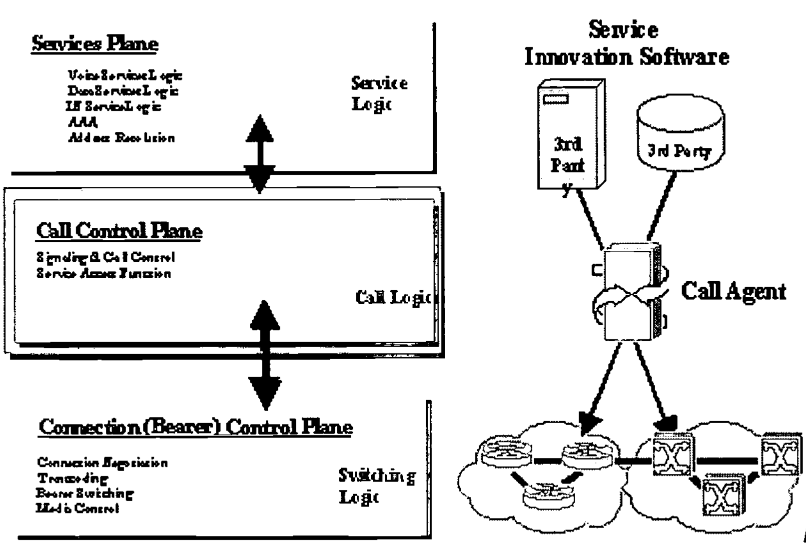


Fig #8: Hardware-Independent and Open

Call Control Architecture

1. It allows the deployment of packet backbones and the gradual adoption of packet based voice switching
2. It provides for flexibility in the selection of packet switching hardware
3. It allows flexibility and innovation in the development of new services
4. It allows carriers to provide unique and differentiated services, possibly by partnering with important clients to meet their needs

This architecture has very different requirements from the hobbyist / enterprise level "Internet telephony" experiments that have become popular in recent months. This architecture, rather, seeks to duplicate the levels of quality, reliability, scalability, ease of use, and features of the PSTN on an integrated voice/ data architecture. To achieve these goals, Bellcore first looked at the ITU IP telephony protocol standard H.323. Unfortunately, we found it lacking in three areas:

1. The complexity of H.323 resulted in too much overhead traffic
2. The complexity also resulted in poor performance and scalability
3. H.323 was not well suited to development of carrier-class feature sets

Consequently, Bellcore, with its partners Cisco Systems and Level 3 Communications developed its own call-control protocol – initially named the *Simple Gateway Control Protocol (SGCP)* and subsequently modified to meet Level 3's needs it became the *Media Gateway Control Protocol (MGCP).* MGCP has been submitted to both the ITU and the IETF as a recommended standard for use throughout the world. MGCP requires very little overhead and therefore operates on minimal CPE, scales well, and allows excellent performance. It allows complexity to be offloaded from the network into the call-control layer.

Summary:

This paper has looked at the market and business drivers to move from today's TDM PSTN architecture to one which is far more efficient in the transport and switching of data and mixed data-voice traffic. It has also suggested several strategies to migrate from the PSTN to a Next Generation Network architecture on an incremental, profitable basis. Finally, it suggests a modern services control architecture that allows for the immediate handling of voice telephony in an NGN architecture, and the support of advanced data and voice services in the future.

Return to Top View Full-screen

Telecom Mergers and Acquisitions Following the Asian Financial Crisis

Glenn S. Gerstell

ABSTRACT

Recent announcements by major international telecom operators unveiling significant new investments in Asia has marked the beginning of what may prove to be an important new phase in that region's road to recovery. In Korea, Bell Canada International (BCI) and the AIG Asian Infrastructure Fund (AIG) of the United States recently announced US$260 million worth of new equity and debt investments in Hansol PCS. Deals such as these are indicative of the new opportunities that the Asian economic crisis has presented to foreign investors.

View Full Text

Telecom Mergers and Acquisitions Following the Asian Financial Crisis

I. INTRODUCTION

Recent announcements by major international telecom operators unveiling significant new investments in Asia have marked the beginning of what may prove to be an important new phase in that region's road to recovery.

In Korea, Bell Canada International (BCI) and the AIG Asian Infrastructure Fund (AIG) of the United States recently announced US$260 million worth of new equity and debt investments in Hansol PCS. BCI will be providing not only much-needed cash but also new officers to take charge of Hansol's management and technical operations. In addition, British Telecommunications Plc (BT) recently closed two major Asian acquisitions: in Korea, the purchase for approximately US$400 million of a 23.49% stake in LG Telecom, and in Malaysia, the purchase for approximately US$470 million of a 33.3% stake in Binariang Bhd. Similarly, Philippine Long Distance Telephone (PLDT) has been widely reported at the time of this paper to be seeking a major strategic partner for its Piltel subsidiary to supply new equity and technical and operational expertise, and was itself the target of a possible takeover by the First Pacific Group of Hong Kong. Deals such as these are indicative of the new opportunities that the Asian economic crisis has presented to foreign investors.

The Hansol group, one of South Korea's largest *chaebol*, was spun off from the Samsung group in the early 1990s and is Korea's largest paper producer. Its other significant ventures include mobile telecoms, construction and investment banking. Each of these investments has suffered badly under the strain of the economic crisis, but Hansol has taken an aggressive approach toward attracting foreign investment to stave off further damage and, ultimately, turn its business around. Reportedly, Hansol's asset sales will reduce its debt to only 40 percent of equity. Hansol sold two-thirds of its main paper business for US$1 billion to Abitibi Consolidated of Canada and Morske Skog Industries of Norway, the largest foreign investment to date in South Korea. The investment by BCI and AIG of approximately US$260 million in Hansol PCS, which was struggling under a heavy debt load, unpaid subscriber bills and strong competition, represents another substantial step in the direction of financial health for Hansol and, presumably, a bargain opportunity for BCI and AIG. The investment works out to an acquisition cost of approximately $650 per existing cellular subscriber, which is less than half the current per subscriber value in the developed US cellular market. In exchange

- for their investment, BCI and AIG will receive equity stakes of 23.6% and 15.8%, respectively, through a combination of common shares, convertible preference shares and convertible bonds. In addition, BCI will play an active role in Hansol's financial and technical operations and will select several top executives, including the deputy chief executive officer and the chief financial officer. According to BCI, the Hansol investment will nearly double – to 2 million – the number of subscribers served by BCI operations.

Elsewhere in South Korea, British Telecom has announced a substantial investment in LG Telecom, another of Korea's digital PCS service providers, which had also been suffering from high debt service costs and competitive pressures to cut subscriber prices. Closed in early October, the deal reportedly calls for BT to acquire a 23.49% stake in LG Telecom for an approximate price of US$390 million, the largest single foreign investment in South Korean telecoms. BT will become the second largest shareholder in LG Telecom and, while it publicly admits that the Asian financial crisis and oversupply are affecting its business prospects, BT is reportedly taking advantage of this buying opportunity to position itself for the long haul in South Korea and Asia more generally. In particular LG Telecom will afford BT a strategic entry into the CDMA market, with over one million existing subscribers using that technology. In return, BT will assist LG Telecom in marketing the latter's telecom products and services in worldwide markets.

Indeed, just one week after finalizing its LG Telecom acquisition, BT closed its second major Asian investment of the year, the purchase of 33.3% of Malaysia's second largest cellular telecom company (with almost 500,000 subscribers), Binariang Bhd, for approximately US$470 million. This transaction represented the first major investment in Malaysia by a foreign company since Malaysia instituted capital controls this September. In the case of Binariang, it represents the second major injection of foreign equity -- it had earlier benefited from a strategic investment from former regional Bell operator US West (now MediaOne). But for its own corporate objectives, MediaOne wished to reduce its wireless operations in Asia, and it declined to make new investments in Binariang when the combination of the Asian financial crisis and local competitive pressures called for more funds -- thus allowing a new strategic partner and operator to enter the picture. MediaOne's holding in Binariang is now reduced to below 13%.

Three interrelated factors have generated these and other (as yet unrealized) opportunities. First, prices are low. The excitement of the mid-nineties in investing in Asian and Latin American telecoms enabled governments in privatization and licensing auctions, as well as domestic potential joint venture partners, to demand steep premiums of foreign equity investors. Now many of the telecom projects in Asia (and to a lesser extent Latin America) have been forced to revise their business plans downward to reflect overly optimistic revenue projections and higher expenses. Debt service is a major component of those expenses. The easy availability of funds from the bank syndicated loan and capital markets over the past few years also encouraged many new telecom companies to borrow more aggressively than in retrospect they should have. Some of those increased expenses are also due to the higher cost of dollars relative to the local currency, while others are attributable to, say, higher marketing expenses needed to attract initial customers or to offset churn among the subscriber base. As a result, existing shareholders can't point to rosy rates of return for prospective new equity holders, so less aggressive prices are being demanded of newcomers. Throughout the region -- from the KSO operators in Indonesia, to the private concessionaires in Thailand, to the new local exchange carriers in the Philippines, to wireless operators in Malaysia, Korea and even Hong Kong -- the story of financial troubles is the same. A further depressant on equity values is that even before the financial crisis swept over Asia, several major international operators who had previously joined the rush to invest were now in the process of rationalizing their holdings and divesting themselves of some Asian equity stakes that no longer fit into the strategic plan. Bell South, Ameritech and others have reduced their equity holdings in various telecom operators in the Asia-Pacific region over the past year, and several other international players were rumored to be willing to sell their "strategic stakes" if the right price could be found.

Second, existing shareholders in many telecom projects need funds quickly, either to inject into their projects with business plans in tatters or to salvage the shareholder's ventures in other industries that are also reeling from the same economic crises. So stakes in some telecom ventures that weren't available for sale at any price several months ago are now on the auction block. Finally, particularly in Asia, governments increasingly recognize that they too need to facilitate more foreign investment, and they are willing to bend limits on foreign ownership in the telecom sector or to otherwise encourage this investment. Notably, Malaysia loosened restrictions on foreign ownership of telecom companies -- but China, not (at least yet) faced with the same economic pressures and with a far different domestic situation, has recently deferred plans to open up telecom operations to foreign investment.

But not all of these recently uncovered investment opportunities are what they seem. Most need to be examined carefully to see what they actually contain. Investing in start-up or newly privatized telecom companies is difficult enough, and investing in financially distressed environments is fraught with even more risk. Common sense mandates extra examination in these circumstances. Yet the circumstances are often exigent. Frequently, a foreign investor is presented with a seemingly attractive investment opportunity, where the investor senses it may have a favorable bargaining position, but where it realizes it must act swiftly to capitalize on that superior position and to secure the investment. Perhaps the seller is demanding funds immediately or perhaps other scavengers are scouring the same beach. It is obvious that the need for speed is antithetical to the more extensive "due diligence" investigations clearly called for by the risk of investing in financially distressed circumstances. An investor must be prepared for the complex task confronting it in these situations, as there will be no time for trial-and-error approaches to investment decisions. With that in mind, here are some critical aspects of the process that an investor should give thought to beforehand in assessing and realizing upon the investment opportunity.

II. DUE DILEGENCE INVESTIGATIONS

The due diligence investigation regarding a company that is the subject of a prospective equity investment is of course the foundation of the investment decision itself. In the context of a financially distressed acquisition, that investigation assumes, if possible, an even greater significance. At the top of the list is the need to have a rigorous and detailed analysis of just what is the cause of the current business problem. Are the project economics affected solely by an external currency crisis, with the company's operations and prospects otherwise tracking the business plan? Or does the currency crisis or other macroeconomic circumstance spell trouble for the financial projections (as slowdowns in GNP growth and other indicators correlate so closely with telecoms subscriber take-up rates, minutes of use, overall business *versus* residential use, etc.)?

More disturbing, perhaps, and more difficult to uncover, is the possibility that in attributing business reversals so easily to macroeconomic or other external factors one may be overlooking internal deficiencies. Such facile and tempting attributions can obscure potentially deeper problems. A more vigorous business investigation is often called for in such cases to verify, for example, the installation progress or operational and financial performance of a telecom project. This may lead to an uncomfortable level of inquiry, as investors may be leery of pressing their putative partners too hard in uncovering the facts, or those partners may be defensive about the extensive and detailed scope of questioning required to ascertain the situation. And even if internal misjudgments are uncovered, for example, involving excessive discounting of handset prices, the inquiry does not end there, as a full market study may be required to determine whether current market conditions would allow a re-pricing that more appropriately reflects costs.

Normally, a prospective equity investor would rely on representations and warranties from selling shareholders or the issuing company itself, as set forth in a stock purchase agreement. These representations would invariably be buttressed by varying degrees of investigation that would justify the degree of reliance on the representations, ranging from simple review of audited financial statements and management interviews, to detailed review of a company's files and outside audits. This would especially be the case if the target of the investment were a publicly-listed company, as the investor could to some extent rely on the public disclosure rules in many jurisdictions to flush out most problems. Where financial problems are evident, however, more extensive investigations are required (even in the case of publicly-listed companies) to generate confidence in representations. Perhaps a spot-check of assets is warranted, interviews with the company's auditors are appropriate, or a random audit of subscriber billing records is called for.

Many telecom installation projects established over the past few years in the emerging markets were in the form of special purpose corporations owned by a consortium of domestic and foreign shareholders. These corporations were not creditworthy in themselves, but entered into equipment supply, technical assistance and operating contracts with various vendors and, often, limited recourse project finance arrangements with lenders. As a result, these corporations are subject to a complex array of contractual arrangements, and, again, more detailed analysis of these documents will be required. The financial problems besetting the project company may well have directly tripped various covenants or defaults in these contracts, or perhaps in response to those problems the company has suspended or abandoned its construction schedule, thus setting the stage for a future default. Or the default could be more subtle, for example as project finance lenders might invoke a "material adverse change" default clause in the loan documentation because of the Asian currency crisis. At a minimum, an investor would want to verify the status of such key contractual arrangements as an interconnection agreement with the public switched telephone network or a turnkey construction contract with a cellular network supplier. Clearly, in many cases there will be no substitute for a comprehensive review of a project company's vendor and financing contracts to see what existing and potential defaults confront the prospective investor. In some cases it may be appropriate for the investor to seek authorization from the company allowing the investor to inquire directly from vendors and other contractual counterparties as to the company's performance and prospects.

Presumably any foreign telecom operator shopping among the troubled projects in, say, Southeast Asia, would be sophisticated, experienced and large enough to be able to undertake the enhanced due diligence investigations necessary in a financially distressed environment. But even these investors increasingly rely on outside experts such as marketing and strategic consultants to verify demand analyses and business plans, accounting firms to conduct special audits, international legal counsel to review contractual arrangements and technical advisors to assess the company's technology and network design. These experts are brought in not only to assist with the sheer scope of the investigation, but also to place their independent imprimatur on the results. Many board members, let alone the business development officer in the field, will feel more comfortable in making an investment in a troubled situation if outside experts have vetted the opportunity. And of course, not all investors have adequate resources in-house, as funds and other financial investors are also looking at these opportunities, and they may be less familiar with the industry or may not have the internal operational expertise required for such investigations. The consequence is that for almost every investor the extensive examination required for an acquisition in a financially distressed situation will entail outside experts. Moreover, many of the recent telecom ventures have been undertaken in developing countries where the depth and sophistication of the local bar is not up to international standards. Investors have in such cases frequently utilized international law firms to "look over the shoulder" of local counsel and help with the sheer logistics of these multiparty transactions. Coordinating the endeavors of these experts and marshaling their findings in a coherent and useful fashion are tasks that the careful investor would do well to plan for beforehand.

While lawyers will figure prominently as one of the outside experts utilized in any cross-border acquisition, their scope of inquiry will of necessity be broader in a distressed situation. An investor should seek advice from local counsel as to the country's bankruptcy laws, because of course the situation could go from bad to worse, notwithstanding the investment. The efficacy of judicial recourse generally in the country will be a subject of examination, as a prudent investor may want to know if it can sue local shareholders that default in their future capital contributions. As noted above, this extended legal inquiry will often be overseen by outside international counsel, who may bring to bear their often greater sophistication and ability to apply experiences from other countries to the current situation.

III. NEGOTIATIONS IN THE DISTRESSED ENVIRONMENT

Negotiations over an investment in a company in financial distress can be especially problematic. The desultory, sometimes almost languid, pace of negotiations in proposed start-up ventures is not seen in the distressed context. There, intense time pressure, typically generated by the company's imminent cash flow shortages, pervades the negotiations. Personal emotions also enter the picture, as desperate selling shareholders may be irritable at best, or senior corporate officers may be guilty or defensive about deficiencies or oversights for which they may be blamed. The Indonesian CFO who saved corporate funds by avoiding costly Rupiah-Dollar hedges in early 1997 now looks imprudent. Compounding the problem is the fact that those same time pressures often mandate that the extensive due diligence investigations described above must occur in tandem with the negotiations, before the investor has had a chance to obtain, let alone factor in, their results.

The usually unequal bargaining power found in distressed acquisitions itself spawns difficulty. While the foreign investor typically enjoys the superior negotiating leverage afforded it by the selling shareholder's or company's urgent need for funds, this uneven situation leads to brinkmanship negotiations, where the investor finds it all too easy to place issues on a "take-it-or-leave-it" basis, knowing full well how badly its investment is required. While such an investor may secure the investment on that basis, negotiations can become especially contentious, and it may well have poisoned the long-term relationship with its new partners. Thus, the investor can be put in the sometimes frustrating situation of according its negotiating partners more rights than they are entitled to by reason of their distressed circumstances, in an effort to encourage future harmonious relationships. Only time will tell whether that strategy proved wise, or whether the investor wound up with fewer rights than it could have insisted on *and* an ungrateful fellow shareholder.

An ironic and vexing feature of the overall superior negotiating position enjoyed by the foreign investor is that its power to effect change is often circumscribed by the structure it is investing into. At a minimum, the target company may not have sufficient authorized capital to permit the proposed investment or perhaps the optimal instrument for investment is not common stock but a new class of preferred or a convertible bond that requires lengthy corporate or shareholder approvals. Prospective acquirers of course appreciate that, unlike investing in a new venture where one is writing on a blank slate, they are entering into already established shareholder arrangements. From the investor's viewpoint, the situation is manifestly worse where one existing shareholder is selling its stake, as opposed to the case where a company is issuing new shares and presumably would be more receptive to changes in minority voting protections, board representation, capital contributions and other matters typically of concern to incoming shareholders. An investor may seek changes in a company's articles of association, by-laws and shareholders agreements to protect or help attain its business objectives in the investment, but time may not permit the lengthy approval process often required in many developing countries for changes to articles of association, or perhaps the other shareholders have little incentive to acquiesce in such changes. Of course, at some point the other shareholders will have to calculate the risk that their lack of concurrence will cause the prospective investor to walk offstage, but maybe others are waiting in the wings.

One consequence of being forced to accept existing arrangements is that investors may wish to place greater reliance on the commercial and contractual arrangements with the other shareholders or the company, rather than on structural or legal protections found under the articles of association or local corporate laws. For example, ideally an investor might ask that the articles of association be amended to require that a technical assistance agreement with the proposed investor could be terminated only with the board votes of that investor (presumably if it were not in default). But if amending the articles would take too long, then instead the investor might take special steps to structure the technical assistance agreement so that it would be very costly for the company to terminate the agreement.

As an outgrowth of its due diligence investigation of the business plan, a new investor will often insist on changes, sometimes dramatic, to the company's installation schedule and operations. To insure the efficacy of its investment, the investor may demand that its equity injection be devoted to a particular capital expenditure or be held in reserve for contingencies, rather than be consumed in continuing operating losses. Again, this may entail obtaining the concurrence of whatever majority of board directors or shareholders as may have been specified for amendments to the business plan.

Yet another area, and a critical one, where an investor in telecom projects must deal with existing arrangements is the "sponsor support" that project finance lenders may have required. Typically, commercial bank lenders to telecom projects in the emerging markets have insisted on substantial equity components of a project's capitalization. This is obtained through contractually committed equity contributions from shareholders, some of which may be contingent on the company's cash shortfalls or financial ratio failures, and non-creditworthy sponsors are often required to post letters of credit to back up their equity commitments. A proposed new equity investor must recognize that first, the lenders' consent may be required for the share issuance or transfer (often not an obstacle where the new investor may be a savior), and second, the lenders may insist on the investor assuming the same, or perhaps greater, future equity commitments to the project.

An investor already deep in negotiations with existing shareholders or the company may thus have to open a second or third front with the project lenders. And this additional front may be a wide one. The lenders may use the occasion to demand that the new equity injection be spent in a certain way, perhaps to bring debt service current or to fund a debt reserve account, ways that the new investor may well regard as having value only insofar as it buys the lenders' cooperation. Again, time pressures and brinkmanship are features of these negotiations with lenders, who on one hand are eager to reach into the new investor's deep pockets, but on the other realize they can ill afford to scare away any source of equity.

But it is not simply a question of how much, if any, support the new investor will give to the financially distressed project. The investor will want to be assured that its outlay of funds (whether to selling shareholders or to the company itself) will not be followed by lenders' enforcement action or liquidation. As a result a prospective acquirer will insist that, for example, as a condition to its investment the lenders waive existing defaults or loosen covenants to avert future defaults, or in more distressed cases, postpone debt service payments, stretch out amortization schedules or even write-off debt or convert it to equity. These "workout" discussions can be protracted and complicated, with their success hinging in part on how desperately the lenders need the new investor, whether other alternatives are available and whether the investor can credibly establish its interest. The last point is often difficult, as an investor may not know whether a particular acquisition makes sense unless accommodations with lenders are reached, and those in turn are hard to achieve without a conviction on the lenders' part that the investor is likely to proceed. These lender negotiations require great skill, a clear and convincing communication from the investor as to its minimum conditions, and sufficient time to be consummated in the context of the overall investment negotiation.

A concurrent, but typically less intense, series of negotiations may need to be undertaken with vendors and other contractual parties to the company, seeking waivers of defaults, amendments and the like. The detailed due diligence investigations noted above will have indicated where negotiations or restructurings are warranted. Vendors are often more pliable than lenders, in part because of the former's ability to recoup losses through future sales. Furthermore, equipment vendors may have a global relationship with an international telecom operator and can thus be persuaded to make concessions to facilitate a particular investment so as to preserve that larger relationship. Finally, another crucial series of negotiations that may be required, reflecting the significance of telecommunications to national infrastructure, is with the government. Many telecoms concessions and licenses granted in Asia and Latin America require that changes in shareholding structures be approved by the relevant authorities. While most would presumably welcome with open arms a new investor in a troubled project, they may insist on unattractive conditions for the investor or may not wish to acquiesce in the investor's requests for certain concessions or waivers.

As if the prospect of extensive due diligence investigations and multiple concurrent negotiations were not daunting enough, a final hurdle often remains for those investors that seek to finance their acquisition. While using internal equity to fund the investment may be the quickest and simplest, it obviously does not take advantage of the possibility of leveraging the investment for a higher return. Thus, many investors in the emerging markets will want the higher risk offset by the prospect of a higher return through a financing of their investment. The very problems that led to the financial distress of the to-be-acquired company are likely to cause international lenders to be wary of further extensions of credit in support of that company or more broadly in that country. So financing, at least on attractive terms, may be hard to come by. If the investor desires to limit recourse to itself in some fashion or if the investor does not have sufficient credit standing to support an investment of this magnitude, the potential lenders to the investor will to some extent want to look over the terms of the investment. That, of course, raises the specter of the investor's own lenders second-guessing the decisions of the investor, and presumably any investor will want to keep its lenders out of the decision-making and negotiating process for the underlying investment. The situation is complicated enough!

The Asian currency crisis has generated some attractive investment opportunities, but they require exceptional levels of due diligence investigation and complex negotiations with lenders, governments and others that are often not involved under more stable circumstances. Compounding the difficulty is the need to make rapid investment decisions before the company's imminent cash shortages eliminate the opportunity entirely. With careful examination and some luck, the skillful investor will be able to discern the valuable opportunity from those better left alone and to minimize risks in executing a well-structured acquisition.

Return to Top View Full-screen

A Compatibility Framework for Evaluating Communications Industry Strategic Alliances

Michael McGrath and Elizabeth More

Macquarie University, Australia

ABSTRACT

This paper outlines a study in progress, focussed on inter-firm cooperation through mechanisms of strategic alliances within the Australian communications industry. The study aims to increase understanding of how such structural arrangements actually work - how they are formed, organised and managed over time. One aim is to move beyond the current, superficial rhetoric promoting such arrangements as the answer to industry ills. A complementary (and equally important) objective is the development of a "compatibility framework", designed to guide prospective inter-organisational collaborators in the establishment and management of a proposed partnership and to identify likely outcomes. A prototype implementation of an early version of this framework is described.

View Full Text

A Compatibility Framework for Evaluating Communications Industry Strategic Alliances

I. INTRODUCTION

This paper draws on experiences with cooperative relationships and the practice of such relationships from the perspective of the Australian communications industry - including computing, telecommunications and the media. Specifically: 1) we present some results of an earlier, longitudinal, 3-year case study which traced the development, progress and management of a number of the major relationships within the Australian telecommunications industry; 2) we then present details of a follow-up study, where we have extended the scope of our original investigations to encompass the wider communications industry; and, finally, 3) we outline details of a *compatibility framework,* designed to guide prospective inter-organisational collaborators in the establishment and management of a proposed partnership and to identify likely outcomes (both positive and negative).

Technology and value-added services enable the identification and development of new types of products, business opportunities and information technology applications, encompassing the three industry sectors identified above. Full advantage of these applications, however, can only be taken if the right alliances are in place, the business and regulatory environment is favourable and, critically, the alliances are managed effectively. Importantly, while there has been considerable research into strategic alliances over recent years, most studies have focused on types of alliances and contractual arrangements, often from an economic perspective. Few studies have explored the nature and management of ongoing relationships per se (Price, 1996).

The compatibility framework referred to above identifies critical success factors for strategic alliances (derived both from the literature and our own communications industry research). Our early results indicate that establishing an effective collaborative partnership requires a much more fine-grained analysis than has traditionally been employed in investigating these types of inter-organisational arrangements. For example, it is not sufficient to merely look for compatible motives, organisation sizes, strengths, weaknesses, product and customer bases etc. These are undeniably important but no more so than factors such as: getting the miniature of interface management right; establishing an atmosphere of mutual trust; and ensuring effective one-to-one communication at all levels of the interface. We have implemented a prototype version of our framework as an advisory expert system that can be employed: 1) to indicate weaknesses in the detail of the proposed arrangements; and 2) to suggest possible solutions. Stage 3 of this development involves the implementation of a module that can be employed to predict the likely outcome of a proposed inter-organisational alliance. This work builds on our previous research into both strategic alliances within the telecommunications industry, and into the development and automated implementation of organisation and management theory models (McGrath, 1994, 1998; More and McGrath, 1996).

733

731

II. STRATEGIC ALLIANCES: BACKGROUND

"... more alliances and co-operative arrangements have been announced since 1981 than in all previous years. The current wave of alliance activity between firms from advanced market economies is expected to persist ... and alliances are increasingly being recognized as a significant organizational form."

(Glaister and Buckley, 1998: p.89)

While not a new organisational form, especially for entry into markets of developing countries, today alliances are burgeoning even in advanced market economies (Glaister and Buckley, 1994). This is largely because of their flexibility in structural terms when broadly based but also because of the escalating need for interdependencies in organisational life, both internally and externally to meet the demands of increasingly complex and competitive environments globally. Particularly in high-technology industries, remarkable growth in organisational cooperation and collaboration, both nationally and internationally, has provided a fertile field for theory building and testing.

Collaborative relationships may be regarded as those special affiliations between at least two organisations, aimed at pooling resources, having joint activities, research and development needs, and endeavouring to attain competitive advantage. Ideally there should be respect for organisational autonomy and individuality and an emphasis on some sort of permanent commitment. Such relationships are motivated in numerous ways, including government regulation, risk reduction, competition and the like. Actual agreements and structures are also diverse, ranging from the extremes of internal organisation and pure contractual arrangements, to the popular joint ventures, strategic alliances, and broad partnerships.

A major part of the research in the field has concentrated on the rationale for collaboration forming rather than the more diffuse and intangible area of development of such relationships over time. Experience with research into the Australian telecommunications sector, the results of a longitudinal case study (More and McGrath, 1996) exploring the development, progress and management of broadly based strategic alliances between suppliers and customers, demonstrates some pivotal lessons that go beyond the mere economics of collaboration.

Our study focussed on Telstra, the previous monopoly telecommunications carrier, and its four strategic alliances (Alcatel, Ericsson, Nortel, Siemens); the second general telecommunications carrier, Optus, and its five strategic partnerships (DEC, Fujitsu, Leighton Contractors, Nokia Telecommunications, and Nortel Australia); and the third cellular mobile company, Vodafone, and its two alliances (Ericsson Australia and Keycorp). Extracting rich data from intensive interviews with key managers and senior executives involved in telecommunications alliances and with those in Government bodies and industry associations, the following key findings emerged:

- While many relationships were initially based in expedience, centred on operational, pragmatic and short-term needs, this did not necessarily diminish an alliance's strategic element, nor exclude the possibilities of future longer term relationships.

- Major overt motivations for relationships included increased innovation; access to labour, technology and expertise; market access and global market capability; and risk sharing. An underlying covert motive was the pressure by Government for such relationships, in order to promote local industry hand in hand with technology transfer from multinationals to Australian companies.

- Some of the key areas of concern were: pressure for rapid return on investment; employing and keeping suitably qualified staff; the time involved in maintaining relationships; and difficulties with professional cultures undermining broader organisation strategy and culture.

- Vital benefits encompassed product development, growing business opportunities, profit, credibility, technology access, speed, quality output, access to markets, competitive advantage, reduced costs, and organisational learning.

- Critical success factors (CSFs) in management of the alliances included assigning alliance management responsibility to a specific individual or group; little reliance on formal legal arrangements; clear coordination and control mechanisms; a heavy emphasis on commitment, trust, and effective communication; and the necessary senior management involvement in the creation and nurturing of relationships.

With reference to the last of these, effective coordination and control was consistently mentioned by our interviewees as being absolutely vital. Relationships between some of the more common mechanisms employed are illustrated in Figure 1. Examples used in the remainder of the paper will be based largely on the coordination and control CSF and this representation.

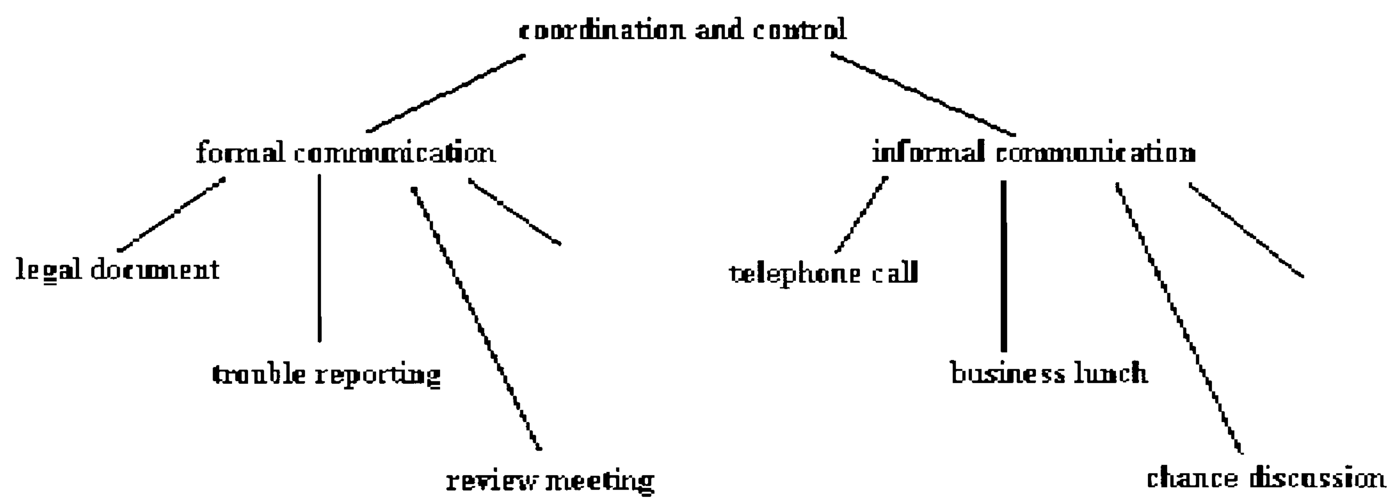


Figure 1: Alliance coordination and control mechanisms.

III. CURRENT STUDY: RESEARCH DESIGN

Much of the literature, academic and popular, theoretical and pragmatic, has focussed in the main on relationships within specific industries, whereas current developments suggest that, at least in some arenas, what is emerging is cross industry collaboration of diverse types. Nowhere is this more apparent that in the convergence of telecommunications, entertainment, computing and media industries - for us, evident in the conglomerate known as the Australian communications and entertainment industry. What we find here is the convergence of telecommunications, media and communications technologies and services between traditional broadcasting and other types of media and communications services. This has involved increasing interdependencies in areas that must cooperate with each other in forging the pivotal nexus between content, form, and transmission in order to be competitive in the global marketplace.

In the Australian communications sector there are a myriad of contemporary problems. These follow the 1997 Telstra float to sell one third of the Government owned telecommunications carrier and the July 1 start of industry-wide deregulation with full competition in services and facilities. They include:

- Cross media ownership laws
- The perceived versus the real nature of competition in a deregulated environment
- The desire for cable to deliver more than pay – i.e. competitive telephony
- Pay television operators struggling to balance television and telephony, with losses in the billions of dollars over the last few years
- The proposed sale of the other two-thirds of Telstra
- The regulatory nightmares posed by different technologies in terms of universal service funding arrangements
- Global pressures, possibly affecting Government's abilities to set local content requirements and regulations on ownership
- Controversy over digital broadcasting for radio and television; and
- Ongoing debates about the national broadcaster (the Australian Broadcasting Corporation), tax concessions for the film industry, and outsourcing in both

Ongoing convergence and the introduction of digital television gives rise to ongoing challenges to traditional ways of regulating broadcast media. In 1998 the current free-to-air television companies were given exclusive rights to digital terrestrial transmission until 2008. An infinite variety of services and opportunities will severely test legislators, financiers, technologists and the public. HDTV broadcasting is set to commence in metropolitan areas at the beginning of 2001, bringing with it a whole new set of concerns.

Some claim that the Government's decision to give the digital broadcast spectrum away free to existing networks, who will be protected from competitors until 2008, is a serious mistake. As the Sydney Morning Herald (13 July, 1998: p.14) puts it:

> *"This is an issue that goes far beyond an interest in the range and quality of television reception. In fact it goes to the heart of the information age and the type of economy that will be built on it. Digital broadcasting constitutes the next breakthrough in data delivery. When linked to television it will provide the pipeline for a range of information services,*

including the Internet. The advantage the Government has just handed the existing networks is that they will be able to provide a range of data services to their established audiences while other data service providers ... will be restricted in taking full advantage of the integration and cross-marketing benefits arising from the new technology. Ultimately the loser is the customer because the Government is precluding the possibility of better and more innovative services in a more efficient and competitive industry."

Given such complexity it is hardly surprising then that industry members find the need for increasing collaboration. We find partnerships and joint ventures across the industry. These include:

- The recent 50/50 partnerships between Australian Consolidated Press and Time Warner Inc. – a magazine publishing house in Australia called Premier Magazines
- The joint venture in pay TV, between News Ltd and Telstra, a collaboration between the giants in Australia's newspaper and telecommunications industry for the major cable player Foxtel
- The joint venture between the commercial television player, Seven Network with Optus Communications, again uniting telephony and pay television
- Publishing and Broadcasting Ltd's Channel Nine joint venture with Microsoft Corp. to provide online consumer products for Australia, New Zealand and New Guinea; and
- The joint venture of IBM with Telstra and Lend Lease for information technology outsourcing

In addition we have a burgeoning multimedia industry, alongside the more focussed information industry interest with growing e-commerce, and other dimensions to the Internet. Electronic commerce is a real focus for both industry and the Government, given that it is not just concerned with delivering the traditional in a new way but also with new products and service, changing markets and demographics, efficiency and effectiveness, a real client focus, competition and the like.

Consequently, the environment is changing and developing even more complexities as we move beyond the within-industry relationships that our earlier study investigated in telecommunications. Moreover, a number of studies have indicated that a significant number of inter-organisational collaborative arrangements fail: studies by McKinsey and Co., Coopers and Lybrand, among others, have reported that 7 out of 10 joint ventures do not meet expectations or disband; international alliances are even more prone to failure (Stafford, 1994); Bain and Co. found that only 2% of all alliance negotiations actually produced lasting performance improvements for those involved; and, finally, even when they succeed, strategic alliances are expensive exercises (Rigby and Buchanan, 1994). What we are attempting now is to map and model these more intricate collaborative organisational relationships in order to better understand the realities of strategic practice and performance in these high technology arenas. A secondary aim is to produce some sort of aid, based on the best research and experience reports available, that might be used by prospective collaborators to: guide the establishment and operations of the arrangement; and, quite possibly, to predict negative consequences before the event.

741 742

Our research design is illustrated in Figure 2. Our earlier detailed study of the Australian telecommunications industry produced a wealth of information that has both informed and motivated our follow-up study of the wider communications and entertainment industry. A further outcome of our earlier study was a preliminary list of strategic alliances CSFs. We have since used these to develop a preliminary version of a *CSF Model*. Findings from our current study will be used to refine this model which, in turn, is the basis for our *Compatibility Framework* - the automated implementation of which is, in effect, an advisory expert system. A prototype system, based on our earlier study and preliminary findings from the current study, has already been implemented (detail is presented in Section 5).

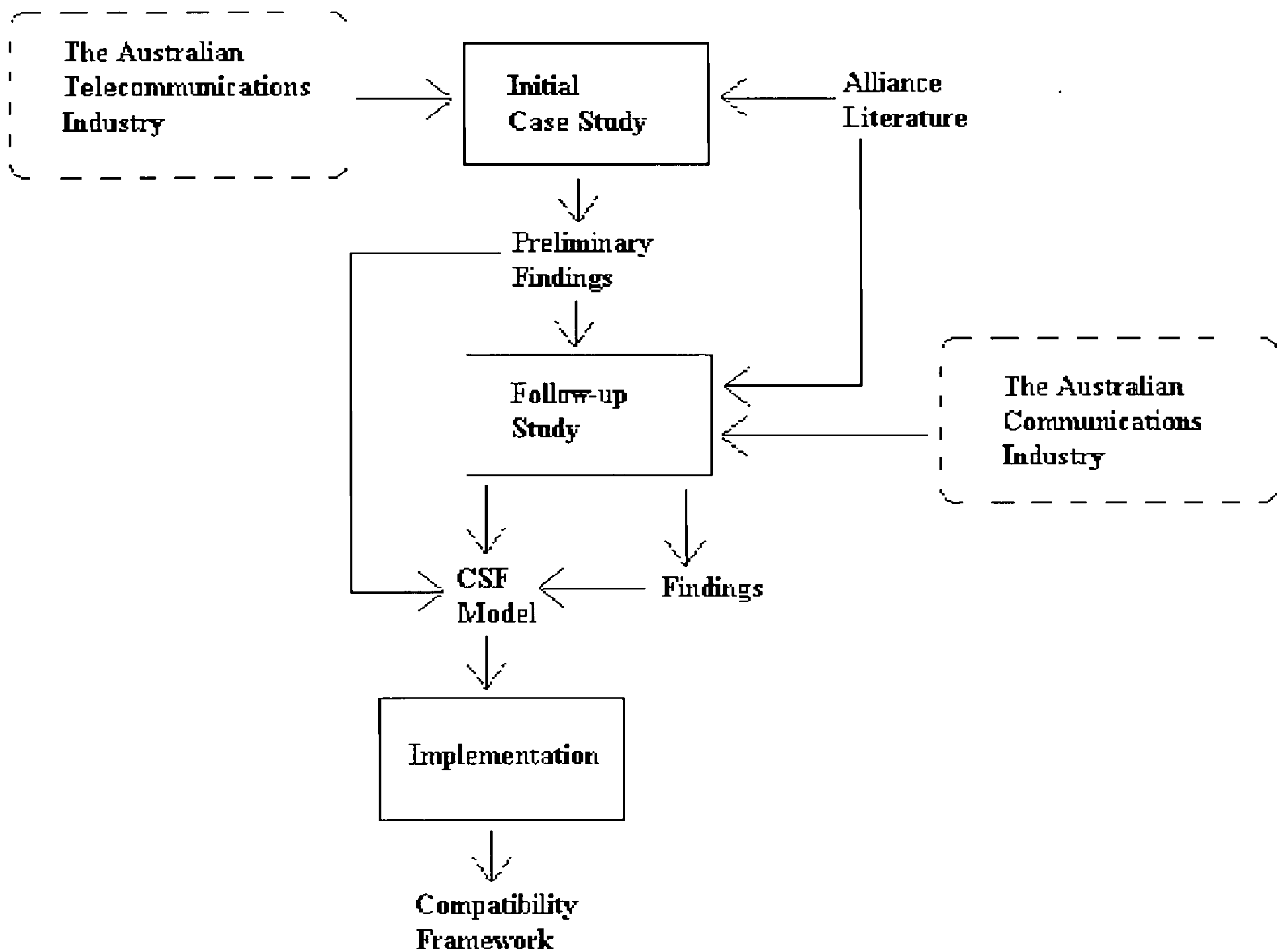


Figure 2: Research design.

IV. RATIONALE FOR MODELING

Not surprisingly, the challenging environment faced in Australia and internationally across telecommunications, computing, media, and entertainment industries, encourages organisations to investigate means for better control and prediction amidst the chaos and uncertainty. Consequently, the need for some answers being provided by modelling ought be investigated. Some of the bases for looking towards modelling include the real need for some sort of certainty and predictability; a psychological and business imperative for control; the emotional desire for predictability; concerns over government policy; costs containment; and the reality of formal modelling helping to clarify theoretical management constructs and practice.

Unfortunately, however, many organisation and management theory (OMT) models leave much to be desired. For example, in an important recent work, Jaques (1996) has argued that, despite massive efforts by organisation and social science experts, only the merest beginnings of an organisation and management science have become evident. In arguing this case, he reserves particular criticism for *"the pile of vague and ill-defined terms that litter the field"* and notes that "*Without --- clear meaning it is impossible to think, or to test propositions, or to talk to one another with any hope of understanding"* (p. 10). These observations are consistent with an increasing body of OMT research that has addressed the benefits of formal models as opposed to informal, literary theorising. For example, Bendor and Moe (1992) claim that more formal representations clarify chains of reasoning and simplify the task of verifying that conclusions do, indeed, follow from assumptions; McGrath (1994) points to the clarification of concept overlaps, ambiguities and inconsistencies; and Curtis, Kellner and Over (1992) suggest that the properties of multiple model perspectives can be analysed more accurately where representation constructs are formally constrained. In addition, formal models can generally be implemented more readily and modelling both "soft" and "hard" data, using a common approach, reduces the possibility that the critical softer aspects will be overlooked. There is, however, little consensus on the merits or otherwise of the various candidate specification languages and schemes.

Cecez-Kecmanovic and Marjanovic (1995) have proposed a theoretical framework for investigating the nature of organisational processes from a social interaction perspective. A detailed description of this promising (but relatively immature) modelling perspective is beyond the scope of this paper but they, along with others, are critical of the well-established, more formal alternatives employed for the representation and communication of organisational knowledge: specifically, the management information systems (MIS), rational choice (RC), artificial intelligence (AI) and object-oriented (OO) approaches. Below, some brief observations relevant to the AI and RC approaches are offered.

Organisations can be viewed as information processing systems (IPS). Newell and Simon (1972) presented an IPS model in which organisational parties, with limited information processing capabilities, can solve complex problems through *division of labour, specisalisation* and *cooperation.* This mirrors a common AI problem solving method, which involves: the recursive dissection of a problem into subproblems (division of labour); the selection of subproblem-appropriate operators at each node of the solution search tree (specialisation); and backtracking, combined with directed information flows to promising processes (cooperation). The analogy can be taken further, since the organisational rules used to resolve routine decision making situations are often expressed in "Standard Operating Procedure" manuals in a form very close to expert system, *If-Then* style production rules (or, at least, can be readily and naturally translated to this form). Thus, the attractiveness of the AI approach for modelling and simulating many organisational decision making situations can readily be seen.

Bendor and Moe (1992) while noting that, within the subfield of studies of public organisations, RC analysis has become the dominant mode of thinking, point to a number of problems. Specifically: 1) some heroic assumptions are made regarding the information processing capabilities of organisational parties; 2) little allowance is made for "out-of-equilibrium" behaviour; 3) there is an undue focus on dyadic relations (e.g. an agency and a median legislator); and 4) the goals of key parties are often treated in a highly-stylised manner (almost to the point of caricature). Despite this, they point to the benefits and successes of the approach, together with the speed with which the paradigm has been adopted (particularly within the subfield of the study of public organisations). The authors conclude that the gap between the rich literary descriptions of organisations (employed for the great majority of OMT specifications) and the spare, quantitative RC models is so wide that researchers might conclude that they face a dichotomous choice: either pursue a descriptive approach, resulting in rich but loosely-structured models, or give up most of what they know and build rigorous but highly-simplified models!

Recently, however, considerable attention has been focused on the relative merits of *qualitative* and *quantitative* representations of organisations and OMT. Early models were highly quantitative: principally because, as noted by Masuch (1992), if a computerised implementation was desired, model developers had little alternative. Masuch though, further notes that much OMT is highly-qualitative and this, combined with the relatively recent proliferation of powerful AI tools outside laboratories, has resulted in a pronounced shift towards qualitative models. Despite this trend, however, he cautions against over-enthusiasm for the qualitative approach and quite sensibly suggests that a quantitative conceptualisation scheme should always be employed where details of the phenomenon under study are most naturally expressed in quantitative terms. Such an approach accords with the modelling philosophy underpinning this work where our models are represented in a variety of formalisms - both qualitative and quantitative. This is consistent with the view of Curtis et al. (1992) who have argued that different modelling objectives, user diversity, conflicting requirements and the need for both large and small-grained levels of abstraction all demand OMT models permitting multi-paradigm representations.

V. A STRATEGIC ALLIANCES COMPATIBLITY FRAMEWORK

Our compatibility framework is illustrated in Figure 3. At its core is a strategic alliances CSF data model, derived from our industry studies, and represented in entity-relationship (E-R) form (Chen, 1976). Much of the material gathered during our studies can be classified as beliefs, values, norms and heuristics. These are represented within our framework using *activity theory* (Kuutti, 1996), a theory that, in our view, is well-suited to the explication of *softer* organisational behaviour knowledge of this sort. The *harder* data (or more well-structured elements) of our model have been implemented as a Microsoft *Access* database, while the remainder has been implemented using our *SATBPA (System for Activity Theory Business Process Analysis)* tool (Ellison and McGrath, 1998). SATBPA employs the *ESTA* expert system shell (to assist with the entry of data on the specific alliance being analysed) and the *Axon* "idea processor" (used for much of the knowledge manipulation and analysis). Further detail on each of these framework components is provided in the following subsections (5.1 - 5.3).

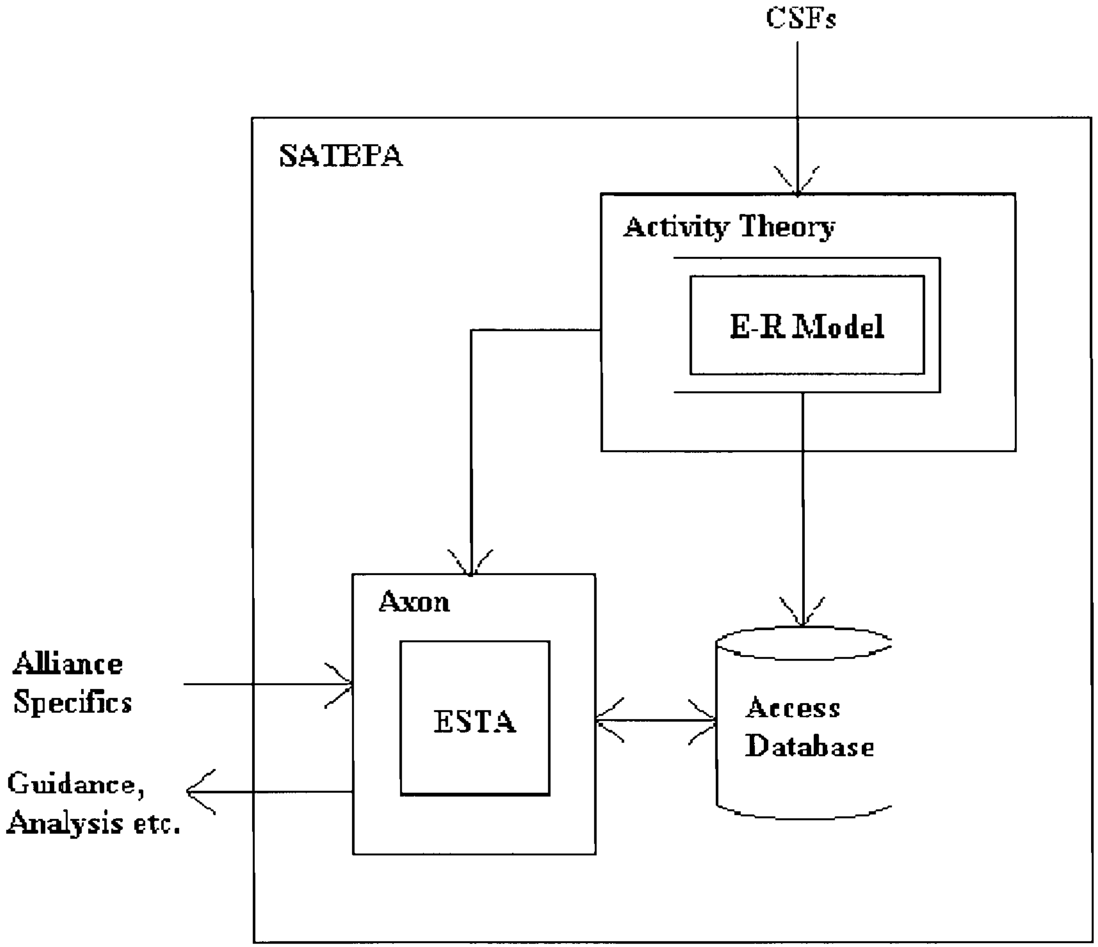


Figure 3: Compatibility framework.

1. ***Activity Theory as a Basis for Business Process Modelling***

749

Activity theory was originated by the Russian psychologist Lev Vygotsky (1978) around 1930 and subsequently became one of the major Soviet psychology theories, being used widely in areas such as the education of disabled children and the ergonomic design of equipment control panels. More recently, the theory has been used in the area of HCI design (Nardi, 1996). Here, we briefly introduce activity theory and our own interpretation and automated implementation of some key elements of the theory. For a detailed introduction, the reader is referred to Kuutti (1996).

An *activity* is seen as a system of human "doing" whereby a *subject* works on an *object* in order to obtain a desired *outcome*. In order to do this, the subject employs *tools*. A subject may be an individual or a composite entity (e.g. a company, an organisation unit or a labour union). Many subjects may be involved in an activity, and each subject may be involved in one or more roles and have multiple *motives*. *Rules* (which include norms, values, beliefs etc.) are both explicit and implicit, and specify how subjects fit into communities. An activity may be broken down into *actions* and actions, in turn, may be decomposed into *operations*. Actions are well-defined processes directed at specific, conscious *goals*, while operations may be thought of as (largely) automatic responses to prevailing *conditions*. Activities, in time, may become actions and actions, when well-entrenched, may become operations. Movement in the other direction within this hierarchy is also possible. Finally, one subject's operation may be another's action or activity (where, for example, the former is experienced and the latter is a new hire).

Within the inter-organisational collaboration domain, "formal communication" might be an activity, with "trouble reporting (TR)" as a subsidiary activity. Subjects involved in this latter activity could include alliance coordinators. One significant object of the activity is the report itself, and tools used to assist subjects could include documented procedures supported by an automated control system and performance reports. Activity outcomes are closely related to motives and these often vary with subjects. For example, in a carrier-vendor alliance, the coordinator on the vendor side will want to keep TR to a minimum while the carrier coordinator may be using the reports as a means of improving vendor performance (i.e. by applying pressure). Rules include well-documented specifications of which subject should do what and when, as well as beliefs such as "the carrier coordinator is out to destroy this alliance" - perhaps a reasonable response from a vendor coordinator inundated with trivial reports.

SATBPA is an automated tool that provides an interface to a database designed to record the detail of business processes in a form consistent with activity theory. This work has been described in more detail by Ellison and McGrath (1998), where it was remarked that SATBPA is intended as the first step towards the development of a methodology for the structured application of activity theory in business process modelling. This addresses a major problem currently confronting potential activity theory practitioners — namely a distinct lack of any clear, prescriptive guidelines.

Formal conceptual modelling techniques have been employed to define the SATBPA repository. As such, we have found it necessary, on occasions, to employ terminology other than that found in the more standard presentations of activity theory. In particular: 1) the concepts of subject and community have been combined into a single notion of *subject;* 2) subjects can be decomposed in many different ways, and can be involved in many relationships with other subjects in different *roles;* 3) we have eliminated Kuutti's 3-level hierarchy (Kuutti, 1996) and replaced it with the single concept of a *process,* which may be decomposed to as many levels as the user desires (note though, that the user may still type any process as an *activity, action* or *operation);* 4) tools and objects have been merged into a single *artefact* concept (recognising that an object produced by one process can be utilised as a tool in another process); and 5) the rules that define communities and the division of labour have tentatively been labelled *understandings* (and are the predominate means employed for the representation of soft factors).

2. *Our Data Meta-Model*

The framework repository is specified conceptually at both the data and meta-data levels in E-R form (Ellison and McGrath, 1998). An abbreviated version of the data meta-model is presented below in Figure 4:

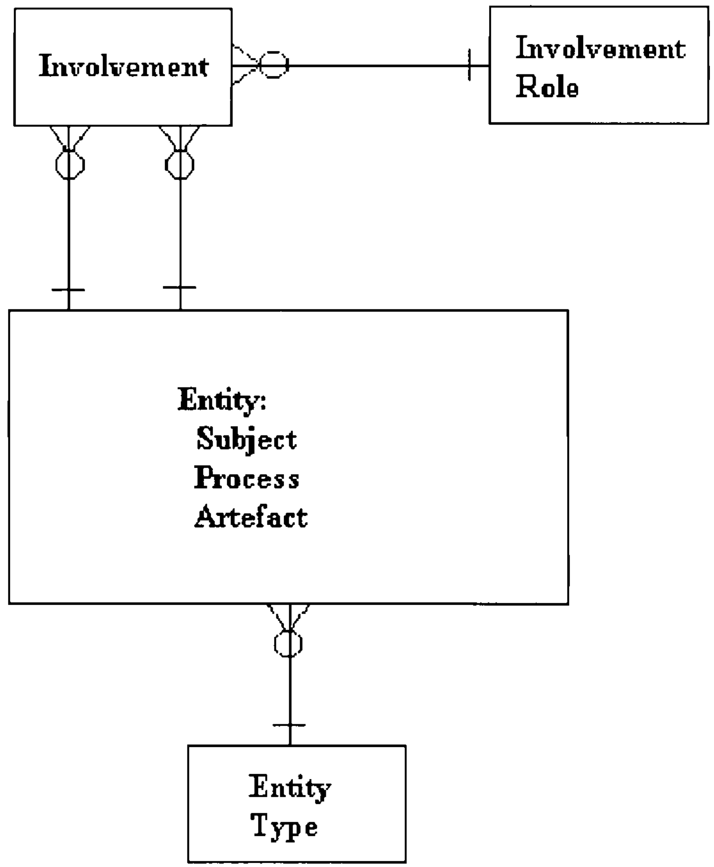


Figure 4: Compatibility framework data meta-model.

The repository itself has been implemented in Microsoft *Access* and a sample database, with a relational schema derived from our E-R model is presented in Figure 5. Examples presented in the remainder of the paper are based largely on the data in these tables.

subject	subj-id	subj-type		process	proc-id	proc-type
	Coordinator-1	person			TR	formal commn
	Coordinator-2	person			telephone call	informal commn

753

754

spi	subj-id	proc-id	spi-role
	Coordinator-1	TR	instigates
	Coordinator-2	TR	resolves

ppi	proc-1	proc-2	ppi-role
	TR	telephone call	preferred mechanism
	TR	telephone call	immediate
	TR	TR-resolution	rapid

ssi	subj-1	subj-2	ssi-role
	Coordinator-1	Coordinator-2	have good relnship

Glossary

spi subject-process involvement

ppi process-process involvement

ssi subject-subject involvement

Figure 5: A sample compatibility framework database (partial).

3. *Example: Trouble Reporting*

As noted previously, effective coordination and control mechanisms are vital to the success of any inter-organisational collaborative partnership. Consider the following quote, from a senior Australian telecommunications executive, interviewed by More and McGrath (1996: p.44):

"I suppose one of the most important points in that was that we would never let any problems become issues …as soon as something

arose we would get on the phone straight away to discuss it, never let it sort of fester, have documents flying backwards and forwards and escalating. ...I had very good direct connections ...so as soon as something was going wrong, they'd ring me and I'd ring them and we'd sort it out rather than let it escalate."

Obviously, the interviewee was of the firm belief that a rapid response to problems is required, that the telephone should be the preferred method of communication for problem resolution and that excellent personal relationships between alliance coordinators is essential. Within our framework, the underlying structure of beliefs of this sort (as well as other softer aspects) are represented as "understandings".

An *understanding* may involve instances of any fundamental SATBPA (surface-level) data model entity and relationship types (i.e. *process, artefact* and *subject,* as well as all intersecting entity types). Each understanding is held by one-and-only-one subject but any one subject will generally have a number of understandings. Each understanding must be of one-and-only-one *understanding type (UT),* examples of which are *belief, norm, value* and *regulation.* An understanding must have a relationship with at least one, and possibly many SATBPA entity instances, and a single entity might be involved in a number of understandings. The general format of an understanding is:

understanding(U_id, Subject, UT, [conclusions], {conditions})

where the conclusions list is of the form:

$[concln_1, \{C_{12}, concln_2),---\}]$

where C_{ij} are the logical operators, *and,* and (inclusive) *or* and detail within the curly brackets, { }, is optional. The conditions list is of a similar form:

$\{[condn_1, C_{12}, condn_2,---]\}$

where, again, detail enclosed within the brackets, { }, is optional. Thus, an understanding might have no conditions associated with it. So, we might represent important aspects of our interviewee's beliefs on problem resolution as the conclusion:

[ppi(TR, TR-resolution, rapid)]

and the conditions list:

[spi(Coordinator-1, TR, instigates),

and spi(Coordinator-2, TR, resolves),

and ppi(TR, telephone call, preferred mechanism),

757 758

and ppi(TR, telephone call, immediate),

and ssi(Coordinator-1, Coordinator-2, have good relnship)].

Note that both the conclusion and conditions are expressed in terms of our database tuples (see Figure 5). The interviewee's belief may be (loosely) read declaratively as:

"If trouble reports are to be resolved rapidly then use the telephone to report the problem, report the problem immediately, and it helps if the alliance coordinators have a good relationship."

Users, however, are not required to interact with our knowledge base at this deep structure level. Instead, the features of the *ESTA* expert system shell and the *Axon* idea processor are employed to support both the entry of alliance data, plus a number of knowledge analysis and advice features, in natural language format. An example is presented in Figure 6. The *Axon* screen portrayed here has a concept map as background, while the foreground displays a checklist of coordination and control issues designed: to limit the possibility that critical aspects will be ignored; and to provoke the user's thinking. This particular screen was displayed automatically, by a pre-coded *Axon* action, following user entry of specific coordination and control data via the expert system.

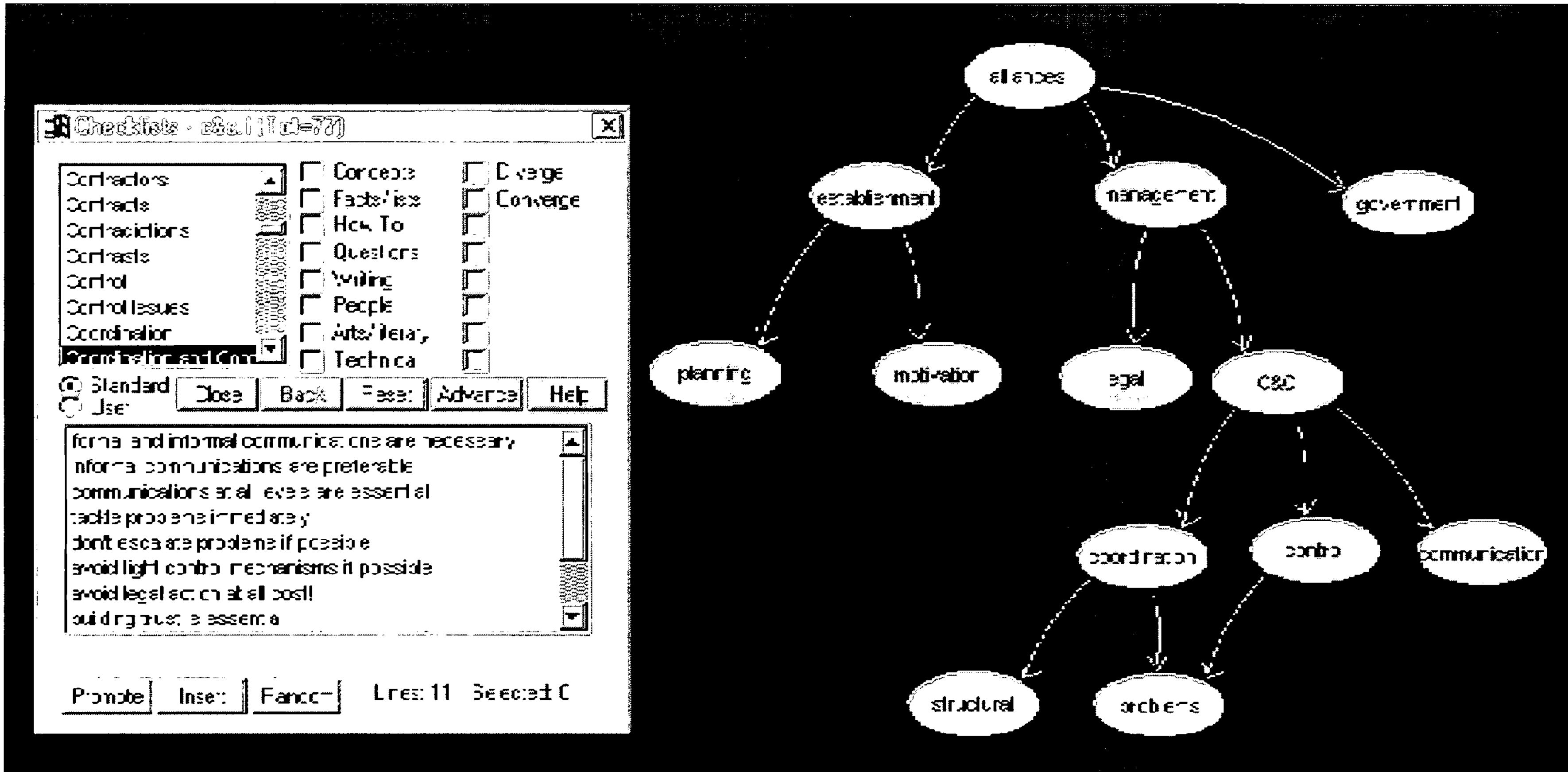


Figure 6: Typical Axon advice screen.

VI. **CONCLUSION**

The growth in research and publications on inter-organisational collaboration and alliances demonstrates the rising interest in the phenomenon. Such work has ably added to the body of knowledge on the topic but often in rather narrow ways – narrow in an economic focus, in terms of the need for understanding of development over time, and in terms of the broader cross industry relationships. Such relationships have moved beyond technology and narrow industry boundaries to the real need to better comprehend the human dimensions of the complex and challenging phenomenon of inter-organisational collaboration. The work outlined here contributes to such increased comprehension. Based on empirical research in one industry initially, the development of a formal model (together with its automated implementation) provides one approach to gaining some semblance of control and predictive capacity in an otherwise all too chaotic and risky area of strategic activity.

VII. REFERENCES

1. Bendor, J. and Moe, T.M. 1992. "Bureaucracy and Subgovernments - A Simulation Model." In M. Masuch and M. Warglien (eds.), *Artificial Intelligence in Organization and Management Theory.* North-Holland, Amsterdam, pp. 119-141.

2. Cecez-Kecmanovic, D. and Marjanovic, O. 1995. "IT as a Medium for Social Interaction." *Proceedings of the 6th Australasian Conference on Information Systems,* Perth, Australia, Sept. 26-29, pp. 597-612.

3. Chen, P.P.S. 1976. "The Entity-Relationship Model - Towards a Unified View of Data." *ACM Transactions on Database Systems*, Vol.1, No.1, pp. 9-36.

4. Curtis, B., Kellner, M.I. and Over, J. 1992. "Process Modelling." *Communications of the ACM,* Vol.35, No.9, pp. 75-90.

5. Ellison, M. and McGrath, G.M. 1998. "Activity Theory and Process Modelling." *Proceedings of the 9th International Conference of the International Resources Management Association,* Boston, 17-20 May, pp. 565-573.

6. Glaister, K. and Buckley, P. 1994. "UK International Joint Ventures: An Analysis of Patterns of Activity and Distribution." *British Journal of Management,* Vol. 5, No. 1, pp. 33-51.

7. Glaister, K. and Buckley, P. 1998. "Measures of Performance in UK International Alliances." *Organization Studies,* Vol. 19, No. 1, pp. 89-118.

8. Jaques, E. 1996. *Requisite Organization.* (Revised second edition - Final Draft), Cason Hall and Co., Arlington, Virginia.

9. Kuutti, K. 1996. "Activity Theory as a Potential Framework for Human-Computer Interaction Research." in Nardi, Bonnie A. (ed.), *Context and Consciousness: Activity Theory and Human-Computer Interaction.* MIT Press, Cambridge, MA, pp. 17-44.

10. McGrath, G.M. 1994. "MP/L1: Towards an Automated Model of Organisational Power." *Proceedings of the 2nd IEEE Australian and New Zealand Conference on Intelligent Information Systems,* Brisbane, Australia, 29 Nov. - 2 Dec., pp. 487-491.

11. McGrath, G.M. 1998. "Behavioral Issues in Software Engineering Process Modelling: A

12. Multi-Paradigm Approach." *Proceedings of the 31st Hawaii International Conference on System Sciences (Organizational Systems and Technology Track)*, Hawaii, 6-9 Jan., Vol.6, pp. 93-102.

13. Masuch, M. 1992. "Introduction - Artificial Intelligence in Organisation and Management Theory." In M. Masuch and M. Warglien (eds.), *Artificial Intelligence in Organization and Management Theory.* North-Holland, Amsterdam, pp. 1-19.

14. More, E. and McGrath, M. 1996. *Cooperative Corporate strategies in Australia's Telecommunications Sector – The Nature of Strategic Alliances.* Canberra: DIST.

15. Nardi, Bonnie A. 1996. *Context and Consciousness: Activity Theory and Human-Computer Interaction.* MIT Press, Cambridge, MA.

16. Newell, A. and Simon, A. 1972. *Human Problem Solving.* Prentice-Hall, Englewood Cliffs, New Jersey.

17. Price, C. 1996. "The Evolution of Inter-Organizational Relationships: Exploration of the Implementation Phase." *Unpublished PhD Dissertation,* Graduate School of Management, Boston University.

18. Rigby, D. and Buchanan, R. 1994. "Putting More Strategy into Strategic Alliances." *Directors and Boards,* Vol.18, No.2, Winter, pp. 14-19.

19. Stafford, E. 1994. "Using Co-operative Strategies to Make Alliances Work." *Long Range Planning,* Vol.27, No.3, pp. 67-74.

20. Vygotsky, L. S. 1994. *Mind and Society.* Harvard University Press, Cambridge MA.

VIII. ENDNOTES

- *ESTA* is a registered trademark of the *Prolog Development Center,* Copenhagen, Denmark.
- *Axon* is a registered trademark of *Axon Research,* Singapore.

Return to Top   View Full-screen

Globalization Strategies of World Major Telcos

Tae Woong Park, Hoe Il Kang, Sung Soo Han

Electronics and Telecommnucations Research Institute, Republic of Korea

ABSTRACT

As the current economic and industrial policies of many countries shift toward the open economic system and globalization, world major telcos, especially dominant carriers in advanced countries, face the challenge of entering foreign markets and implementing global strategies. In this paper, we analyze the behavioral pattern of major telcos' entries into foreign markets for last ten years and try to suggest meaningful typology of globalization strategies of telcos. We also draw some implications for telcos' foreign entry strategy.

View Full Text

Globalization Strategies of World Major Telcos

I. INTRODUCTION

The globalization or internationalization of major dominant carriers in advanced countries has been an impending task due to the following external and internal factors:

Externally, telecommunications carriers are asked to adapt themselves to the following changes of global telecommunications environments. Firstly, related with the technological environments, as technological change speeds up towards intelligent, broadband, high-speed, and integrated services, the timing of development and applications of new technology are very important. Secondly, regarding customer needs, global markets are being integrated into one, and unmet needs of telecommunications services are revealed rapidly. Thirdly, concerning the global regulatory environments, borderless world and globalization are proceeding or directed. Hence, applications and commercialization of new technology, satisfaction of unmet telecommunications needs, internationalization or globalization of telecommunications business through foreign entry of telecommunications business are imminent.

Internally, as competition becomes fierce in domestic markets due to new entrants from other industries and foreign countries, telcos have to find out more profitable and promising market opportunities abroad.

This paper aims at finding out differentiated behavioral patterns of world major telcos ' internationalization or globalization activities and classifying types of the major telecommunications carriers' globalization strategies according to the behavioral characteristics of their foreign entries during the last ten years. We also draw out the implications for the foreign entry strategies of telecommunications carriers.

II. BEHAVIORAL PATTERNS OF WORLD MAJOR TELCOS' GLOBALIZATION ACTIVITIES

In this paper, we tried to suggest strategically meaningful typology of major telcos' globalizations strategy in view of common framework, rather than to focus on the detailed descriptions of the behavior of foreign entry, for which the behavioral characteristics of foreign entry activities of 17 carriers in Table 1 were analyzed. Their foreign entry activities between 1988 and 1996 were analyzed in view of business scope, target geographic area (region or country), entry mode and timing.

Table 1. Telcos analyzed in this paper

	Name		Name
1	Airtouch	10	Telefonica
2	Ameritech	11	US West
3	AT&T	12	NYNEX
4	Bell South	13	Bell Atlantic
5	C&W	14	SBC
6	DT	15	ST
7	FT	16	Telstra
8	KT	17	BT

9	NTT

1. ***Scope of business***

During the last ten years, the number of 17 telcos' foreign entry cases analyzed here has been 421, with 34.2% of wireless telecommunications and 19.0% of VAS (value-added services). Foreign entry cases with such multiple services as wired, wireless and value-added services simultaneously constitute 16.6% of all cases. This reflects the rapid development of wireless technology in the early 1990s. Airtouch appears as a carrier of pursuing the wireless-oriented focusing strategy, for all of its 17 entries are with 15 cellular and 2 paging services . On the other hand, C&W, ST, and BT seek the entry strategy with broader scope of service.

Table 2. Frequency of foreign entry cases by Scope of business and telcos

Service / Telco	Wired	Wireless	Satellite	VAS.	Netw. Constr.	Broad-casting	Others	Multiple	Total
Airtouch		17 (100.0)							17 (100.0)
Ameritech		2 (28.6)					2 (28.6)	3 (42.9)	7 (100.0)
AT&T	2 (6.1)	7 (21.2)		10 (30.3)	9 (27.3)	1 (3.0)		4 (12.1)	33 (100.0)
Bell South		10 (41.7)		6 (25.0)			1	7 (29.2)	24 (100.0)
C&W	10 (19.2)	16 (30.8)	3 (5.8)	3 (5.8)	9 (17.3)			11 (21.2)	52 (100.0)
DT	1 (5.0)	9 (45.0)		1 (5.0)	2 (10.0)			7 (35.0)	20 (100.0)
FT		9 (33.3)	1 (3.7)	7 (25.9)	1 (3.7)			9 (33.3)	27 (100.0)
KT		7 (43.8)			1 (6.3)	1 (6.3)	2 (12.5)	5 (31.3)	16 (100.0)
NTT	4 (25.0)	3 (18.8)		6 (37.5)				3 (18.8)	16 (100.0)
Telefonica	1 (3.6)	11 (39.3)		3 (10.7)	2 (7.1)	3 (10.7)	2 (7.1)	6 (21.4)	28 (100.0)

US West		5 (26.3)			3 (15.8)	7 (36.8)	1 (5.3)	3 (5.3)	19 (100.0)
NYNEX	1 (5.6)	5 (27.8)		1 (5.6)	4 (22.2)	1 (5.6)	5 (27.8)	1 (5.6)	18 (100.0)
Bell Atlantic		8 (50.0)		5 (31.3)			2 (12.5)	1 (6.3)	16 (100.0)
SBC		3 (42.9)				2 (28.6)		2 (28.6)	7 (100.0)
ST	1 (2.5)	11 (27.5)		8 (20.0)	1 (2.5)	3 (7.5)	14 (35.0)	2 (5.0)	40 (100.0)
Telstra	2 (7.4)	5 (18.5)	4 (14.8)	5 (18.5)	7 (25.9)		2 (7.4)	2 (7.4)	27 (100.0)
BT	2 (3.7)	16 (29.6)	3 (5.6)	25 (46.3)	4 (7.4)			4 (7.4)	54 (100.0)
Total	24 (5.7)	144 (34.2)	11 (2.6)	80 (19.0)	43 (10.2)	18 (4.3)	31 (7.4)	70 (16.6)	421 (100.0)

Note : 1) The differences in observed values among tables are due to the missing value of relevant variables. 2) VAS: value-added service, Netw. Constr.: Network Construction, Multiple: simultaneous provision of multiple services 3) "Frequency of foreign entry cases by" in the title of above table will be omitted from the title of <table 4> on.

2. *Geographic target area (region)*

The main target markets of world major telcos are Southeast Asia (21.6%), West Europe (18.5%) and Northeast Asia (15.9%). Little attention is paid to Central Asia as a target market of telecos' foregin entry . This seems to be due to a lack of industrial attractiveness from the point of view of the purchasing power and economic developmental level. *(see Table 3)*

Table3. Foreign entry frequency by geographic target area

Geographic target area	No. of Entry	Ratio	Average level of economic development*
Southeast Asia	95	23.5	2
West Europe	81	19.3	4
Northeast Asia	70	15.0	3
Central and South America	62	12.8	2
East Europe	60	14.4	2

North America	19	4.0	4
Middle East	22	4.5	3
Oceania	16	3.5	4
Africa	8	1.6	1
Central Asia	6	1.3	1
Total	439	100.0	

Note: 1) The level of economic development is based on ITU data . 2) Northeast Asia: Korea, Japan, China, Mongolia, Tiwan; Southeast Asia : Malaysia, Indonesia, Vietnam, etc.

The main target markets of Airtouch, whose core business is wireless service, are West Europe and Northeast Asia, which show that Airtouch concentrates on the areas with the relatively high purchasing power. AT&T puts more emphasis on Northeast Asia and Central & South America , even though its geographical coverage of foreign entry is global. While C&W and BT appear to seek the high geographic diversification strategy, RBOCs of U.S. show inclination of focusing on market segment specific to each of them. For example, Bell South focuses more on Central & South America, US West on East Europe & CIS, NYNEX on Southeast Asia, and Bell Atlantic on West Europe. Meanwhile, Telefonica focuses on Central & South America, and ST on Southeast Asia. (see *Table 4*)

Table 4. Geographic target area (region) by telcos

	N-east Asia	S-East Asia	Centr. Asia	Ocea-nia	Nor. Ame.	Cen. South Ame.	West Euro.	East Eur. & CIS	Mid. East	Afr.	Total
Airtouch	5 (29.4)	2 (11.8)					9 (52.9)	1 (5.9)			17 (100.0)
Ameritech	1 (14.3)			1 (14.3)			3 (42.9)	2 (28.6)			7 (100.0)
AT&T	10 (29.4)	3 (8.8)			2 (5.9)	9 (26.5)	2 (5.9)	4 (11.8)	4 (11.8)		34 (100.0)
Bell South	2 (8.3)	4 (16.7)		2 (8.3)		10 (41.7)	5 (20.8)		1 (4.2)		24 (100.0)
C&W	12 (23.1)	7 (13.5)	1 (1.9)	3 (5.8)	3 (5.8)	7 (13.5)	7 (13.5)	6 (11.5)	4 (7.7)	2 (3.8)	52 (100.0)
DT		5 (25.0)	2 (10.0)				1 (5.0)	12 (60.0)			20 (100.0)
FT	1 (3.4)	2 (6.9)				5 (17.2)	11 (37.9)	6 (20.7)	2 (6.9)	2 (6.9)	29 (100.0)
KT	5 (31.3)	4 (25.0)	1 (6.3)		2 (12.5)	1 (6.3)		3 (18.8)			16 (100.0)

NTT	5 (31.3)	8 (50.0)	1 (6.3)		2 (12.5)						16 (100.0)
Telefonica						25 (89.3)	2 (7.1)	1 (3.6)			28 (100.0)
US West	1 (4.3)	2 (8.7)				1 (4.3)	6 (26.1)	13 (56.5)			23 (100.0)
NYNEX	4 (22.2)	7 (38.9)		1 (5.6)			5 (27.8)	1 (5.6)			18 (100.0)
Bell Atlantic		1 (5.6)		3 (16.7)	1 (5.6)	1 (5.6)	8 (44.4)	2 (11.1)	2 (11.1)		18 (100.0)
SBC	1 (14.3)					2 (28.6)	2 (28.6)		1 (14.3)	1 (14.3)	7 (100.0)
ST	6 (15.0)	25 (62.5)		2 (5.0)	1 (2.5)		5 (12.5)			1 (2.5)	40 (100.0)
Telstra	4 (12.1)	16 (48.5)	1 (3.0)		3 (9.1)		2 (6.1)	2 (6.1)	4 (12.1)	1 (3.0)	33 (100.0)
BT	13 (22.8)	9 (15.8)		4 (7.0)	5 (8.8)	1 (1.8)	13 (22.8)	7 (12.3)	4 (7.0)	1 (1.8)	57 (100.0)
Total	70 (15.9)	95 (21.6)	6 (1.4)	16 (3.6)	19 (4.3)	62 (14.1)	81 (18.5)	60 (13.7)	22 (5.0)	8 (1.8)	439 (100.0)

3. *Mode of Entry*

Mode of Entry in internationalization is dependent mainly on target market characteristics (government policy, regulatory barriers, market conditions, etc) and carrier characteristics (financial capability, technological capability, marketing capability, etc). However, in this paper, we don't deal with decision factors of entry mode, but consider the revealed situation. The mode of entry most frequently used is new consortium type with 35.4%. This result shows the telcos' common attitude of averting the risks that stems from the locality of services, huge size and irreversibility of investments. The respective share of 'establishment of new entities' and 'investment in existing firms'(including non-equity business alliances) in total cases are 75.7% and 24.3%. There is no significant difference between carriers' modes of entry. However, DT, NTT, and SBC appear to have the intention to take advantage of the dominant local partners' resources, rather than to run businesses only with their own leadership.

Table 5. Modes of entry by telcos

Mode / Carrier	New Subs.	New Mono. JV	New Duo. JV	New Consortium	Sole Acqu.	Joint Acqu.	Minor Equ. Inv..	Busi. Alliance	Total

Airtouch		2	2	9	1	3			17
		11.8	11.8	52.9	5.9	17.6			100.0
Ameritech		1	2	1		2			6
		16.7	33.3	16.7		33.3			100.0
AT&T	8	3	2	8	2	9			32
	25.0	9.4	6.3	25.0	6.3	28.1			100.0
Bell South		7	6	7	4				24
		29.2	25.0	29.2	16.7				100.0
C&W	2	4	13	14	4	6	4		47
	4.3	8.5	27.7	29.8	8.5	12.8	8.5		100.0
DT			5	10		2			17
			29.4	58.8		11.8			100.0
FT	5	4	11	7		1	1		29
	17.2	13.8	37.9	24.1		3.4	3.4		100.0
KT	2	2	4	4			2		14
	14.3	14.3	28.6	28.6			14.3		100.0
NTT			2	7		2	1	1	13
			15.4	53.8		15.4	7.7	7.7	100.0
Telefonica	2	2	8	13			1		26
	7.7	7.7	30.8	50.0			3.8		100.0
US West	1	1	5	10				4	21
	4.8	4.8	23.8	47.6				19.0	100.0
NYNEX	1		4	5		1	4		15
	6.7		26.7	33.3		6.7	26.7		100.0
Bell Atlantic			4	10			1		15
			26.7	66.7			6.7		100.0
SBC				3			2		5
				60.0			40.0		100.0
ST	13	3	10	8		6			40
	32.5	7.5	25.0	20.0		15.0			100.0

Telstra	1	5	8	5		3		2	24
	4.2	20.8	33.3	20.8		12.5		8.3	100.0
BT	1		3	19	1	10	1	15	50
	2.0		6.0	38.0	2.0	20.0	2.0	30.0	100.0
Total	36	34	89	140	12	45	17	22	395
	9.1	8.6	22.5	35.4	3.0	11.4	4.3	5.6	100.0

New Subs.: New subsidiary; New Mono. JV: JV with dominant/monopolistic governance; New Duo. JV: JV with duopolistic governance shared by two partners; Consortium : distributed governance structure; Sole Acqu.: Acquisition by one company; Minor. Equ. Inv.: minority equity investment; Busi. Alliance: Non-equity-based business alliance

4. *Timing of Entry*

Though timing of entry and sequence of entry play an important role in entry strategies, we only consider the timing of entry here. A number of telcos' foreign entry cases shows an increasing trend since the early 1990s, particularly from 1994 (18.1%) and 1995 (20.0%) on. This trend reflects the policy of world-wide deregulation of 1990s and the acceleration of technological developments. As to the regulation, there was the removal of line-of-business restrictions of US telecommunications carriers and the acceleration of WTO activities in the mid-1990s. As to the technology, the carriers improve their abilities to offer the services through the competitive developments of wireless technology deployed rapidly beginning early 1990s and VAS technology. Particularly, BT, ST, Airtouch, and US West are identified to have put greater emphasis on globalization in recent years than before.

Table 6. Numbers of cases of foreign entry by telcos

Timing / Carrier	By 1990	1991 – 1993	1994 – 1996
Airtouch	1	7	8
Ameritech	1	2	3
AT&T		9	16
Bell South	4	8	10
C&W	8	11	12
DT		9	9
FT	1	11	13
KT		1	15
NTT		3	9
Telefonica	5	8	11
US West	3	2	18
NYNEX	4	10	4
Bell Atlantic	3	7	8
SBC	3		4

ST		19	21
Telstra	8	16	6
BT	6	10	28
Total	37	133	195

Note: Cases of 1996 include those which happened by the end of the first half of the year

6. *Scope of business according to timing of entry*

Until the late 1980s, the share of wired telecommunications and that of VAS were similar. But, since the early 1990s, the entry with wireless telecommunications has been rapidly increased. The early and mid 1990s witnessed the increase of entry with VAS. In addition, since the early 1990s, the entry cases with multiple businesses such as the wired, wireless, and VAS also have been rapidly increased.

Table 7. Scope of business by timing of entry

Timing Business	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total
Wired Telecom	0	1	0	2	3	2	2	8	2	20
Wireless Telecom	4	5	4	14	18	14	23	23	23	128
Satellite Telecom	1	0	2	2	2	1	1	2	0	11
VAS	0	5	2	4	8	9	12	10	12	62
Broadcasting	2	1	0	0	0	2	3	5	1	15
Multiple	0	2	6	7	6	11	9	11	7	59
Network Establish.	0	3	5	4	4	5	7	3	6	37
Others	0	1	1	0	4	4	7	11	1	29
Total	7	18	20	34	45	48	64	73	52	361

7. *Geographic target area (region) by timing of entry*

As is shown in <Table 8>, Central & South America, West Europe and North America have been entered since the late 1980s, East Asia and East Europe since the early 1990s, and other areas since the mid 1990s. Recently, the entry into East Asia, Southeast Asia, and East Europe has been increased.

Table 8. Geographic target area (region) by timing of entry

Timing Area	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total
Northeast Asia	0	0	2	9	2	8	8	20	7	56
Southeast Asia	1	5	4	3	19	7	16	22	11	88
Central Asia	0	0	0	1	0	1	1	1	2	6
Oceania	0	1	3	1	3	2	0	1	2	13
North America	2	3	2	0	0	3	1	2	2	15
Cen. & Sou. America	3	1	6	8	2	5	11	5	7	48
West Europe	2	4	2	7	9	11	18	17	2	72
East Europe & CIS	0	1	2	5	8	10	10	4	14	54
Middle East	0	3	0	2	2	2	2	2	4	17
Africa	0	0	0	0	2	0	1	1	1	5
Total	8	18	21	36	47	49	68	75	52	374

8. *Mode of entry according to timing of entry*

Whether the timing of entry affects the mode of entry, the trends of mode of entry by timing of entry are analyzed and the results are shown in <Table 9>. Mode of entry by entry year shows no differences. However, the mode of entry of joint establishment of new business by multiple carriers is increasing. This seems to embody the incentive to reduce risks and to confront locality in environmental factors (regulation and license).

Table 9. Mode of entry according to timing of entry

year Mode	1988	1989	1990	1991	1992	1993	1994	1995	1996	Total
New sole establ.	1	0	2	2	5	6	6	7	3	32
New mono. JV	0	2	3	6	3	2	6	3	6	31
New duo. JV	1	5	5	6	13	14	14	11	8	77
New Multi-car. JV	1	3	7	11	11	13	27	32	21	126
Sole. Acquisition	1	0	0	1	2	0	2	1	0	7
Joint Acquisition	1	2	0	4	5	9	4	9	4	38
Minor equity investment	0	1	0	4	2	1	1	2	1	12

Business alliance	1	0	0	0	1	0	4	3	4	13
Total	6	13	17	34	42	45	64	68	47	336

9. *Scope of Business by geographic target areas*

Table 10 shows scope of business by geographic target areas entered by telcos. The entry with the wireless services has the highest share in most areas, particularly, the proportion is the highest in Northeast Asia and West Europe. And diverse services are provided in Southeast Asia. This phenomenon seems to result from the facts that the basic services are well settled down in Northeast Asia and West Europe and that in Southeast Asia the infrastructure for the services are not well established. Entry into Oceania is mainly with the multiple services of the wired and wireless, broadcasting services. In Africa, according to the regional characteristics, the share of wireless telecommunications as a basic telecom service is greater than that of wired telecommunications that need a large amount of initial investments.and relatively long period for service initiation.

Table 10. Scope of Business by Geographic target areas (regions)

Business Target Area	Wired	Wire-less	Satel-lite	VAS .	Broad-casting	Multiple	Netw Const	Others	Total
Northeast Asia	4	32	1	11	3	6	6	7	70
Southeast Asia	8	25	5	14	3	13	12	11	91
Central Asia	0	1	0	1	0	0	3	1	6
Oceania	0	3	0	7	0	5	1	0	16
North America	3	5	0	4	0	1	3	0	16
Central and South America	4	21	0	4	3	24	2	2	60
West Europe	1	28	1	23	7	7	5	7	79
East Europe	4	22	2	9	1	11	5	2	56
Middle East	0	3	2	5	1	3	5	1	20
Africa	0	4	0	2	0	0	0	0	6
Total	24	144	11	80	18	70	42	31	420

10. *Mode of entry by scope of business*

The investigation of mode of entry by business scope shows that mode of entry differs in a certain extent with business characteristics. Particularly, in the case of entry with VAS, new duopolistic JV with local partners is mostly preferred. This shows that the beginning of VAS is more effective when linked with the local carriers that have the existing network or run businesses. The most widely adopted mode of entry is consortium. *<see Table 11>*

Table 11. Mode of entry by scope of business

Business Mode	Wired	Wire-less	Sate-llite	Supp.	Broad	Com-posite	Net. Estab.	Other	Total
New Overseas Subsidiary	0 (0.0)	4 (2.9)	2 (22.2)	9 (12.2)	1 (6.3)	2 (3.0)	6 (20.7)	12 (42.9)	36
New Mono. JV	0 (0.0)	9 (6.5)	1 (11.1)	8 (10.8)	1 (6.3)	9 (13.6)	3 (10.3)	2 (7.1)	33
New Duopo. JV	3 (15.0)	26 (18.8)	1 (11.1)	19 (25.7)	5 (31.3)	18 (27.3)	7 (24.1)	7 (25.0)	86
Consortium	10 (50.0)	71 (51.4)	2 (22.2)	15 (20.3)	7 (43.8)	18 (27.3)	10 (34.5)	4 (14.3)	137
Sole. Acquisition	2 (10.0)	6 (4.3)	0 (0.0)	0 (0.0)	0 (0.0)	4 (6.1)	0 (0.0)	0 (0.0)	12
Joint Acquisition	4 (20.0)	11 (8.0)	3 (33.3)	8 (10.8)	0 (0.0)	12 (18.2)	3 (10.3)	0 (0.0)	41
Minority Equity Investment	0 (0.0)	9 (6.5)	0 (0.0)	1 (1.4)	1 (6.3)	2 (3.0)	0 (0.0)	2 (7.1)	15
Non-equity-based Business Alliances	1 (5.0)	2 (1.4)	0 (0.0)	14 (18.9)	1 (6.3)	1 (1.5)	0 (0.0)	1 (3.6)	20
Total	20 (100.0)	138 (100.0)	9 (100.0)	74 (100.0)	16 (100.0)	66 (100.0)	29 (100.0)	28 (100.0)	380

11. *Mode of entry by Geographic target areas*

We attempt to investigate the mode of entry by target areas to show that the mode of entry may differ according to target market. Entry in the form of the consortium is the highest in all markets, <Table 12>, with the exception in Oceania that new duopolistic JV is the highest, which is thought to be due to the high proportion of VAS and the preference of joint investment.

Table 12. Mode of Entry by Target area

Area Mode	N-East Asia	Southeast Asia	Centr. Asia	Ocea-nia	Nor. Ame.	Cen. South Ame.	West Euro.	East Euro. & CIS	Mid. East	Afr.	Total
New Subsidiary	9	8	0	1	1	4	10	2	1	0	36
New Mono. JV	3	6	1	1	1	8	8	5	0	1	34
New Duopo. JV	10	22	2	5	0	13	17	16	3	1	89

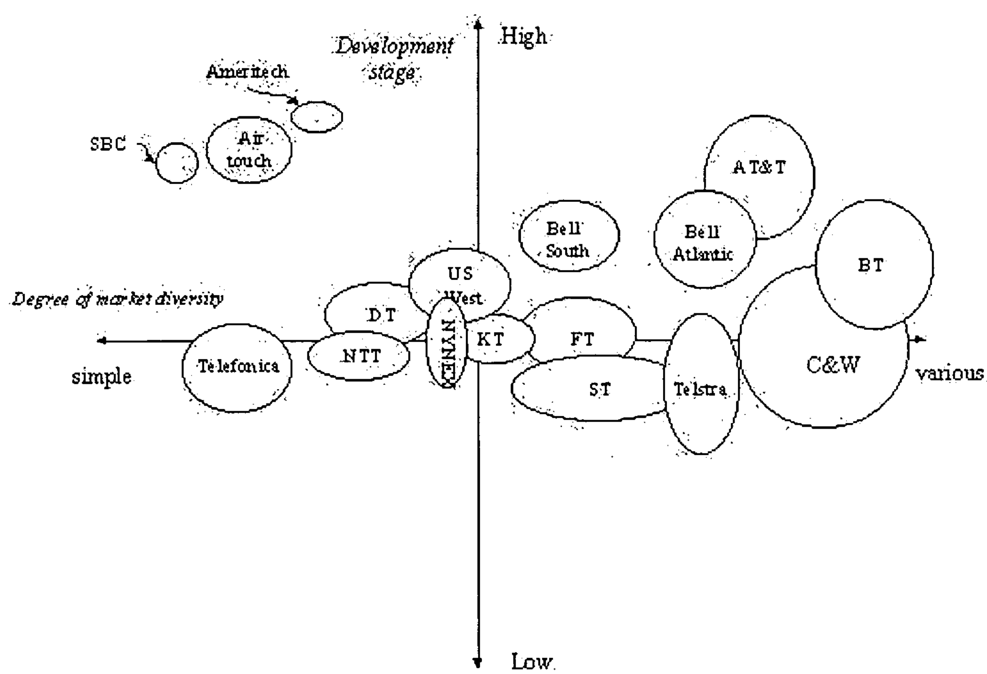
New Consortium	29	30	1	4	5	19	20	23	8	1	140
Sole Acquisition	1	1	0	0	1	8	1	0	0	0	12
Joint Acquisition	2	12	0	3	6	5	10	4	1	2	45
Minor Equ. Inv.	9	1	1	0	2	2	1	0	1	0	17
Busi. Alliances	3	3	0	0	0	0	5	8	2	1	22
Total	66	83	5	14	16	59	72	58	16	6	395

III. *TYPOLOGY OF TELCOS' GLOBALIZATION STRATEGIES*

In order to classify the types of foreign entry strategy according to the characteristics of foreign entry cases of major telecommunications carriers, we applied the following criteria and suggested the typology of globalization strategies .

Strategic positions of major telcos could be illustrated as <Fig. 1> according to economic development stage of target market and degree of market diversity(ITU's classification on development stage is adopted for representing economic development stage, and the degree of market diversity is measured by the number of countries entered by each telco.) And they could be also illustrated as <Fig 2> according to width of target market(the number of regions entered) and the number of business scopes. (the circle size in Figures roughly denote the amount of foreign entry cases)

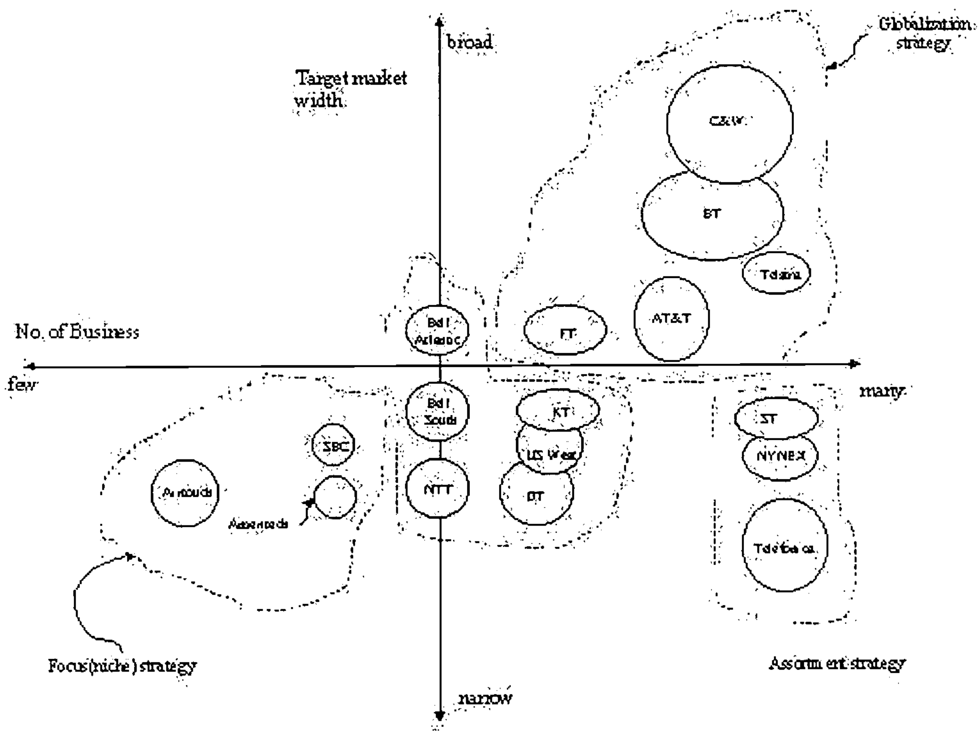
Figure 1 . Economic development level of target market and degree of market diversity



C&W enters the markets with various economic conditions, so this firm can be said to pursue the long-term preemptive strategy in order to act as the first-mover in the future as well as in the present. And its degree of market diversity is so large that this firm is classified as the type of globalized firm. On the other hand, Airtouch focuses on the areas with the higher level of economic conditions or purchasing power and its business scope is limited to its core business. This firm appears to pursue the rapid pay-back & profit-maximization strategy .

C&W, BT, AT&T and FT appear to be global carriers with wide target markets, broad business scopes, and the high degree of internalization. Airtouch, Ameritech and SBC appear to be carriers pursuing focus strategy of entering a small number of market with the core business. ST and Telefonica could be classified as a telco of the assortment strategy of targeting a relatively narrow width of geographic markets with broad business scopes. The remaining Bell Atlantic, Bell South, NTT, DT, US West can be classified as the middle-of-the-road carriers from the perspectives of the range of geographic market coverage and business scopes.

Figure 2. Width of geographic target market, and the number of business scopes



IV. CONCLUSIONS

The summary of our findings on the behavioral pattern of telecos' globalization and the classifications of their strategy types are as follows. Strategies are classified into the following types: (1) focus strategy of targeting narrow range of foreign markets with a small number of core business; (2) assortment strategy of entering narrow range of markets with many services; (3) global strategy of targeting the global market with broad range of businesses.

The implications of the typology for the foreign entry of telecommunications carriers are as follows: Firstly, when determining to enter into the foreign markets, the carrier should determine whether to adopt the focused strategy, assortment or globalization one, based on the evaluation of the competency. This implies that entry into the areas without the competitive edge is not desirable. Secondly, related with where to enter, major carriers show inclination of targeting the geographically and culturally close areas first and also of targeting the different target markets according to the scope of business. For example, in the case of wireless telecommunications, the strategy of Airtouch is adopted that it enters the area with the high level of economic development. In this regard, the determination of target market should be required to be fit with the business scope .Thirdly, the mode of entry should be decided considering such factors as risk, entry barrier, locality of demand and so on. As we know from the fact that most frequently adopted entry mode were 'Consortium', 'Joint Venture', and 'Joint Acquisition', risk-aversion is one of the most important factors in deciding entry mode.

This paper mainly focused on finding out general characteristics about current situation of major telcos' globalization. Therefore such research topics as decision factors of the type of globalization strategy, relationship between strategy type and globalization performance, etc. remain to be studied in the future.

V. REFERENCES

1. *Communication Companies Analysis*, Espicom Business Intelligence Publications Limited, 1996-7.
2. *Telecommunications Companies League Tables*, Espicom Business Intelligence Publications Limited, 1997.
3. *World Telecommunication Development Report : Trade in Telecommunications,* ITU., 1997

Return to Top   View Full-screen

Comparative Analysis of Telecommunications Globalization

Yale M. Braunstein, Meheroo Jussawalla, Stephen Morris

University of California Berkeley, U.S.A

ABSTRACT

We begin with an overview of the current state of corporate strategies and government policies in the international telecommunications sectors of the United States, the European Union, and Japan. We then survey the major trends in the industry worldwide and analyze the determinants of the differing rates of growth of telecommunications carriers. In the final sections we discuss the strategic options available to smaller countries and carriers that could bring about the benefits from increasing globalization in telecommunications.

View Full Text

Comparative Analysis Of Telecommunications Globalization

I. INTRODUCTION

The domestic telecommunications markets in the United States, the states of the European Union, and Japan differ in their structures, their rates of growth, and on their reliance on the inflows associated with terminating international calls. They also differ in their current level of openness to foreign investment and in the relationship between equipment manufacturers and carriers.

The telecommunications firms surveyed here also differ in the nature of their foreign direct investment (FDI) in telecommunications markets abroad. While carriers in both the EU and the United States invest heavily in the relatively liberalized cellular markets internationally, EU-based carriers generally tend to invest in markets to which they have a "natural" cultural or historical affinity. U.S.-based carriers, on the other hand, appear to be more motivated by market opportunities and expectations of growth in their choice of FDI.

Between 1985 and 1995 telecommunications revenues for the countries surveyed have generally grown at rates faster than the rates of new line activation or increasing call volume. Throughout the areas of study, tariffs have been restructured, the mix of calls—local, long distance (trunk), and international—has changed, and leased-line and mobile services have grown relative to traditional switched, wireline telephony. In all the countries the revenues for telecommunications carriers has increased dramatically with the liberalization of domestic markets. Yet we do not see any obvious correlation between a relatively "early" or "late" opening of domestic markets and overall rates of revenue growth.

As telecommunications markets are liberalized around the world, the role of national governments is changing from that of a direct player in the industry to that of policy maker and regulator. At the same time, the nature of international telecommunications trade is evolving from a bilateral, nation-to-nation framework to a multinational, multilateral company-to-company paradigm. Major international telecommunications alliances have taken many forms, and the alliances have the potential to dominate parts of international telecommunications as they hope to realize significant market and cost advantages. Nevertheless, the demand will continue to increase for smaller firms able to provide local presence and technological expertise. The recently concluded World Trade Organization (WTO) Agreement on Basic Services will continue the opening of telecommunications markets to additional foreign collaboration and entry.

Within such an environment as described above there are various strategic options available to smaller countries and carriers. We believe that the business model underlying telecommunications is undergoing fundamental change worldwide. It will be necessary for smaller carriers to consider structural changes as they select and implement strategies. Domestic joint ventures, vertical integration, and multilateral projects need to be evaluated correctly and, if adopted, supported and nurtured.

II. PART I: KEY FINDINGS

1. 783

784

a. *Difference in Environment*

The domestic telecommunications markets in the United States, the states of the European Union, and Japan differ in their structures, rates of growth, and reliance on inflows associated with terminating international calls. They also differ in their openness to foreign investment and in the nature of the relationships between equipment manufacturers and carriers. (We discuss these difference in more detail elsewhere.)

b. *Rate of growth of domestic markets*

There have been different rates of growth in the domestic markets of the United States, Japan, and the countries that comprise the European Union. As one can see in Table 1, telecommunications revenues for the ten-year period from 1986 to 1995 have generally grown at rates faster than those of activating new lines or of increasing call volume, though the rate of increase has differed among countries. It is useful to look at the possible determinants of the different rates of growth across the twelve countries that are studied in the papers in this volume. Two possible hypotheses are that the differences in the rates of growth are determined either by the extent and timing of the opening of domestic telecommunications service markets or by relative level of economic development and rates of average economic growth.

As we have complete data on main (fixed) lines in operation and total telecommunications service revenues from the ITU, we focus on these measures. First we look at whether early or late opening of domestic markets appears to affect growth in telecommunications services. It does not appear that there is a correlation of when domestic markets were opened and the rate of revenue increases. (Although it is difficult to fix a single date, this discussion focuses on Europe and uses the dates presented in the papers by Elixmann and by Scanlan, Williams, and Whalley. See Table 2 for a complete listing of these dates.)

We then tested the hypothesis that growth in telecommunications services was related to the level of development and the rate of overall economic growth using more formal methods. Given the nature of the data, we chose to employ both non-parametric tests that compare rankings and linear regression methods. The results from the two approaches gave similar results, and we found that growth in telecommunications was inversely related to the initial level of economic development and positively related to the level of growth in the aggregate economy, although with varying levels of statistical significance. In other words we found that, in general, the countries that started with the lowest levels of per-capita gross domestic product (GDP) in 1985 had the highest rates in telecommunications growth over the next nine years. Additionally, the rate of telecommunications growth was positively correlated with the rate of overall economic growth. In these analyses we used per-capita GDP, converted to U.S. dollars at market exchange rates, as the measure of economic development.

The correlations for the rankings of the twelve countries by telecommunications lines and revenues, on one hand, and economic level and growth, on the other, are shown in Table 3. The telecommunications data used are shown in Table 1 and the values of 1986 GDP per capita and growth in GDP per capita (both in U.S. dollars) are shown in Table 2. Both sets of data were taken originally from tables provided by the ITU.

785 We also used linear regression methods to investigate the relationships between the telecommunications growth variables and the variables based on aggregate economic data. The same data set was used. Although one should worry that the small sample size and limited range of the growth rate variables may lead to violations of the assumptions of the linear regression model, one can draw 786

modest conclusions from the results. We ran two sets of regressions, one with growth in telecommunications lines as the dependent variable, the other with growth in telecommunications revenues. Each set consisted of three equations—one with the level of 1986 GDP per capita as the independent variable, one with the rate of growth of GDP per capita, and one with both independent variables. As shown in Table 4, three of the four single-variable regressions were statistically significant and all the coefficients in these equations had the expected signs. Only two of the four coefficients from the multiple regression equations had significant coefficients, and one of the coefficients that was not statistically different from zero had the wrong sign. Overall, we found that the regression results confirm the results of the non-parametric tests in that overall growth in telecommunications services in the twelve countries, by either measure, was inversely related to the initial level of GDP and—in most cases—positively related to the growth of the overall economy. We see from the R^2 values that the variation in overall aggregate growth (on a per-capita basis) accounted for approximately 20% - 40% of the growth in telecommunications.

c. *"Natural" markets for international communications*

Countries often have "natural" foreign markets for their goods and services. The criteria for these "natural" markets include geographic proximity, common language, and former colonies. There are also high telecommunications traffic destinations that may be influenced by the presence of multi-national corporation traffic as well as the presence of immigrants within a country. For investment in international telecommunications, some countries may try to enter their "natural" markets or markets of high traffic destination. Others may pursue a different course of action based on other factors, such as experience in a certain technology.

2. *Strategic Differences*

a. *Reliance on international settlements*

International telecommunications settlement flows are determined by the accounting rates agreed to by correspondent carriers and the traffic volumes (and, especially, any imbalances). These flows influence the revenues, profits, and strategies of all telecommunications carriers.

The United States has experienced a steady increase in the number of outgoing calls in relation to incoming calls. There has been a corresponding growth in the balance of payments US carriers have made to overseas carriers. As a result, the Federal Communications Commission (FCC) has endorsed changing the accounting rates among nations so as to more accurately track actual costs. This is discussed more fully in Braunstein's Section 3.1.

Japan and Italy have also experienced an increase in outgoing calls over incoming calls, but overall revenues did not decline. Countries such as France, Denmark, Germany and the Netherlands have had the ratio of incoming and outgoing international calls remain fairly constant for the time period 1986-1995. Spain, which has also seen its international call ratio remain constant, has seen a constant erosion in revenue gains, from an increase of 18.3% in 1991 over 1990 revenues, to only a 6.9% gain in 1995. Increases in revenues in Denmark, though, remained fairly constant for the same time period. Portugal, which has balked at opening up its domestic markets to competition, has experienced a much larger number of incoming international calls than outgoing calls (as much as 229% more in 1986, and still 175% more in 1995). Portugal would seem to be relying on the favorable international settlements and is not in a hurry to open its domestic markets.

b. ***Summary of findings—U.S and Europe***

Differences in industry structure, history, and regulatory approaches make it difficult to directly compare the globalization strategies of carriers based in the United States, the countries of the European Union, and Japan. Nevertheless, the large numbers of U.S.- and EU-based carriers makes it worthwhile to attempt such a comparison, at least for these two regions.

We have looked at seven different areas in which we find useful comparisons that can be drawn. (See Table 5.) First, the nature of international traffic varies across the two regions. Most international traffic from the EU countries is to other countries within Europe. On the other hand, while Canada is the highest-ranking destination from the U.S., the remaining top countries are located throughout the world (Mexico, U.K., Germany, and Japan, in order). This is clearly related to the second difference—accounting rate issues appear to be more important in the U.S. as the imbalance in international traffic leads to massive recurring cash outflows.

The patterns of foreign direct investments by carriers in each region can also be compared. It appears as though FDI by EU-based carriers depends, to a degree, on commonalities of interest—common language or culture, close distances, trading relationships, etc. By comparison, the foreign investments by U.S. carriers seem to be more motivated by perceived market opportunities and less by any "natural" affinities. However, both the EU and U.S. carriers have made major investments in cellular systems in other countries, as this has been one of the earliest areas of liberalization and openness to foreign investments.

Equipment manufacturers still have close ties to national carriers in several European countries. These relationships play a role in investment strategies, both domestic and foreign. The only large firm with a similar link in the U.S. is Motorola. (Smaller firms such as Qualcomm also combine technology, manufacturing, and carrier divisions; AT&T was another example before the spin-off of Lucent Corporation.)

Major carriers form and join international alliances for several reasons. It appears as though carriers in both regions view these alliances as efficient ways of providing high-margin value-added and vertical services to large multi-national corporations. In addition, the European carriers may consider the alliances as a useful substitute for direct investments while the U.S. carriers may focus on the possibility of controlling foreign operators in countries that are major recipients of U.S. calls, thus recapturing some of the settlements outflow.

Finally, while we realize any summary statements risk being too simplistic, we believe investment strategies by EU firms are more likely to have a technology-driven component. The most obvious example is the promotion of the G.S.M. digital mobile standard. It promotes a pan-European technology, provides added-value for the customers of European carriers when they travel, and generally contributes to the image of a united Europe. On the other hand, the investments of the U.S. carriers are more driven by expected market return. Using the same example, U.S. firms appear willing to propose any cellular standard, whether based on specific regulatory requirements or likely marketing and cost advantages.

III. PART II: TRENDS, LESSONS, AND OPTIONS

1. *Changing Industry Structure*

a. *Benefits from telecommunication trade liberalization*

We now discuss the benefits of telecommunications trade liberalization. Freer trade in telecommunications promises to deliver at least three economic gains: new and improved products and services, lower prices, and additional investment. Open trade in telecommunication services should result in more competition, lowering prices for most businesses and for many consumers and providing both with a choice of different service providers.

Probably the clearest evidence comes from the market segment where competition is currently the most keen: in international telephone services. Those markets where direct competition is permitted have achieved higher rates of growth than in countries that have retained a monopoly. For developed economies, this difference is significant; competition has raised the growth rate of traffic per subscriber from 5.6 per cent to 9.3 per cent per year since 1990. However, for emerging markets the difference is much more striking: over the same period competitive markets grew their international traffic per subscriber by 11.7 per cent per year compared with just 5.2 per cent per year in monopoly markets. This suggests that the potential benefits of trade liberalization might actually be greater for emerging markets than for developed ones.

Why should this be so? One part of the answer is because of unmet demand. Some 43 million people are on registered waiting lists for telephone connections in emerging markets and the average waiting time is more than a year. By introducing new investment in the market, waiting lists can be sharply reduced, as has been the case in developing markets that have privatized their public telecommunication operators at the start of the 1990s.

What about the potential costs of trade liberalization? Some governments are afraid that they will lose the ability to control entry and ownership in their domestic markets. The truth is that, at the international level, governments have practically lost the power to dictate who can provide services. For example, the development of alternative calling procedures such as call-back has occurred at a much faster rate than had been expected over the past few years. As a result, almost all markets are now open to some degree of competition.

By making commitments to open their market, governments are merely acknowledging what is already happening. In particular, it is necessary to reflect on the changing role of government, from being a direct player in telecommunications to a policy maker and regulator. Even though their direct operational influence may be greatly diminished, there will be more work for governments to do under a competitive market environment than was the case under monopoly service provision. That is because existing market players as well as potential new entrants will be looking for clear guidance on what sort of regime will be established for issues such as interconnection, numbering, universal service obligations and tariff policy.

b. *Towards a multilateral trade framework*

A new paradigm is emerging for international trade in telecommunications. The old paradigm, which might be loosely described as "inter-national" telecommunications, was based on bilateral relations between countries. The monopoly operators in those countries
791 collaborated in the joint provision of international services. This model is now breaking down, not so much because the system is not

working, but rather because it now fails to capture the full picture. A new pattern based on global competition is emerging. It recognizes that trade in telecommunication equipment and services now takes place in a multilateral environment in which the majority of trade relationships include multiple intermediaries between buyer and seller. We are moving from a world of one-to-one relations to a world of many-to-many. It is not nations that trade with other nations, but companies and individuals that conduct trade with each other.

What will be the impact of the market opening moves agreed at the World Trade Organization? The agreements are significant for two main reasons. First, because the countries which have made offers or commitments account for such a large part of the total world market. The 69 governments that made offers under the negotiations on basic telecommunications services (Geneva, 15 February 1997) constitute some 94 per cent of the global market for telecommunication services. Similarly, the 28 governments that signed the Ministerial Declaration on Information Technology products (Singapore, December 13 1996) account for 84 per cent of global telecommunication equipment exports. Second, because the agreements have been negotiated as part of a multilateral treaty, the offers and commitments are binding on governments and practically irreversible.

For many telecommunication users, the transition to a multilateral trading system will bring benefits in terms of greater choice and lower prices. For the majority of carriers, there will be significant benefits in terms of creating new market opportunities and a more level playing field. The goal is to extend the multilateral solution in which all countries move forward together and in which all benefit, not just those carriers with market power. Only then will the benefits of global competition be extended to all the world's inhabitants.

2. *Review of Strategies*

To better understand possible strategic options for smaller carriers, it would be instructive to review strategies of telecommunications carriers in the United States and Europe. Whether one looks at North America or Western Europe, one is struck by the diversity of approaches to international and global operations. This is the case whether one looks at carrier agreements, foreign direct investments, or alliances.

a. *Difficulties for smaller corporations*

Smaller corporations are at a disadvantage in the move to globalization for several reasons. The existing international telecommunications alliances have been created by some of the world's largest carriers, and they have exhibited a preference for dealing with others of a similar nature. The current international carrier alliances can be viewed as an attempt to replace the former club of national monopoly carriers with a cartel of alliances made up of mixes of former monopoly carriers and the largest "new" entrants. Regardless of whether the goal of these alliances is primarily to provide service for the largest multi-national corporations, their effect is to enable end-to-end control of key international links, providing their members with market and cost advantages.

The alliances differ in their structure, especially in the mix of equity participation and looser affiliations on other-than-equity bases. Even after recent changes, in all of the major alliances the members are either very large telephone carriers with considerable international presence (e.g., MCI, Sprint), or carriers who are dominant in their home countries (e.g., KPN, Telia), or carriers who are both (e.g., AT&T, BT, etc.). With few exceptions, smaller, non-dominant carriers appear to be effectively excluded so far.

793 Fortunately, there are compensating factors. First, regulatory intervention has reduced the potential payoff from controlling both ends of an international link. Regulations such as parallel accounting rate requirements and proportionate return have been effective. Second, 794

although the pressure to lower accounting rates to more closely reflect costs will negatively affect many carriers from smaller countries, this change will go a long way toward "leveling the playing field" for new entrants by reducing the financial cushion of many incumbent carriers. And third, the existence of multiple alliances means smaller firms may be able to play one large entity off against another to find the best "partners." This last point may have been illustrated by Telefonica's move from Unisource to Concert in 1997.

b. *Lessons learned from the U.S. and European carriers*

The most obvious conclusion about the process of globalization one can draw from the activities of U.S. and European telecommunications firms is that globalization efforts are not always as logical or as profitable as one might wish. For example, whether one looks at Ameritech in Poland or U S West in the United Kingdom, it has been difficult at times to directly apply U.S. experience to operations in other countries. Nevertheless, many of the U.S. carriers' foreign investments have been quite successful. The U.S. firms seem to be particularly able to work with complex consortia of investment groups and flexible enough to structure such groups to meet both the requirements of the host country and the needs of the others in the consortia. However, the U.S. carriers seem to choose opportunities where they have a controlling role. Similarly, European carriers have had varying results with international investments. The most obvious recent case has been BT's problems with its investment in MCI.

The second conclusion is that the U.S. firms appear to be settling for longer pay-back periods for their international investments than one might expect from all the focus on short-term corporate earnings. The reasons for this are probably complex, and this conclusion should be viewed as tentative and in need of confirmation. But if this is true, the reasons possibly include:

- The foreign investments are relatively very small and therefore early losses have a minimal effect on reported earnings
- The expected future growth rates of revenues and earnings from the international investments are higher than in the home markets
- A desire to learn about competitive markets from which some of the firms are excluded in the U.S. outweighs the need for short-term earnings.

The third conclusion is that many telecommunications firms seem either to have a "portfolio" approach to international investments or a focus on investments that capitalize on their proprietary technologies and complementary lines of business. Although it takes significant time and resources to develop and manage interests in a number of countries, such an approach can markedly reduce the risks of international investments. Similarly, having experience with a specific technology can help offset the risks from not having country-specific experience. To cite one obvious example, Motorola has developed supplier relationships with entities in which it has invested in both the cellular and satellite industries. The practical effect of this dual relationship is that lower profits from the partnership can be balanced against additional sales by the parent company. (This is, of course, similar to Korean firms entering international markets that use CDMA technology.)

c. Value Added Services

795

Policy makers in many countries protect the incumbent monopoly carrier. For a variety of reasons, including technological, bureaucratic, and political arguments, competition is restricted. Multi-national corporate customers are demanding that regulators in many countries allow competition in the provision of business services in the belief that competition will lead to lower prices and a wider range of services. Historically, multi-national corporations will move operations out of countries where access to adequate and reasonably priced telecommunication services are lacking. Often, agreements are reached where competition is allowed in the provision of value added services while the incumbent monopoly provides basic services and keeps the infrastructure intact. As a result there is a hybrid structure where global, integrated services are provided for multi-national companies by a variety of firms while some of the monopolistic services of the incumbent carrier are maintained.

IV. PART III. FUTURE SCENARIOS AND STRATEGIC OPTIONS

1. *Telecommunications Services*

We now turn to the future and the strategic options for smaller carriers and countries. There is no doubt that the business and economic model underlying both domestic and international telecommunications has been changing. Countries around the globe are witnessing the introduction of new services, the entry and growth of new carriers, and the changing economics of international traffic. There is pressure for tariff re-balancing in many countries as the system of subsidizing local service with super-normal profits in long-distance (trunk) and international services comes under attack from several directions. This is a time of transition, and there is no one clear strategy that is guaranteed to be the best for any particular carrier.

The pressure for prices in all aspects of telecommunications to more closely track costs will continue. Governments and carriers in all parts of the world recognize this fact; it is one of the key reasons that the adoption of the WTO telecommunications agreement may not be the major cause of drastic change. The result of this more open, more competitive future is that a firm will have to seek opportunities as they present themselves or risk becoming a slow growth, low margin operation.

We believe that there are five options that emerge from the analyses in this paper and the other recent studies cited above. They cover domestic, regional, and international opportunities and should not be viewed as mutually exclusive. In fact, as times and conditions change, the preferred mix and exact details will need to be adjusted to reflect the new environment. Starting with the more domestically oriented ones first, the options are:

- Lead the domestic market in an era of phased liberalization
- Seek opportunities to integrate vertically
- Promote regional opportunities
- Capture a major share of regional markets
- Expand enhanced services internationally.

797

We now cover each of these options in turn.

a. Lead the domestic market in an era of phased liberalization.

The deliberate, phased introduction of domestic competition planned by many countries has the problem that, while monopoly telecommunications revenues are protected, it is at the risk of alienating both the business sector and the growing numbers of telecommunications subscribers. Carriers need to develop and maintain a forward-looking plan to rebalance domestic tariffs and renegotiate international tariffs so that both become both more cost-based and more robust in the face of competitive and political threats. This domestic focus can either be the first step in a phased domestic-regional-international growth strategy or an integral part of realignment as telecommunications markets become more global.

b. Seek opportunities to integrate vertically.

At the same time that new carriers enter the domestic market, there will be opportunities for incumbent carriers to acquire firms in related markets or to form alliances with these firms. As the telecommunications business becomes more fragmented, many customers seek to simplify the nature of the choices they are forced to make. By developing new service offerings, if necessary with outside partners, the incumbent can continue to be the carrier of choice.

c. Promote regional opportunities.

As we have discussed in Part I, carriers frequently expand into neighboring countries or into nations with which there is a pre-existing common factor such as language or trade. This is often seen as an intermediate stage between operating solely in the home market and a full range of international activities. Ideally, one should look for opportunities of high growth as well as some degree of natural advantage.

Such an opportunity may be found in the situation in Northeast Asia. There are obvious opportunities in the Tumen River Development Area, and existing carriers from the region are ideally situated to play a primary role in the development of that region's infrastructure. Any one carrier is likely to find itself both a partner and a competitor with other carriers as it becomes increasingly active regionally. The regional strategy likely to be most successful is one that both draws on a carrier's experience in its home market and enables it to work successfully with carefully chosen partners.

d. Capture a major share of a regional market.

Even though many countries are pursuing similar objectives in protecting their own markets—at least temporarily, developing strategies to penetrate those markets is important. The multi-national business customer wants a telecommunications service provider that can offer global services. Any one carrier may have to partner with others in global alliances in order to serve this important segment of the market.

One strategy could be to target companies that are either exclusively or primarily regional in their operations. Even though there is competition in providing services for these companies, a carrier might do well by targeting a limited number of vertical market segments
799 for enhanced business services. Aggressive pricing, high quality of service, and an emphasis on doing business with regional companies might be an effective strategy against the larger global competitors.

e. Expand enhanced services internationally.

Areas that one should investigate are those markets where the margin between costs and prices is likely to remain at above-normal levels. Many believe that in the near future the greatest profits and profit margins are to be earned in international value added services for business customers. Enhanced vertical services will become increasingly profitable while the transmission of raw signals will become an increasingly low-margin business. Next in profitability to look at may be international gateways and international transmission via satellite.

2. *Equipment manufacturing*

One international trade strategy for telecommunications equipment is to use the knowledge of the workforce to maintain a competitive advantage. The employees continually build upon their knowledge and expertise, staying ahead of their competitors. Simply designing and building equipment that can be reverse engineered and copied will lead to only a short-term advantage in the marketplace.

Competitive advantage in telecommunications equipment manufacture is tied to liberalization in telecommunications services. As an example, Terry Curtis has described the result of Korea's moves toward liberalization in telecommunications services to be:

> *"...an open network with multiple carriers and, therefore, equipment from multiple vendors. As the rest of the world's telecom networks are opened to competition and interconnection, those manufacturers that have the greatest experience in providing equipment and software that functions well in multi-vendor, multi-carrier networks will have a distinct advantage. Having such a network in the Republic of Korea will ensure that Korean manufacturers are able to produce products suited to such an environment."*

Carriers working closely with the manufacturers will be able to identify and quantify various aspects of the technology and improve upon it, a process that would normally be done by the developer of the technology.

V. CONCLUSION

Carriers have employed a number of strategies in their efforts to globalize their services, from alliances and multilateral partnerships to foreign direct investment. The partnerships and investments include entering "natural" markets as well as high traffic destinations. There is no clear pattern of globalization strategy among different carriers, and revenue growth is apparently not correlated with strategy.

The early or late opening of domestic telecommunications markets does not appear to correlate with the rate of revenue increases received by the carriers. However, growth in telecommunications services revenue is related to the level of development and the rate of overall economic growth in the carrier's home country.

There is no "magic bullet" that will guarantee that any carrier will continue to grow and thrive in the changing world of telecommunications. Choices in strategy are made for a variety of reasons—choices that may not necessarily result in the highest revenues or growth rate. There continue to be major changes in technology, domestic policy, international relations, and the overall economy that present both great challenges and opportunities to the telecommunications carriers of the world.

Return to Top View Full-screen

Table 1: Domestic Telecommunications Markets in 12 Countries

Country	Main Lines (000) 1986	Main Lines (000) 1995	Annual % Increase (Lines)	Minutes of Telephone Service (Billion) 1986	Minutes of Telephone Service (Billion) 1995	Annual % Increase (MTS)	Calls 1986 (millions)	Calls 1995 (millions)	Annual % Increase (Calls)	Revenues 1986 (billion)	Revenues 1995 (billion)	Annual % Increase (Rev)
USA	122,203	164,624	3.4%	1103	1511.5	5.6%				$102.93	$178.16	6.3%
Japan	46,772	61,106	3.0%	185.16	233.28	3.4%				¥5313	¥8806	5.8%
EU Countries:												
UK	21,727	29,411	3.4%	92.973 (1992)	116.547	7.8%				£9.424	£17.528	7.3%
Sweden	5,373	5,967	1.2%	23.945 (1988)	30.711	2.8%				18.366 Kronor	33.205 Kronor	7.0%
Finland	2,272	2,801	2.4%				2707	3735	3.8%	5.489 Markka	11.067 Markka	8.2%
Denmark	2,628	3,193	2.2%				4141	4209	0.4%	13.306 Kroner	19 Kroner	4.2%
Netherlands	6,029	8,120	3.4%				5879	9490	5.5%	6.913 Guilder	13.623 Guilder	7.9%
Germany	26,189	40,400	4.9%				28520	52500	7.1%	35.327 DM	68.835 DM	7.8%
France	23,911	32,400	3.4%	96.96 (1989)	104.4	4.5%				90.74 Franc	135.58 Franc	4.7%
Italy	18,253	24,845	3.5%				18.451	35	7.4%	13950 Lira	32598 Lira	10.3%
Spain	9,785	15,095	4.9%				11175	17358	5.2%	468 Peseta	1372 Peseta	12.8%
Portugal	1,511	3,584	10.1%							99.51 Escudo	429.18 Escudo	17.7%

SOURCES: ITU Yearbook of Statistics, 1997. (Growth rates calculated by authors.)

Go back

Table 2: Gross Domestic Product per capita and Growth Rates

Country	GDP per capita in USD 1986	GDP per capita in USD 1995	Annual % Increase (GDP per capita in USD)	Year Market Opened - Cellular	Year Market Opened - Fixed
USA	18301	27569	4.7%	1984	
Japan	16344	41004	10.8%	1985	
UK	9970	19095	7.5%	1984	1985
Sweden	15891	25973	5.6%	1981	1991
Finland	14237	24091	6.0%	1992	1994
Denmark	16075	33013	8.3%	1992	1996
Netherlands	12265	25501	8.5%	1995	1997
Germany	14527	29554	8.2%	1992	1998
France	13168	26504	8.1%	1992	1998
Italy	10548	18962	6.7%	1995	1998

Spain	5969	14260	10.2%	1995	1999
Portugal	3469	9175	11.4%	1992	2000

NOTES: GDP converted from local currency to U.S. Dollars at year's average market exchange rate. Market opening in all countries has been a process and, therefore, difficult to assign to a single year. U.S. and Japan dates are for major policy changes.

SOURCES: GDP, population, and exchange rate data from ITU. Growth rates calculated by authors. Market opening years for European countries from Elixmann.

Go back

Table 3: Correlation Coefficients for Rankings

(Measured by Kendall's Tau b)

	1986 GDP per capita	Growth in GDP per capita
Growth in lines	-.485* (.014)	.333 (.065)
Growth in revenue	-.606* (.003)	.212 (.169)

NOTES: Entry in each cell is correlation coefficient, followed by p-value in parentheses. An asterisk (*) indicates significant at 95% level or better.

SOURCE: Authors' calculations; see text.

Go back

Table 4: Regression Analysis of Telecommunications Growth Rates

Dependent Variable	Independent Variable(s) (all per capita in USD)	Coefficients	p-values	R2
Lines growth	Growth in GDP	.689*	.026	.406
Lines growth	1986 GDP	-.390*	.004	.585
Lines growth	Growth in GDP 1986 GDP	.303 -.300*	.292 .041	.636
Revenue growth	Growth in GDP	.873	.115	.230
Revenue growth	1986 GDP	-.740*	.000	.761
Revenue growth	Growth in GDP 1986 GDP	-.117 -.780*	.757 .001	.764

NOTES: An asterisk (*) indicates significant at 95% level or better.

SOURCE: Authors' calculations; see text.

Go back

Table 5: Summary of Findings—EU & U.S.

European Union	United States
International traffic primarily within EU	U.S.'s top destination is Canada; remaining traffic highly fragmented
FDI depends on common interests (language, distance, etc.).	FDI depends more on market opportunities.
Heavy investor in cellular.	Heavy investor in cellular

Strong role for equipment manufacturers.	Manufacturing role only important for Motorola (and for AT&T in past).
Accounting rate issues not so important.	Accounting rate issues very important (due to large traffic imbalance).
Major reasons for alliances: • replace FDI • serve MNCs • (lesser interest in controlling both ends)	Major reasons for alliances: • control both ends • least-cost routing • serve MNCs
Strategies often technology-driven.	Strategies often market-driven.

Go back

The Role Of Community Telecenter (CTC)

In Accelerating Educational (Community) Development In Indonesian Rural Area

Naswil Idris and John M. Renner

Universitas Terbuka, Indonesia

Edith Cowan University, Australia

ABSTRACT

The Indonesian Open Learning University is starting to implement several pilot projects in different places in Indonesia in cooperation with MASTEL (Indonesia Telecommunication Society) Jakarta and Edith Cowan University, Perth, Australia. Generally, the benefits of the Indonesian CTC are to promote village resources for national and international access, to improve national Information Technology (IT) and to inhibit urban migration.

View Full Text

The Role Of Community Telecenter (CTC) In Accelerating Educational (Community) Development In Indonesian Rural Area

I. INTRODUCTION

A. *Telecommunication for all*

Universal Access in Indonesia Director General Post and Telecommunication (1998) explains that the Indonesian telecommunications sector is experiencing unprecedented transformation. Under the Telecommunication Law Number 3/1989 the Government of Indonesia (GOI) has implemented steps to significantly restructure the sector by diversifying the provision of telecommunication services and allowing the participation of private sector to provide basic telecommunication services.

Subsequently, the GOI institutionalized the policy of an open market (Indonesian initiative) on the mobile telecommunications services. Consequently, several private entities have been licensed to operate mobile telephone networks on a fully competitive basis while each one of them has to cooperate with PT Telkom.

As a result of this policy, the Indonesian telecommunication environment has gradually changed from a state-owned monopoly to a sector with competitive multiple operators. The incumbent and the new operators are extensively investing in the expansion of the telecommunications infrastructure in terms of closing the gap between demand and supply of the service.

B. The market structure

Until 1993, there were two incumbent operating agents providing basic telecommunications, namely PT Telkom for domestic services and PT Indosat for international services. In the same year, the Government of Indonesia issued a license for new operators that provides basic international telecommunication services, namely Satelindo. This domestic company also provides satellite and GSM mobile communication services

The license is meant to be a system that will maintain Duopoly in the provision of basic international services for the next ten years starting the year of 1994. At the same time, the GOI also implemented the policy that allows companies to provide GSM mobile telephone service on a fully competitive market environment. As a result, two more GSM mobile licenses have been issued for other domestic companies. In addition to that, foreign mobile operators are allowed to buy significant stakes in all three Indonesia's GSM operators.

There was also a significant effort to the telecommunication restructuring in 1994, through the share market. Indosat - the state owned International operator - offered its shares through an Initial Public Offering (IPO) in New York and Jakarta Stock Exchanges. After this combined offering, the GOI still owns 65% of the outstanding stock of Indosat. This strategy will enable the GOI to retain control over the company.

Furthermore, the GOI implemented two privatization strategies for Telkom, another state-owned company. The first strategy is that Telkom initiated a Joint Operation Scheme (JOS) with private consortia in 1995. Each consortium involves a world class operator with significant expertise and experience, such as France Telecom, US West, Telstra, Cable & Wireless and Singapore Telecom. Under the JOS, those five world class operators entered into Joint Operation Agreements with Telkom. In a specific JOS region, each consortium has to plan, design, and construct, finance and operate the local public switched telephone network (PSTN) for the next 15 years. The second strategy is that Telkom offered its shares through an IPO to overseas and domestic stock markets. The government presently retains over 70% ownership of Telkom.

C. *Universal Service Obligation*

Director General Post and Telecommunication (1998) says that the Government goals for its current five year plan for the domestic telecommunication sector are to increase the accessibility, affordability, and quality of telecommunication services. Consistent with these goals, the Ministry of Tourism, Post and Telecommunication has taken a number of regulatory measures, such as Universal Service Obligation (USO)

Under the Ministerial Decree Number 108/1994, the Government has imposed a USO to all providers of telecommunications services for the construction, development and operation of telecommunications facilities in terms of providing public service in Indonesia.

Telkom as the only domestic fix telephone network operator is required to meet the USO. The long-term objective of USO is to ensure that every household wanting telephone service could be connected to the public network at affordable process.

Under the contractual arrangement (JOS), Telkom and its joint operation partners have to allocate 20% of their annual investments on installation in unserved or underserved areas regardless of commercial considerations. Meanwhile, other carriers like mobile communication and international service providers have to contribute to Telkom's cost fulfilling the USO. This contribution is built in to the charge for interconnecting the networks of other carriers to the Public Switch Telecommunication Network (PSTN).

From the technological approach, the policy of USO is implemented through Rural Telecom Project and satellite facilities. Further, from a service approach, USO's policy can be provided through Wartel or Telephone Kiosks and Express Connection.

D. *Universal Access in Indonesia*

Information plays an important role within the global information society. Information should be made accessible throughout the country. Consequently universal access is a necessity in the information era.

Director General Post and Telecommunication (1998) explains that the provision of universal access means placing an affordable telephone service within people's reach. For example, by installing public or community telephones (Wartel or Telephone Kiosks) within walking distance of people's houses. It might be important to note that availability, accessibility and affordability of service are three essential elements of universal access.

As mentioned previously the GOI has imposed the USO of all telecommunications providers. The USO is one strategy to fulfill the element of universal access. However, due to the extensive geographical condition of Indonesia and its low telephone density at the moment, it is obvious that universal access, is difficult to be achieved in short time with a traditional network technology.

Recently, the new technology of global (and regional) mobile personal communications by satellite (GMPCS) has been introduced. This new technology creates access to the network that would be instantly and universally available. However, affordability of GMPCS technology is difficult to accomplish. The GMPCS's tariff is higher than the current PSTN's tariff. It seems that Indonesia needs a strategy to make Universal Access universally available soon and affordable for targeted users GMPCS in Indonesia.

E. *Indonesia's Vision for the 21st Century*

Like most countries today, Director General Post and Telecommunication

(1998) reports that Indonesia is preparing plans to permit its full participation in the information era. Indonesia, like any other developing country, is facing many new challenges. Indonesia is determined to eliminate poverty and by the beginning of the next century, modernize its education system, health care and trading networks. Indonesia has no choice but to ready her people for the new century, the new era of the global information society and the era of liberalized and free trade.

Indonesia has to take innovative initiatives to empower its society, so that they will be ready to face the very competitive, global information society. For this purpose Indonesia has formulated its vision, "Nusantara 21" (N21).

- ***"Nusantara 21" (N21):***

  This vision holds out a dream that by the year 2001, according to Director General Post and Telecommunication (1998) the whole archipelago country will have access to wide band information infrastructure and systems from anywhere at any time, so that Indonesian people will be empowered, enriched, and ready to face the era of the global information society.

  The vision expects that by the year 2001, all the major islands will be linked by wide band optical fiber system, all the major cities will be served either by terrestrial, submarine cable system or multimedia broadband satellite system. By that time, 11 multimedia cities will be fully wired, and Indonesia's National Information Infrastructure (NII) will be very well in place and connected to the regional (Asia Pacific Information Infrastructure/APII) and the Global Information Infrastructure.

  Action plans have been formulated for the development of various applications, such as government on line, electronic commerce, healthcare, education, tourism, telecommuting, banking and financial services. These initiatives will be supported by a local research and development program, soft and hardware industries and accelerated human resources development.

  On the other hand, the Indonesian government has appointed a Presidential Team, consisting of a number of cabinet ministers, in charge of coordinating the mobilization of necessary resources and the implementation of N21.

  Currently, we are working with the World Bank in developing some of the priority applications such as tourism, science and technology application, postal services application, and health care application.

F. *Telecom in Indonesia and Universal Service Obligation*

TABLE 1. Telecom in Indonesia and Universal Service Obligation

Operating Statistics 1997	
Exchange Capacity	7,392,197
Lines in service	4,982,466
Lines in service per 100 inhabitants	2.5
Public telephones	166,274
Pulse Production (in million)	35,347
Call Completion Rate (%)	
Local	60.4
Domestic long distance	56.5
Total employees	37,644
Lines in service per employees	131.2
Internet users	more than 250,000 (1997)

II. SOME COMPONENTS OF CTC

A. *Distance Education Satellite System (SISDIKSAT)*

Under supervision of Directorate General of Higher Education and USAID Washington, Universitas Terbuka (UT), the Indonesia Open Learning University participated in a Rural Satellite Project with eleven other public universities in the eastern islands of Indonesia. There were three components of media, printed through fax, graphics (teleblackboard) an audio conferencing.

In 1976, Indonesia became the first country in the developing world to create its own satellite-based communications network. Launched in 1976, the Palapa A1 was soon followed by two other satellites in the system which links many of the islands comprising the 3000 mile long archipelago. But Indonesia did little to use its potential satellite network for other than commercial services. In 1982, with the initiation of the Indonesian Distance Education Satellite System (SISDIKSAT), the resources of the Palapa telecommunications system were employed to meet the challenges of increasing the opportunities for and quality of university education in Indonesia.

Tietjen, K. (1987) reports : SISDIKSAT was designed to maximize the scarce professional and teaching resources of the Eastern Islands Association, a group of fairly new universities and teacher training colleges in eastern Indonesia. Isolated by vast distances of ocean, each university depended on its own limited resources to achieve the growth expected in Indonesia's higher education system. Alone, these institutions could not offer the quality of instruction and full curricula as expected of the universities or serve the overwhelming number of students requesting admission. Multi-site communications were critical to their development.

SISDIKSAT's main activities are course sharing, enrichment seminars, training programs, information exchange, and message service. Through its teleconferencing network, SISDIKSAT provides rarely available academic courses to university students and improves faculty knowledge and teaching skills through in-service training programs and seminars, SISDIKSAT makes the expert resources of one university available to the others, thus multiplying the outreach and impact of these resources.

With 15 sites, SISDIKSAT is the largest teleconferencing network in the any developing world, connecting 12 widely separated universities, the Ministry of Education, Open Learning University headquarters in Jakarta, and the Agricultural Institute in Bogor. First SISDIKSAT began operations at 11 sites, later four additional sites have joined the network. The most technically complex and ambitious of the three RSP teleconferencing networks, SISDIKSAT posed a real challenge for demonstrating the specialized use of satellite communication for development.

All SISDIKSAT sites rely on the existing telephone system; access to the satellite is achieved through dedicated line from the universities to the nearest earth station. The land lines and satellite capacity are leased on a 24-hours basis, by passing the noisy local telephone switches and controlling the circuit quality. The user, SISDIKSAT, and the TELECOMMUNICATIONS COMPANY PT TELKOM share technical management of the SISDIKSAT network. The SISDIKSAT electronic classroom consists of an audioconferencing channel for two-way voice communications. A second channel is used for graphics and hard copy transfer, private telephone conversations, and as a back up. Each site is equipped with auxiliary power supply units.

B. *Project Share (Project Satellite for Health and Rural Education)*

Under CIDA and University of Guelph sponsorship, UT joined computer teleconferencing with seven other public universities in Indonesia, the so called SHARE Project (Project Satellite for Health and Rural Education). UT lecturers and students benefited from this project in using email and computer teleconferencing with Canadian Universities in Toronto, Vacounver and Guelph.

The objectives of this project are:

- To establish a computer conference via satellites (INTELSAT and Palapa) for participants from universities in Indonesia (including Universitas Terbuka) and abroad.
- To explore the use of computer telecommunication networks (computer conferencing) as a new medium to support various academic activities such as research, continuing education and project management.
- To facilitate the interchange and evolution of ideas and information over a period of time between Indonesian and academic institutions abroad in the areas of : biotechnology, medicine and computer networking.
- To demonstrate the establishment of computer communications via satellite between isolated communities and project centers in Indonesia and abroad.

The dedicated lines from the Indonesian sites converge in Jakarta, in the SKDP (public switched data service) network operated by Indosat. An X-25, synchronous line at 2400 baud carries the data via a voice circuit on an Intelsat Pacific Satellite (intelsat Project Share) to Vancouver

From Vancouver the data travels on intergateway lines to the Teleglobe SL-10 computer in Montreal. The data leaves the SL-10 and terminates on the public

Datapac network connected to the computer conferencing host (COSY) at the University of Guelph.

The reverse route carriers participants using Datapac to connect to the University of Guelph to lease or retrieve information. All Indonesian communications were channeled through Guelph. Project Share was started 1986 and terminated in 1988.

1. *Tourism Posts and Telecommunication Kiosk Phone (Warparpostel):*

Under supervision of the Ministry of Tourism, Posts and Telecommunication Indonesia private companies developed more than 1000 Tourism Posts and Telecommunication Kiosks Phone (Warparpostel) to serve Indonesians and tourist from abroad with the valuable information and with telecommunication facilities. The sites are located at public places. Warparpostel kiosks play a very important role in sharing the limited number of telephone lines in the country.

2. *Virtual Campus in Internet Cafe (at the Post Office):*

The Virtual Campus provides "just-in-time" contact and support, and is used in conjunction with traditional printed materials. Students can enter the campus through Wasantara Net at the post office at any time, day, or night, seven days a week and avail themselves of the many services provided for them.

Post office management charges around 50 cents US$ per an hour. The following services and facilities are currently available on the Virtual Campus: email, chat, talk, library, news group and send & receive files (upload/download).

3. *Experience in Summary:*

The experiences during the development of these embryos Project Sites or the relevant components of the CTC will be become an asset for the person who are involves in the coming pilot projects in the field.

Experiences that could contribute to the CTC development, include:

- Indonesian people need peer groups to discuss many topics. They are able to learn from this discussion on the Project Site.
- The most effective feedback takes place not in the formal meetings but informally on the Project Site.
- Indonesian people are not willing to openly express their points of view in public meetings or official ceremonies, but more so on the Project Site.
- Indonesians prefer to work in the company of others. They need neighbors to talk to. The Project Site is providing such an environment.
- Culturally Indonesia is a very open society, based on sharing and offering help to other people in informal settings.
- Therefore they need the "service points " within walking (traveling) distance to transmit information, to confirm and to deny the information, to discuss and to interact with others.
- The flow of information (in terms of knowledge, skills and so on) can easily reach the people on the Project Site rather than through other media.
- Project Sites are considered to be preferable, comfortable places to visit in leisure time.
- The member who joins the embryo Project Site tends to be more innovative compared to those who join later.
- Embryo Project Sites are considered a source of knowledge like a learning center.
- Project Sites are considered to be important clubs with high status.

III. CTC DEFINED

ITU (1998) defines that CTC (Community Telecenter) is a shared information and communication facility for people in rural and isolated areas, and is used as a means of improving access to telematic technologies in remote areas. Such centers provide information technology (IT) and telecommunication service, user support, and training for the population of a community who cannot afford such facilities on an individual basis and/or do not have the Skills to use such tools. The set up and applications supported by such centers varies considerably. It its simplest form, widely introduced in developing countries, it may provide public telephone, and fax services only, and be handled by a local shopkeeper. However, such CTCs are usually established in more densely populated areas and do not qualify as "multipurpose" centers.

At the other end of the scale, there are CTCs with (shared) offices for local small businesses and "teleworkers" and are equipped with computers, printers, photocopiers, etc. Such centers provide access to data networks (i.e., Internet) for email, file transfer, access to electronic libraries and databases, government and community information systems, market and price information, environmental watch services, etc., as well as facilities and equipment for teletraining and telemedicine. Some may also provide facilities, equipment, and training for local production (and reception) of broadcast radio and television programs.

Calvano M. (1998) says that the Community Telecenter becomes the focal point of the telecommunity. It is a new way of building empowered rural communities and networks of communities. By linking rural :

- Health ; Health Community Center
- Education ; The Indonesian Open Learning University
- Government; Village Center civil servant services.
- Business : Cooperative Center, and small scale industry

With advanced telecommunication and technology it is possible to create sustainable economic opportunities for rural communities. CTC allow rural communities the ability to harness the same development strategies, broadband telecommunications, and advanced technology normally reserved for metropolitan areas. The advanced technologies found in a CTC may include:

- Imaging
- Interactive videoconferencing

- Bridging services
- Internet/community network hub
- Telecommuting center
- Telemarketing
- Telecommunications

Calvano M. (1998) states that the CTC for a local business provides access to the telecommunications network and advanced technologies where the users pay only for the time in which they use the service. The CTC is built to satisfy the specific needs of each group and designed to provide them access to the worldwide network. The CTC is an opportunity to bring affordable advanced telecommunications and technologies to rural and remote communities to increase revenue opportunities, and save costs through shared resources.

IV. PLANNING TELECENTERS FOR INDONESIA

The Workshop on the Equal Distribution of Information (RATINFO) of the Indonesian Telecommunication Society (MASTEL) last May 1998 in Jakarta engaged a study team to determine the feasibility and requirements for a pilot project for establishing Community Teleservice Centers to support integrated rural development in Indonesia, and prepare a project proposal including the following action data and information:

- Identify, in consultation with the Government Officials and other Indonesian partners, the area/s where the pilot project will be implemented
- Identify national and local partners who are willing to participate in, and contribute to the pilot project implementation
- Prepare, in cooperation with concerned partners, a summary of current and planned public services, economic activities, etc. As requested in the attached Guidelines for preparation of pilot projects proposals
- Assess demand and estimate potential need for telecommunications services in the selected are including new applications such as telemedicine and tele education.

- Define, in consultation with all partners, the applications to be tried out during the pilot project.
- Make a preliminary annual forecast of subscriber and users of the services to be introduced during the pilot project and for a planning horizon of 10 years.
- Make a preliminary annual forecast of the telecommunications traffic that will be generated over the next 10 years (incoming and outgoing).
- Review existing tariff structures and prepare a preliminary proposal for tariffs to be tested in the pilot project.
- Make a preliminary forecast of the revenues from telecommunication services over the planning period.
- Survey existing telecommunication infrastructure, make technical economic analysis of technology options and propose technical solutions for provision of the telecommunication services in the selected region and for integration of these rural systems with the national and international network.
- Make a preliminary cost estimate of telecommunication and information technology hardware and software required for the pilot project.
- Make a preliminary estimate of operation and maintenance costs (including training) for the telecommunication system as well as for Community Teleservice Centers.
- Identify possible regulatory constrains and propose solutions for these during the pilot project so as to avoid any delays in its implementation.
- Prepare a preliminary business plan for the pilot project, indicating estimated costs and revenues, return on investment, and other financial key figures.
- Prepare a preliminary work plan for implementation of the pilot project, indicating contributions of the different national and local partners (in kind or in cash).

V. PILOT PROJECT IDENTIFICATIONS

Because of the heavy monetary crisis in the last 12 months in Indonesia CTC Pilot Projects couldn't be identified properly. Instead, MASTEL (Indonesian Telecommunication Society) arranged several seminars to discuss and focus the potential pilot projects and to develop the prototype of the pilot projects in rural poor and urban rich. The MASTEL members from ITU (International Telecommunication Union), Ministry of Post and Telecommunication, PT Telkom, Universities, International Telecom Operators, Lawyers, and so on have discussed thoroughly to focus the major potential pilot projects.

There will be no budget from Government to sponsor pilot projects. Therefore the chairman and members of MASTEL agreed to offer a pilot project to be carried out or sponsored by private companies.

Several alternatives have been developed. The virtual campuses (under cooperation between UT and Edith Cowan University) located at the post offices will be expanded. Health and business activities will be added to the educational programs. Public places like the Training courses, private universities, Mosque and so on will be coupled by building the Annex pavilion to accommodate CTC activities. Existing learning resource centers belonging to the private school or university sites in the in country side will be encouraged to adjust themselves to be the real CTC as planned. Several Open University virtual campus sites will be developed in such away by adding health, community development and business activities.

Because of the Indonesian Government cannot afford to support the CTC pilot projects, MASTEL and Edith Cowan University Perth, Australia are now considering to carry out one or two pilot projects in Jakarta, and several others in country sites.

VI. CONCLUSION

Information and communication are important elements in the growth of societies, they determine the characteristics of the societies. Information societies can only grow when information networks are established, and basic agreement and rules are set on the what, the who and the how of communications. Informal social structures and formal institutional structures are basically communication and information networks, managing the processing of information and its flow.

The importance of information and its technology to society is even more obvious, when we examine how to support the various elements of a society. Society, according to the sociologists, is a collection of people who share a common culture (which they transmit to succeeding generations), a common territory, and a common identity, and who interact in a socially structured relationship. The common culture provides a shared "design for living", common geographic territory provides a shared space and shared telecommunication facilities, in which to carry out the design and both provide a shared sense of identity, a sense of communality. All of these could only be developed by human interaction, in other words by communication and the exchange of information like in the CTC. When members are dispersed in a shared space in so wide a country as Indonesia, information and communication technology become essential to overcome space and time constraints, and maintain national integration as well as development in the area of education, health, business, and community services.

The channels of interaction are structural elements or building blocks, of society. Social structure is the recurrent pattern of the relationships among the elements of society, i.e. status, role, groups, organizations, social institutions, and community- all of which are based on the management of information. Status for example may be accorded on the basis of social perception that is developed or built through media or multi media exposure. Organizations, social institutions, and community in today's society require interconnection through "telecommunication infrastructure", and adequate information storage, processing, transmitting and broadcasting like the activities in the CTC, in the service point or focal point, supported by Information technology.

Therefore, CTC pilot projects hopefully could prove to reach the objective of the Indonesian CTC to improve village living standards, to promote individual equal opportunities for access to information, and to enhance work opportunities.

In the area of education the CTC pilot projects will to accommodate student activities as the bridge to the Indonesian Open Learning University in Jakarta. CTC hopefully will play an important role as information center, and place to interact with students, as well as for entertainment to attract them to visit CTC as many times as possible.

In the area of health the CTC pilot Projects will enhance the role of CTC to educate the people to have a good health habit, and to carry out promotive, preventive, curative and rehabilitative activities of health programs in local areas.

In the area of telecommunication the CTC pilot project will expand the telecommunication market and create the new telecommunication business, such as telephone sets, facsimiles, computers, modems, Radio sets, TV sets, photocopy machines.

Even though Indonesia has experienced a financial crisis over the past 10 months, and most likely will continue to suffer economic difficulties for the next few years, the CTC concept is alive and thriving. MASTEL (Indonesian Telecommunication Society), Edith Cowan University, Perth Australia and the leaders in the telecommunication and information sectors continue to promote CTC implementation even while other innovations and, technology-intensive projects are being cancelled or rescheduled. This is a clear tribute to the expected impact of CTC services on socio - economic development in the information era.

Finally, CTC pilot projects hopefully can predict that CTC could improve the quality of life of Indonesian people through ***Broadening Access to Information***.

VII. BIBLIOGRAPHY

1. Calvano, Michael (1998), *Establishing Community Telecenters to Support Integrated Rural Development* (pp 7-9), ITU, Jakarta.

2. Corrigan, Marrie (1997), *The Virtual Campus User Guide*, Perth Australia.

3. Dahlan, M. Alwi (1995), *Information, Technology and Society*, AMIC Annual Conference on Communications, Culture and Development, Jakarta.

4. Directorate General of Posts and Telecommunications, *Speeches of Director General Posts and Telecommunication* (1998) (pp 1-13), Jakarta.

5. Idris, N., Renner, J. (1997), *The Role of Network and Information System (Nusantara-21) in speeding Up Development of the Implementation Virtual Campus in Indonesia*, PTC 97 Proceeding, Honolulu, Hawaii.

6. Idris, Naswil (1992), *The New Media Environment in Asia Implication for Communication Education and Training: The Indonesian Case,* Conference on Communication in a Changing Asia, Manila.

7. ITU (1998), *World Telecommunication Development Conference (WTDC-98), Community Teleservice Centers to Support Integrated Rural Development* (pp 3-5), Plenary Meeting, Valletta, Malta.

8. PT Telkom (1997): Annual Report 1997 (pp 7), Jakarta.

9. MASTEL (1998), *Community Telecenter.* Group Discussion of CTC, Jakarta.

10. Renner, John (1995), *Convergence of Communication Technologies to Achieve Educational Excellence. A case for the Virtual Campus,* PTC 95 Proceeding, Honolulu, Hawaii.

11. Tietjen, Karen (1987). USAID, *Program Overview, Telecommunication and Rural Development* (pp 4i-5i), Washington DC.

Return to Top View Full-screen

Attracting And Nurturing Small Businesses In Rural Areas:

A Telecommunications Solution

Alan B. Kamman and Duncan Holiday

Vermont Telecommunications Application Center, U.S.A

ABSTRACT:

This paper presents a solution to the problem of creating a receptive environment for the start up and growth of small businesses in rural areas. Vermont is offered as an example of a rural population with sectors that are under-served by telecommunications. The Vermont Telecommunications Application Center (VTAC) is presented as the kind of organization that can act as a catalyst for the development of needed services, and thereby stimulate growth in the business sector. It is suggested the VTAC can, therefore, serve as a model to be replicated in similar circumstances throughout the U.S. and the world.

This paper also acknowledges a problem that goes beyond the limited brief of the VTAC project, but which needs to addressed because it links the work of that project to the broader aims of rural development in the Pacific Hemisphere and worldwide. This problem has to do with finding ways for small businesses to act as engines for the provision of telecommunication services to chronically under-served poor rural areas. Vermont is again offered as an example of a place where lack of economic resources has placed a portion of the population beyond the immediate reach of small business development programs such as VTAC. It is suggested, however, that the network of institutions, both public and private, for which VTAC serves as a hub, can provide a new level of community-based telecommunications access for education and economic development among the rural poor. VTAC can be seen, thus, as a model to be replicated in the business sector, but also as a facilitator for the extension of telecommunication services beyond the business sector.

View Full Text

Attracting And Nurturing Small Businesses In Rural Areas:

A Telecommunications Solution

I. INTRODUCTION

This paper presents a solution to the problem of creating a receptive environment for the start up and growth of small businesses in rural areas. Vermont is offered as an example of a rural population with sectors that are under-served by telecommunications. The Vermont Telecommunications Application Center (VTAC) is presented as the kind of organization that can act as a catalyst for the development of needed services, and thereby stimulate growth in the business sector. It is suggested that VTAC can, therefore, serve as a model to be replicated in similar circumstances throughout the U.S. and the world.

This paper also acknowledges a problem that goes beyond the limited brief of the VTAC project, but which needs to be addressed because it links the work of that project to the broader aims of rural development in the Pacific Hemisphere and worldwide. This problem has to do with finding ways for small businesses to act as engines for the provision of telecommunication services to chronically un-served and under-served poor rural areas. Vermont is again offered as an example of a place where lack of economic resources has placed a portion of the population beyond the immediate reach of small business development programs such as VTAC. It is suggested, however, that the network of institutions, both public and private, for which VTAC serves as a hub, can provide a new level of community-based telecommunications access for education and economic development among the rural poor. VTAC can be seen, thus, as a model to be replicated in the business sector, but also as a facilitator for the extension of telecommunication services beyond the business sector.

II. BACKGROUND

1. *The State of Vermont*

Vermont is essentially a collection of rural communities. It has 9 cities, 236 towns and 60 villages. The average age of Vermont communities exceeds 200 years. Approximately 77% of Vermonters live in rural areas. Among the 50 states, Vermont ranks 43rd in geographic area (9,615 square miles) and 49th in population (585,000). It ranks 35th in average annual pay ($25,583) and 50th in State and Local Government Revenue.

It is a State where the economy depends greatly on small, entrepreneurial businesses. In terms of average annual employment, excluding State Government, 42% of Vermont's workers are employed in service industries and an additional 28% are employed in retail trade; a total of 70% of the population. Of the 18,000 full-time business firms with employees in Vermont, 97.5% are small businesses (businesses with fewer than 500 workers). There are also approximately 35,000 full-time self-employed persons, for a total estimated full-time small-business population exceeding 53,000 firms. Income from these small businesses exceeds one billion dollars. Largest growth has been experienced by small businesses with less than 20 employees. This reflects the importance of small business firms as job creators in the State of Vermont.

Vermont shuns smokestack industries. Therefore its future lies primarily with small, homegrown, entrepreneurial-driven companies. There are dozens of small, socially responsible, sustainable businesses such as Ben & Jerry's, Otter Creek Brewing Company, and Vermont Teddy Bear. In addition it is home to some of the largest mail-order operations in the nation, including Vermont Country Store, Gardeners Supply, Orvis, and Resolution, Inc.

2. *Telecommunications Services*

There are eleven local exchange carriers within the State. Bell Atlantic accounts for 84.5% of the access lines, Vermont Telephone provides 5.2% and Champlain/Waitsfield provides 5.1%. The other eight companies provide the remaining 5.2%. Currently there have been 35 CLEC (Competitive Local Exchange Carrier) licenses granted by Vermont's Public Service Board. Hyperion is actively promoting service. Burlington Electric Company also has approval to do so from the City of Burlington and the State. June 24, 1998, they issued a Notice of Market Opportunity, requesting companies interested in partnering with them, to submit credentials.

While several LEC's (Local Exchange Carriers) offer Internet services, the largest providers in the State, such as TogetherNet and SoVerNet, are private organizations. In addition, Adelphia Cable, who provides 90% of the State with its CATV services, just announced a high speed cable modem service, and associated Internet site, to cable subscribers in the area around Burlington. They plan to expand this to their customers throughout the State.

Hyperion, a subsidiary of the national Adelphia organization (Coudersport, PA.) has expended hundreds of thousands of dollars to establish a State-wide fiber optic system in competition with that of Bell Atlantic. In addition, as just mentioned, Hyperion has filed and received permission to be a CLEC.

The Vermont Business Roundtable is an assembly of 116 Chief Executive Officers of companies in Vermont, dedicated to improving the climate for businesses in the State. It produces socio-economic studies to help businesspersons, policy makers, and individuals understand the economic position of Vermont in comparison with its competitors in the region, nation, and world.

Since the members are aware that telecommunications development usually leads economic development, they commissioned a study to examine statewide communications. The study results indicated a wide gap between the telecommunications technology and facilities that are available in Vermont, and the level of understanding (and use) of them by small businesses, individual entrepreneurs, government, educational institutions, and non-profit organizations. As a result, the Roundtable formed a non-profit organization known as the Vermont Telecommunications Application Center (VTAC). VTAC is dedicated to providing the education necessary to close that gap.

3. *Vermont Telecommunications Application Center*

a. Mission

The chief problems that VTAC will address are:

- Inequities in distribution of telecommunications application information in a rural state of small, scattered communities. Many of these areas are underserved

- The need to educate the small businesses and individual entrepreneurs, who represent a critical economic sector, in the most effective application of telecommunications technology tailored to their individual needs

- The need for a central and independent resource to educate end-users in the best practices in telecommunications applications

Vermont has more non-profit groups per capita than any other state. These are often indispensable to the communities they serve. It is important that VTAC also educate these groups on how to apply telecommunications technology to improve their service

A primary purpose of the VTAC project is to make Vermont more attractive for small business startups in rural areas by assuring adequate use of telecommunications facilities. In a rural-dominated state like Vermont, economic well being rests on sustaining small businesses in rural areas and attracting new employers. Telecommunications development makes this possible but only insofar as business owners know when and how to use it. VTAC was created to facilitate education in the use of telecommunications technology essential to these businesses.

Another purpose for the VTAC project is to provide a neutral source of information, unprejudiced by vested interests, whenever telecommunications policy issues or dockets come before the Governor or Legislature. As VTAC is successful in expanding the use of telecommunications infrastructure, it will be a useful resource in the State's efforts to attract new businesses. Government agencies can also learn from advanced users of telecommunications applications.

b. *Funding*

The Vermont Telecommunications Application Center was funded initially by private companies and by the State of Vermont. VTAC is resident at Champlain College's Information Commons in Burlington, VT. The $7 million structure was opened in June, 1998, and is a showcase of useful technology in the media communications, information infrastructure and telecommunications fields. It houses the College's library, computer center, and multi-media laboratories. VTAC's offices and infrastructure support in the Commons represents a major in-kind contribution from Champlain College.

Late in September, 1998, VTAC learned that it was one of 46 successful applicants out of a field of 775 entrants to win a U.S. Department of Commerce TIIAP Award. The National Telecommunications and Information Agency distributed grants totaling $18.5 million dollars under its Telecommunications Information and Infrastructure Assistance Program. Their goal is to support a wide range of projects designed to use new technologies that improve delivery of social services, increase access to lifelong learning, and bring the benefits of the Information Age to underserved areas.

4. *Addressing the Problems*

a. *General*

Emphasis is placed on workable, efficient, tested solutions, tailored to specific needs. VTAC does not propose new design efforts; rather, it proposes enabling users to employ existing techniques in the most appropriate and cost-effective manner. Its tools include:

- Use of a professionally designed, user-friendly web-site
- Interactive presentations given over the Vermont Interactive Television network, which has twelve sites giving full coverage of the State
- Focus Groups of local businesspersons set up in five communities in Vermont, and
- Lectures given by the staff at locations outside the urban area

When designing the website, a primary condition was that it must adhere to standard practices for disabled users. These standards preclude certain color combinations, ASCII drawings, etc. There is an informal organization that reviews website design and issues its stamp; hence the "*Bobby Approved*" on VTAC's Home Page.(http://www.vtac.org)

The first operational consideration is that it must be updated on, at minimum, a three week interval. VTAC managers and designers alike noted that a stale website discourages return visits. Since VTAC has its offices within Champlain College's Information Commons, it hires students from the Computer Division on a part-time basis to handle the mechanics of the procedure, while the VTAC staff provides the content.

The web site concentrates on educating its viewers and helping to facilitate their needs. Its section on "Tutorials" contains technical, semi-technical and marketing papers on most of the more well-known telecommunication topics. Contributions come from service providers, vendors, research papers, and the *Telecommunications* magazine's extensive library.

The site also links viewers to the Home Pages of Vermont-based telecommunications businesses, Vermont government and legislative pages, as well as other applicable sites. These include the U.S. Department of Commerce, Telecommunications Library, etc.

A section titled, *What's new and exciting,?* provides bulletin board style information on selected telecommunications managerial employment positions open throughout the State, synopses of newsworthy events, and brief notices of Statewide interest.

b. *Vermont Interactive Television Network (VIT)*

Vermont Interactive Television, a two-way audio and video interactive telecommunications system, was established to provide access to education and training in underserved areas of the State. Since Vermont is a rural State with a widely scattered population, rugged geography, and long winters, most Vermonters are isolated from educational and training opportunities. VIT provides a needed link. It uses two-way compressed digital video operating over T-1 telephone lines.

VIT has sites at twelve locations throughout Vermont. The appeal to VTAC was that by providing training over the VIT network, it could invite viewers from rural areas throughout Vermont to attend and participate locally. Fees are exceptionally low: $20/hour for the first site and$15 per hour for each additional site. VTAC could cover the State for a total hourly fee of $170.

VTAC decided upon a two-hour program beginning at 8:00AM and ending at 10:00AM, thus making sure that small business owners could get back to their work locations reasonably early. The first program was held October 22, 1998. It featured three segments; "ISDN: Myth or Magic?", "Multi-Media for Small Businesses", and "Alternative Uses of the Internet". Each segment included a 10 minute tutorial followed by a 10 minute testimonial. Professors presented the tutorial and small businesspersons gave the testimonials. Since VIT is interactive, questions were then fielded from all sites throughout the State.

c. *Focus Groups*

VTAC's Business Plan calls for meeting with Focus Groups in five regions of the State, approximately four times per year; a total of twenty meetings. Each Focus Group includes 7-10 local business managers. While local officials such as the Town Manager and Planning Board Chair are invited, the primary objective is to assemble representation from the local small business establishment.

The objective of the meetings is for VTAC to understand the needs of its audience, and creatively deal with their problems and suggestions. At the same time VTAC collects and disseminates information from each Focus Group to the others.

The Focus Groups keep VTAC in touch with the local business community. VTAC, in turn, can use the groups to help proselytize in its behalf. It can also help members of the Focus Group and the communities solve some of their local communications problems.

d. *Lectures and Meetings*

Vermonters have a culture all of their own. Burlington is considered the city of "The Suits." Rural Vermonters have a distrust of those city folk, and, in general, prefer small businesses to large ones. Hence there is a distrust of people and organizations in Burlington telling rural dwellers what to do. VTAC is located in Burlington by virtue of its generous landlord, Champlain College.

Key to VTAC's success is to be known throughout the State by being seen throughout the State. This is the primary reason behind the Focus Groups, using the Vermont Interactive Television's 12-site network, and going to communities to provide information and instruction. Where feasible, VTAC hopes to provide seminars in local communities for the local businesses. Representatives, for example, will prepare a presentation on the use of the Internet to profit small businesses. It will "take the show on the road," presenting in several communities, back-to-back. This should strengthen local ties.

5. *Measuring Success*

The website has significant measurements built in, so VTAC can determine the number of "hits" in total, as well as "hits" per specific page.

The project anticipates helping businesses assure their viability and grow. We will measure the success of our suggestions if implemented by the businesses.

The project also anticipates contributing to the increase of new small and entrepreneurial businesses in Vermont. The Executive Director works with the State of Vermont's Economic Development Secretariat to measure success in this area. VTAC also evaluates the success of its programs by conducting surveys among users on a quarterly basis.

The project anticipates providing a neutral source of information for the State Legislature and other State employees in rendering informed decisions on State matters relating to telecommunications. VTAC will measure the times it replied to requests for advice, gave training sessions and supplied materials.

VTAC will be a success if it helps Vermonters in rural areas develop economically through increased and efficient use of telecommunications applications. By linking education, technology, successful applications, and available facilities, we expect to see measurable economic growth for businesses in Vermont's rural communities and measurable gains among non-profit organizations

6. *Replication of the VTAC Model*

VTAC is complementary to other organizations in the State of Vermont. The Director of the project has had a number of discussions with the State and private agencies that assist small businesses in Vermont. VTAC now has an alliance with the Small Business Development Center (SBDC) and, by extension, with the Small Business Administration (SBA). SBDC often stresses to their clients the need to understand and implement new telecommunications technologies, products and services. It does not have the resources to help them with this. VTAC has been welcomed as the partner who can provide support. In similar manner, Vermont Interactive Television has volunteered to help further VTAC's goals. VTAC is regarded as a needed partner, rather than a competitor offering redundant services.

The VTAC project is designed to be replicated. It is unique in being an organization dedicated to enhance business development within a State through concentration in the specific field of telecommunications. Project documentation will be made available in textbook form to permit replication in similar rural locations both in the United States and in the Pacific Rim.

The problems faced in Vermont are similar to those faced in other locations with primarily rural populations. Where there are few large businesses or smokestack industries, there is a need to attract smaller businesses. An organization such as VTAC should be welcome in other locations where the majority of the businesses are concentrated in a few geographical areas, while others go a-begging. The VTAC project will be easy to replicate for a number of reasons:

- Full documentation will be available
- The interested organizations range from the State government, through Federal Government-sponsored groups such as the SBA and the SBDC
- Telecommunications suppliers of products and services will be strong supporters
- The skills necessary to create, organize and maintain an organization such as VTAC are available

7. *Extension of Services and the VTAC Model*

The immediate economic impact of the VTAC project on Vermont communities will be the providing of new jobs through increased success of small businesses.

Strictly speaking, this accomplishes the VTAC mission and is a direct measure of its success. However, there is also potential for a further direct impact through the extension of telecommunication services beyond applications for businesses. What we have in mind is the provision of community services for end-users that do not themselves have the means to purchase and support on-line facilities. Such extension of services would depend on cooperation and support from users in businesses and non-profit organizations, as well as service providers and agencies within the State.

We will offer three models that utilize VTAC or a similar type of organization as a basis for the extension of telecommunication services:

- VTAC as a hub for focusing collaborative energy. A comparison is drawn between VTAC and the South Asian example of ProPoor.org to demonstrate the broad geographical applicability of this model

- VTAC as conduit for developing "community communication centers"

- VTAC as catalyst for direct provision of services by small businesses.

a. *VTAC as Hub*

The relationship among the various organizations linked through VTAC, including communities such as Bennington which seek solutions for constraints against business development, telecommunication facilities such as Vermont Interactive Television, educational institutions such as Champlain College, and State government services, represents a new level of integration of resources to solve economic problems in rural U.S.. Innovations such as interactive TV and Internet have been essential components for the development of this new business environment. Key to the success of these efforts, however, is the facilitating role of organizations like VTAC that serve to bring the other organizations into contact.

A parallel can be drawn between the role of VTAC in Vermont and that of the newly proposed ProPoor.org, an Internet application for organizations of the poor in South Asia. The population served by the latter is clearly more economically disadvantaged. But, the organizational network and new mix of telecommunication technologies for linking centralized agencies to rural end-users is essentially the same. This comparison highlights the potential for extending the advantages gained in the business sector to less-developed sectors in Vermont and beyond.

The ProPoor.org idea, suggested by Jayesh Parekh (a director on the Board of Sony Entertainment Television) and Ami Doshi (a graduate student at Columbia's

School of International and Public Affairs) uses a website to link various organizations – public, private, international and local – in order to "consolidate" efforts to solve chronic problems of rural poverty. No direct link through the Internet to the unserved communities is envisioned in this model. But, the provision of a web-based clearinghouse for ideas and successful "local" solutions is one of several indirect but effective applications of telecommunications for alleviating this social problem. Another service provided by ProPoor.org is an electronic commerce marketplace to post products for sale by organizations that represent communities of the poor.

Vermont's small business community is already acknowledged widely as exemplary for providing community support. Ben & Jerry's, for example, has set up a foundation, supported by 7.5% of its before tax profit. The Foundation's mission is "...to make the world a better place by empowering Ben & Jerry's employees to use available resources to support and encourage organizations that are working toward eliminating the underlying causes of environmental and social problems." A careful distinction is made in this case between providing support for organizations working toward social change and providing social services. Ben & Jerry's does not provide services, nor does it support organizations outside the U.S.. Thus, Ben & Jerry's is an example of a small business that would not directly support telecommunication services. It would, however, support community organizations that work to eliminate the conditions that cause or perpetuate rural poverty, including those working to eliminate the lack of telecommunication services.

VTAC's website, like ProPoor.org, can serve as a clearinghouse through which new small businesses in Vermont are exposed to examples such as the Ben & Jerry's Foundation. Through links with sites like ProPoor.org such models can be diffused around the world. Likewise, efforts to alleviate rural poverty in Vermont can learn from the examples posted on ProPoor.org.

b. *Community Communication Centers and Community Telecenters*

One mode for direct provision of telecommunication services to the unserved is through Community Communication Centers (CCC's) or Community Telecenters (CTC's). Libraries, schools, churches and other existing institutions might provide space for these centers, but capital to set them up might more likely come from businesses or government.

Professor Royal Colle of Cornell University has studied the phenomenon of the CCC throughout rural Asia and Latin America. His observation is that this level of organization is, indeed, filling a gap between institutional and individual services, a gap into which much of the rural poor fall. His paper "Covering the Last Mile of the

Communication Superhighway – Communication Shops for Rural Communities" points out two distinctive characteristics of these enterprises:

- They are private-sector, commercial undertaking
- They are demand-driven community businesses

The sort of community served by ProPoor.org would be a more likely candidate than the small town or village in Vermont to need such services. Yet, this "last mile" information gap is still to be found in Vermont.

CCC's are expected to be self-supporting through a combination of "for free" and "for fee" services. The problem is start up. Colle suggests the establishment of associations to coordinate support, develop start up packages, and assist in finding places for CCC's, and also to serve as a conduit for loan information. VTAC is in a position to serve in this capacity, particularly where the end result is itself a rural, small business.

The Community Telecenter, CTC, is conceived more as a top-down, public institution, providing internet and other information services to rural areas. These centers are set up and operated in connection with government services, and are expected to facilitate the flow of information, both top-down and bottom-up. Like the CCC, telecenters are expected to become "self-sustaining" based on community use and support.

An early U.S. model for a hybrid form of the Community Communication/Telecenter was the "Community Television" initiative of the 1980's. The FCC required private cable services to provide production facilities for community members to produce their own programming. Any new, small business could now fill a supporting role analogous to that of the cable services. The set up of a computer-based communication center with internet services would be much less expensive than community TV facilities and much less complicated, not requiring full-time technicians or elaborate equipment. Also, incentives like the FCC regulation would not be required, as small businesses could easily see the advantages of earning goodwill in the immediate business environment and bringing more cash flow to their community of clients. If there were no need for such support in the immediate community, the unique power of the World Wide Web would allow a small business in one Vermont community to support such services in surrounding areas. Indeed, a business in Vermont could provide support to such a service in India, Indonesia, or anywhere in the world.

VTAC can act as a conduit for channeling support through small businesses to

CCC's and CTC's, directly or indirectly, by adding links to local and remote communities. It can also act as a channel for communicating incentives to small businesses for their support of start up and operations of such centers.

III. FINAL THOUGHTS

VTAC represents a new level of integration through telecommunication applications for solutions to the problem of attracting and nurturing small businesses in rural areas. Like many organizations worldwide, it is providing a more receptive environment for rural development by acting as a hub for collaboration among a network of national and local organizations. Its focus is on well-tested applications of telecommunications. The replication of the VTAC model is made possible by careful documentation. VTAC can contribute to the extension of rural telecommunication services by acting as a conduit for community support, and by links to similar organizations worldwide.

IV. REFERENCES

1. Jayesh Parekh & Ami Doshi, "*Use of the Internet by Organizations of the Poor in South Asia*". Paper presented at "*Expanding People's Spaces in the Global Economy*" Hanasaari Cultural Centre, Finland, 1998.

2. Paper presented at the 1995 Annual conference of the Asian Mass Communication Research and Information Center (AMIC), Jakarta. Also see royal D. Colle, "*Another Dimension of the Information Superhighway: Communication Shops in the Community*" in Media Asia, v.23, No 4 (1996).

3. Scott S. Robinson, "*Telecenters in Mexico: The First Phase*" paper presented at the UNRISD Conference on Information Technology and Social Development, Geneva, 1998.

Return to Top View Full-screen

Solutions for Providing Telephony Services in Rural Areas

of Less Development Countries

N. K. Chhibber

India Resource Centre, India

ABSTRACT

The developing countries are home of billions of people.Two third of this population lives in villages. Rural population, Which is largely dependent on agriculture provide food for the increasing population and raw material for a large numbers of industries. Yet the quality of life is inferior to the population living in nearby urban areas. Telecommunication can help toward economic growth of these rural areas,but has been given least priority mainly due to lack of financial resources. Technology used in urban areas needs to be applied with innovative changes to reduce the network cost in rural areas. Radio access technology or satellite links offer a quick solution, but copper wire, underground or overhead,cannot be ignored as a cost effective solution. Majority of rural people cannot afford to own a telephone. Further, usage of telephones in villages and hence revenue will always be low. This has resulted in the concept of village Public Telephones which have been found very useful and cost effective. Telecommunication business community and telecommunication associations/forums owe a moral obligation to see that rural telecommunication in less developed countries keep pace with the overall development of telecommunication in the country and at least basic minimum telecommunication facilities are provided in the rural areas without delay.

View Full Text

Solutions For Providing Telephony Services In Rural Areas Of Less Development Countries

I. INTRODUCTION

Mahatma Gandhi, the apostle of peace and non - violence, during India's independence struggle and hope of vast Indian poor said more than half a century back that India lives in its villages. It does so even to - day, though there have been gradual change to urban development and migration of a sizable population from villages to cities and towns.

In most of the less developed countries, majority of the poor population lives in villages having very low per capita income, low literacy rate, poor infrastructural facilities and hardly any employment opportunities except agriculture or manual labour in the fields. The rural scene in these countries is very similar to the Indian rural conditions, except that India and china are very large sized countries. The problems being faced and solutions suggested for improving telephony services in rural areas of India are, therefore, similar to other less developed countries.

The economies of less developed countries depend on agriculture and it is rural population which provide food for the increasing population. Yet it is the majority of rural population, where quality of life is pathetic and much inferior compared to those in urban areas.

Economists and world leaders have realized and accepted that telecommunication plays an important role for economic and industrial growth of less developed countries. The main reasons for very slow improvement in telecommunication in rural areas are lack of financial resources,inaccesability due to poor roads/transportation and unreliable or no power supply.

Improvement in rural telecommunication requires strong will on the part of government. At the same time, current technology which can be utilised should not only be at reasonable cost, but the equipment should be able to operate in rugged environment, at low capacity and needing very less maintenance.

II. INDIAN VILLAGE SCENE

India has a population of nearly one billion people and more than two-third of this population lives in villages, which number about 603,600 villages. The country as a whole has about 19 million telephone lines, which gives an average tele-density of slightly less than2 per 100. But looking at rural India, only 56 %of villages have telephone services and the rural overall telephone density is around 0.3 per hundred. This very low figure of tele- density is quite matched to poor availability of other infrastructural facilities like roads, electricity, drinking water, irrigation, education and medical facilities in a large number of the villages.

It is therefore important that when we talk of providing or improving telephony services in these villages, it is mainly about speech telephony services and not, at this stage, about advanced communication services like broadband multimedia, ISDN, tele- education tele- healthcare or internet connectivity. Though the advantages of tele-education and tele- health schemes must be harnessed, but it will take sometime,when these services and other value added services find its usefulness and market in villages.

India is devided into 26 states or provinces and seven union territories. Telephony services in India are mainly with monopoly government operator, though the process of privatization and competition, by granting licences in some states to private operators has commenced in 1995. But it is only in state of Madhya Pradesh, the private telecommunication services have started in June 98, and that too so far covers few major cities only.

Data on number of total villages and villages without telephony,in India is shown in table 1. A, B, and C are categories indicating high volume of demand / market, medium and small markets respectively.

Table 1. Data On Villages Without Telephones In India

Category	States/Circles	Total no. of villages	Villages without telephones
A	Andhra Pradesh Maharashtra, Tamil Nadu, Guurat	132,649	66,510
B	Haryana, Kerala Madhya Pradesh, Punjab, Rajashthan, Uttar Pradesh (E&W), West Bengal	286,169	113,437

C	Assam, Bihar, Himachal Pradesh, Jammu & Kashmir, North-Eastern States, Orissa	184,802	128,080
	Total	603,620	348,027

III. RURAL MARKET

The official definition of rural area is - "an area which is a non - urban area is a rural area'. An area is called urban area, if it meets following demographic parameters:

- At Least 5,000 persons should reside in the area.
- The population density should be more than 400 / Sq km
- More than 75% of male population should be engaged in non - agriculture profession.

It is not only in India or Asian countries but around the globe, rural communications have been neglected for communication development. The argument given is that because of poor economic conditions in rural areas of less developed countries, the business can never be profitable due to poor demand, low revenue and high investment on network engineering. Even the Government owned operating companies, who have social obligation, and less concerned about profitability, show helplessness, due to non availability of funds. Within limited available resources, any government will give priority to basic amenities like drinking water, electricity, irrigation, medical care and thereafter perhaps telecommunication. Most of the governments have however recognized that without availability of basic telephony services in rural areas, overall improvement of economy and development cannot be achieved at the desired pace.

If telecom networks in rural areas are to be set up in traditional methods, using technologies which are best suited for dense urban areas having large demands and high revenue, operators will not come forward to cover remote rural areas, as it will not make a good business venture.

The concept of Village Public Telephone(VPT) has been found to be useful and cost affective. In small villages, not very many households want to own a telephone connection, but avail of the service available at a convenient location . These VPTs can receive calls also unlike PCOs, from where you can only make calls.

Similar pilot projects have been tried out in Vietnam, in collaboration with the ITU; by providing Community Tele - Service Centres (CTCs). Four such centres have been established in these provinces, two along the Red river in the Northern part of Vietnam near Hanoi and one in the western high-lands in the southern part of Vietnam

A Community Teleservice Centre (CTC) is a shared information and Communication facility for people in rural and selected areas and is used as a means of improving access in remote areas. Such centres provide information technology (IT) and telecommunication support, user support and training for the population of a community, who cannot afford such facilities on an individual basis / or do not have the skills to use such tools. In its simplest form, widely introduced in developing countries, it may provide public telephone and fax services only and be handled by a local shopkeeper.

Such Community Teleservices Centre (CTCs) or Village Public Telephones (VPTs) could offer very attractive business opportunities for local entrepreneurs, and could have a tremendous impact on development in rural and remote areas, provided that services and tariff charged are adopted to the needs of people in such areas and developed. Slowly and gradually, as literacy and commercial activities in the area improve value added services can be combined with the basic telecom services. These CTCs or VPTs have become popular and people are making increasing use of these services.

Here is an example, how telephone service in rural areas help farmers to increase their earning capacity. Farmers take their produce, loaded on bullock carts or tractor trolleys to nearby town markets for selling, to traders. When they reach the market, they sometimes find, the prices offered are too less. But instead of bringing the stuff back to their villages or waiting for a day or two, for the prices to come up, they sell it at whatever rates are offered and go back to save additional expenses and time. Now, when a village Public Telephone (VPT) has been installed in their village, these farmers first find out through telephone, from the town market, the prevailing rates, and if the rates are low, they do not move to the town market, but wait for offer of better rates. These farmers thus are able to make more money as they get higher rates for their produce.

One of the principal reasons for the low traffic from village telephones is non-availability of telephones for people in the nearly villages, where people would very often like to talk to.

In 1987, a concept of hexagon cells was evolved for rural telecommunication in India. The country was divided into hexagonal cells. In a Tehsil or Group area, which is generally a compact administrative unit at the lowest level, there would be an average of 300 villages . In a Tehsil, there would be about 25 hexagonal cells and if these cells are only provided with telephone, this in other words, would mean, that about 10 % villages only are provided with telephone service and rest 90 % of villages remain without a telephone. This scheme has been shelved in 1995, after trying out for about 8 years, due to its limitation.

In rural areas where economy is much lower than that in urban areas, the telephone traffic is mainly confined to villages which are close-by or to villages mostly within the Tehsil itself. One of the major use of telephone service in a village is for the farmers to know the market trends and rates of the agriculture produce so that these farmers can avoid middle men and sell their produce in the market, at the highest rates.

Once the rural people get accustomed to the advantages of telephone services, the use of telephone service in rural areas will increase, resulting in increased revenue.

1. *Existing Services and the Problems*

Overall teledensity in villages in less developed countries varies between 0.05 to 0.5, except China, where it is over 1. Besides, almost 50% of the rural and remote areas in these countries are without any telephony service. Some of the villages which are close to towns / cities or on the main trunk routes, the service is fairly satisfactory, but the main problems are in small villages in remote, out of way areas, where other infrastructure is also lacking.

In villages, where telephony services is existing, it is very unsatisfactory, unreliable and revenue per line is exceedingly low.

There is something totally wanting in the following :

- Engineering
- Choice of technology
- Traffic loading

- Resource mobilisation
- Installation, operation and maintenance of the service.

2. *Under-utilization of Public Telephones in Rural Area*

Telephones in the villages are mostly provided as long distance telephone connection from the nearest exchange. This distance could range from 5 - 50 km and even more in few cases. The telephone traffic from these long distance Public Telephones is very small. Analysis conducted by National Council for Applied Economic Research show the average number of calls per Public Telephone in a month is 60, approximately i.e. two calls per day, in villages having population of 2500 on an average.

Various factors which bring out causes of low usage of telephones in villages are following :

- Even less than 50% villages are having telephony services. Once most of the villages are covered, the usage is likely to increase, as the service will be available to near-by villages , where the usage is going to be maximum.
- Telephones, at presently, have normally been provided in big villages and within a distance of 5 kms from all the other villages. This could satisfy a need only in case of extreme emergency, where a person has to undertake a journey of 5 kms to and fro, accessing a telephone. On the other hand a telephone is expected to be available within easy reach and in any case within the village itself. If this is not so, it gets out of reach.
- In rural areas where economy is much lower than that in urban areas, the telephone traffic is mainly confined to villages, which are close by or to villages mostly within the Group Area it-self. Further local telephone traffic within a small village is almost negligible. It is obvious therefore that unless and until telephone service is made available in all the villages, it is difficult to expect higher calling rates and better traffic loading.

3. *Uneven Tariff*

As for the charging plan, local telephone area constitute the basic charging unit for charging local calls as unit calls. In the entire city limits, calls within the city are treated as local calls, the distance may run upto 20 - 30 kms. But in villages, till 15 August, 1998, this local area was confined to 5 km radius from the telephone exchange, in most cases. Thus a rural telephone subscriber had to pay trunk call charges, when speaking from one village to another at a distance of just beyond 5 km. Tariff was thus highly pitted against the rural telephone subscribers who have no need for local calls and have to pay higher rates for inter exchange calls, which he needs most.

This anomaly has been corrected and now from 15 August 98 onwards any call made from a village telephone, either public or owned, to any other village telephone within the same district, is treated as local calls. As regards the rentals and tariff, these are already half of the rental and tariff being charged in urban areas.

4. *Low Level Technology*

The cost of providing rural telephone service continues to be high, as compared to the providing of the service in urban area. This is mainly so, because, the area to be covered is large and number of telephone connections provided per sq. km is less. In India the average cost of providing a rural telephone is $ 2000, as compared to $ 750 in urban areas.

The traditional method of providing rural telephony services has been by open wire lines or cables, which is extremely time consuming apart from the excessive demand on physical resource like poles, wire. Besides, open wires are prone to interruption due to vagaries of weather, wire thefts, mischief by urchins etc.

Radio sharing systems, known as Multi Access Rural Radio (MARR), has been used since 1991, in India, in many villages. 2/15, MARR equipped with two frequency pairs, serving 15 village telephones based on analog technology has been used. The main disadvantage of this system is poor availability of power supply in villages, and poor maintenance of the equipment, resulting in non functioning of telephones for considerable period of time. Analog MARR, is therefore being phased out and no new areas, will be using analog MARR.

A significant out-come of the advances of technology is that the cost of transmission links has been steadily coming down over the years by making use of electronics, microprocessors and due to high volume production of equipment. The cost of optical fiber cable and wireless local loop technology, are also coming down. But unless, all these networking elements are exploited intelligently, the cost of network will not come down but rather increase. In India low cost, robust and rugged, small capacity switches designed by Centre for Development of

Telematics (C - Dot) have been in use for the last seven years and proved cost effective.

5. *High Cost of Networking*

Till recently, the village telephones were connected as long distance telephones to the terminal exchanges (Local exchanges) and follow the hierarchical route thereafter. However the network should be designed for providing quick and direct interconnection between places having community interest. It is the traffic pattern and not the village size or exchange size, which should determine the routing. All the villages within a group area should have dialing access to all the other villages, not only within the same group areas but villages within the same district, in addition to having access to national network . This type of networking which spreads horizontally and eliminates the vertical separation between switching centers in a hierarchical chain pattern will be more effective for carrying traffic both within two telecom districts and outside.

6. *High Maintenance Cost*

Presently maintenance and fault rectification is done by linesmen, who carry out fault rectification, when fault is reported to the fault-center located at Group Area Centre. These men normally use bicycles to reach the site and thus some times it takes a few days, when the telephone service is restored. Such maintenance by employing men for low traffic routes is a costly proposition. Maintenance philosophy of operating and maintaining the lines in far flung, low traffic areas needs a review.

7. *Delay in Meeting Targets*

Almost all the Governments of the less developed countries have realized the importance of rural telecommunication for its countries and therefore give a special emphasis to this programme. In India, in seventh plan period (1985 - 90), extensive planning exercise was undertaken and a strategy was devised for rural communication. A plan was prepared to cover whole of the inhabited area and the country was divided into 5 km side hexagons and it was proposed to provide at least one long Distance Public Telephone in each of these hexagons. Thus an access to the network was to be ensured to any person of the country within a maximum of 5 km, which it was supposed to cover easily and if necessary even by foot. The total number of such hexagons was 4800 in number and by 1990, 38000 numbers were provided with Long Distance Public Telephones. Most of these phones were based on overhead wires.

This plan failed, because, the presumption that a poor villager will cover 5 km on foot to make a long distance call and pay at the trunk call changes was wrong. Villagers want to make calls to their friends, relatives or for business to nearby villages and towns and cannot afford to pay more than local call charges.

Accordingly the plan was revised and the revised objective was to provide a telephone to every Panchayat (Elected Village Council), 232, 347 in number by 1995 and cover all the remaining villages (150,000) by 1997. Thus phone a village by 1997. This target has also not been met and now it is not before year 2002, that all villages will have at least one Village Public Telephone.

IV. AVAILABLE SOLUTIONS

People living in rural areas around the globe have been increasingly neglected of the overall technological development and in particular of telecommunications. When ITU says, over one half of the world population mainly in Asia and Africa have never made a telephone call, it is not surprising. There has been phenomenal growth in telecommunication service market, during the last 8 - 10 years, but it is mainly confined to urban areas of the less developed countries.

Despite best and sincere efforts of the Governments of these countries, as a socio-economic need, the progress is very very slow. The government owned operating companies donot have adequate funds and professionalism. Governments give low priority to allot funds out of national budget for telecommunications service development. Privatization and competition through private business has not helped, as rural telecommunications market is still characterised as poor and unable to give even some tolerable returns.

The development of rural telecommunications, therefore needs both strong policy commitment on one side, and technology development and access to such technology on the other. The technology has to cater to the following requirements:

- More switching nodes with low capacity switches capable of operating in rugged, dusty, non air-conditioned environment.
- The equipment should be as far as possible maintenance free. Capable of functioning satisfactorily under the extremes of temperature and humidity.
- The cost of providing a telephone in rural areas be brought down

considerably, so that with the limited funds available, more villages are covered.

- The plans and target should be realistic. In India Telecom Commission had set a target of at least one telephone in each of its villages, by 1997, to be provided by Department of telecommunication, which is the Government operator. Incentives were also given to private operators to cover a minimum number of rural telephone lines in their area of license. But as on date, even after two year delay, the target is no where in sight to be met.

- Use of modern technology, in an innovative way.

1. *Technology*

Issues involved in technology selection for rural telecommunications are :

- Government Regulation and Policies.
- Frequency band availability / spectrum allocation.
- Compatibility consideration with existing systems.
- Subscriber distribution - low density.
- Traffic parameters, grade of service and total coverage.
- Services to be provided mainly voice, with capability for fax and data.
- Hardware availability in volume.
- Provenness and reliability of systems.
- Local Manufacturing consideration.
- Availability of sites for equipment and installation time.
- Availability of power supply.
- User acceptability.
- Cost consideration - capital / operational.

- Local tariff policy.
- Returns on Investment and pay back period.

2. *Technology Application for Rural Telecommunications*

Often, cable laying is not an economical way to offer telecom services to rural population, because of the high cost of infrastructure and the delays of route planning and installations.

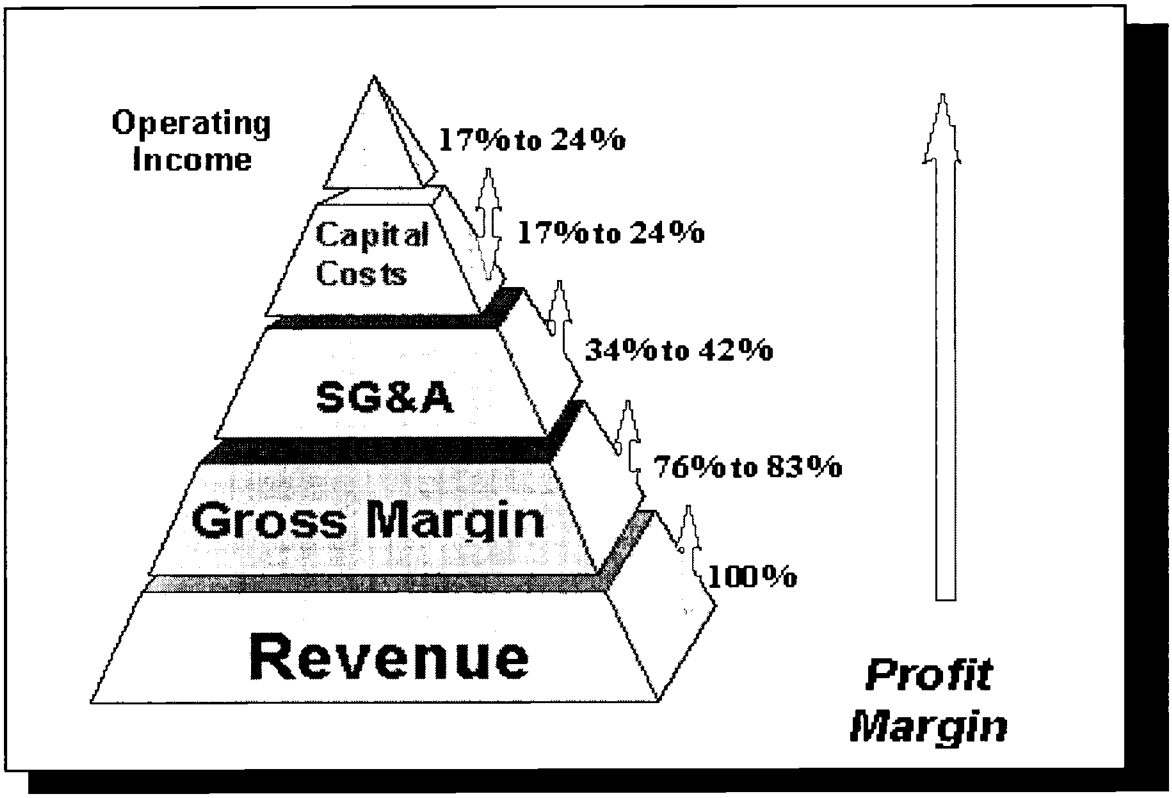
It is the experience of almost all the developing countries that technologies and products in the telecom area are mainly conceived , designed and produced in developed world and the solutions offered as such cannot be very appropriate for the rural areas of less developed countries.

The three major sub systems in any telecommunication network are

- Switching
- Transmission
- Access network

General structure of a Rural Network is shown in Figure 1.

Figure 1:
Typical Service Provider Operating Income



Source: Bloomberg Financials: comparison of financial statements 1993 to 1997

Figure 1. General Structure Of a Rural Network And Operative Function Associated With Its Most Relevant Parts

3. *Switching*

Switching technology has improved manifold and almost all the switching systems have a large number of features and functions controlled through software application. These switches are designed to work in air conditioned environment and for any application changes or maintenance / fault / rectification trained technical personal are required .

Deeply conscious of this, India has made substantial progress in the development of rural digital switches. Low cost, rugged, switching systems having low capacity have been successfully developed and produced in large number. Multinational manufactures are also exploring this market. Thus well designed, reasonably priced switches of desired capacity, to work either in stand alone mode or as Remote Switching Unit (RSU) are available for rural applications.

4. *Transmission*

In rural communication, transmission linking is required :

- Between village exchange and the nearest urban exchange or T A X exchange.
- Between one village exchange to another nearby village exchange.
- Between village exchange and the Base Station or the collection point.

The distance involved range lypieally between a few kilometer to a maximum of around 100 km. Various technologies which are suitable for such links are.

- Digital UHF systems. 10 Channel in 400 - 600 MHZ range
- Digital Microwave 30 Channels 4 - 6 GHZ
- Optical fibre cable links with optical line terminal equipment
- Satellite Communications links - The Fixed Satellite Service via Geostationary satellites operating at c or ku band. This is suitable for isolated, remote and hilly areas, where line-of-sight radio system or cable systems are difficult to install and operate.
- HF Communications Links. A lot of development work has been done on HFCommunication to improve reliability of propagation, which is normally no more than 90% . In fact in remote areas of Nepal and Bhutan, a number of HF links are working for providing essential communication.

5. *Access Net works*

Local loop segment providing coverage from the exchange or the concentrator exchange station to the subscriber, is perhaps the single biggest cause of poor services in rural areas. Various options available are as follows :

- Copper Cable
- Multi Access Radio Relay (MARR) / PMP (Digital)
- Cellular Radio Systems

- Wireless- in- local loop (TDMA/ CDMA)

- VHF single channel

- Satellite communication Direct to Phone through LEO /MEO system.

Each systems has its own advantages and is required to be used in an innovative manner depending on techno-economic considerations, geographical location and maintainability.

VI. SUGGESTED SOLUTIONS

Rural areas in different regions of a country vary in size, demography and economic conditions in general. From a small dwelling of few houses, it can go to clusters of houses, spread in nearby areas as separate villages. Then there are villages on highways, and villages in remote hilly or desert areas, without even proper connecting roads.

There are two types of requirements for rural communications.

- Villages having no existing telecommunication. These villages need to be provided with some minimum telephone lines, like Village Public Telephone as a first step.

- Village already having some existing telecommunication. It could be a village Public Telephone and a few telephone lines as owned telephones or both. The performance of telephone lines in most of such villages is poor and reliabitliy is very low. Further there is a need to argument the capacity to meet additional future demand.

Another point to be considered is that in some villages, people want to talk to subscribers mostly within the district or to nearby villages/towns. Whereas in certain villages, people want to make calls to distant places where their kith and kin have gone to work, not only within the country but to other countries. Invariably such calls will be from a franchised PCO.

1. *Small Isolated Villages*

Under the circumstances, prevailing in the rural areas of less developed countries, a Village Public Telephone be provided first, if no telephone lines exist. This will bring the people living in these areas close to the people living in Urban areas of nearby towns and cities. This will generate and improve economic activities of the villages and people living in these villages will also get a feeling of security. A Village Public Telephone (VPT) can be provided on one of the following systems :

- An open wire line or cable
- On radio system
- On satellite system

Open wires are normally cost effective upto 5 km distance from the exchange, so that loop resistance and signaling loss are within limits. For distances above 5km and upto 30 km, , it is economical to provide VPTs on radio system. If it is a single VPT, a single are two Channels VHF system is most suitable. For isolated villages in hilly areas or islands, satellite link terminals are best suited.

2. *Medium Sized Villages*

In villages, where there is a requirement of a minimum of ten telephones , a small capacity digital exchange, (say 256 lines) capable of working on low power consumption and in non-air-conditioned environments be installed. The access lines be given to nearby subscribers on copper wire and to cluster of houses more than 5-30 km away, point - to - multipoint system is best-suited.

The exchange in turn be interconnected to the nearest exchange at Group Area centre through microwave or small capacity fiber optics links.

For villages having a number of cluster of houses spread over wide area, point -to multi-point system are again best-suited.

3. *Large Sized villages*

In most of the large sized villages, some telecommunication system is already existing. These systems require upgradation , not only in capacity, but improved technology. Villages which are on the highway or on the fringe areas of city, fixed PCO, from the cellular Mobile Network can be provided at special low tariff. A number of equipment manufacturing companies, claim, they have developed new systems based on CDMA, GSM and TDMA, at low cost for rural application. Such manufacturer should be encouraged to set up Pilot Projects in such villages, rather then in big cities. Similarly IRIDIUM Satellite based system, which is now in operation, can also be tried out on trial basis.

Any system selected for rural telecommunication, important point for good revenue and low cost of maintenance is reliability of system. Thus any system which is going to be put up in rural area must have :

- Very high MTBF.
- Low MTTR
- Low turn around time
- To be less theft prone.
- Low cost power supply requirement
- Self diagnostic

4. *Power Plants for Rural Telecommunications*

One of the vital parameters in any telecommunication systems is power plant requirement. It is seen from experience, that outage of communication and fault occurrence increase considerably if power plants are not properly designed and provided.

In most of the villages in less developed countries mains power supply even where available is not reliable . Some-times for hours togather mains power supply is missing. Following types of power plants are recommended.

- SMPS (Switched Mode Power Supply) based power plants with maintenance free batteries. These are efficient and reliable, but mains power supply should be available for at least 12 hours out of 24 hours per day.
- Solar panels along with maintenance free batteries. This is suitable in areas where power supply requirement is small and continuous sunless shade shall not be for more than 6 days.

VII. SOCIAL AND MORAL OBLIGATIONS

It is not only the economic activity which increases with availability of telecommunication in remote rural areas, but the quality of life, security and measures to protect the people from natural calamities also improve.

Rural telecommunications is a big challenge to every less developed country. In most of these countries, 60 - 80 % of population lives in villages, which are small sized and spread over a very large area. Every year during rains and floods / snow, a large number of villages get cut- off from the nearby towns and villages, causing loss of life, and scarcity of food. In some areas, remotely located small villages are looted by decoits, or families killed by anti-social elements or terrorists. Lack of communication increases the suffering of people in these village, in such situations as nearby police personnel or administration comes to know of the incidents after 12 - 24 hours only.

Even with the most optimistic estimate, it shall lake about 8-10 years, when almost all the villages in less developed countries will get covered with affordable and reliable rural telecommunication. In some of the under developed countries of Asia and Africa, it may take even longer This, by present day technology advance and professionalism is a long time. There is thus, a need for some serious thinking and collective steps to be taken to hasten provision of reliable telecommunication for rural development and improving the well being of the villagers in these countries.

Main responsibility of providing telecommunication in rural area is that of the government of the country. However in most of the less developed countries, despite best of intentions and allocation of available resources, the progress will remain slow.

It is here that telecommunication business community who have earned or hopeful of earning big profits from the huge markets in these countries and telecommunication associations / forums like ITU PTC, APT WTO, chambers of commerce, financial institution etc. can join together and contribute towards improving the rural telecommunication by providing basic minimum telephony service in say 10 % of such villages by providing at least a single Village Public Telephone, in a village.

In order to implement such an idea, a non-profit non-government organisation will be required, like say, Group for Improvement of Rural Telecommunications (GIRT), with its sub groups in regions where need is utmost. The role or mission of this Group could be to mobilise resources and to co- ordinate with the government of the countries and existing telecom operators / PTT, to provide telecommunication in such villages, which are small in size and located in remote & difficult terrain.

Members of this Group could be prominent professionals, telecom advisors and representatives from telecom industry and financial institutions. In the next two years if 10 % of the villages requiring telecommunication facilities are covered, it would be a great satisfying achievement.

Let the participants of this most importent conference on telecommunication and information technology in the Pacific hemisphere , PTC 99, make a humble start for those poor and helpless people living in such villages by giving them New Century gift as basic minimum telecommunication service. This in turn will surely improve their standard of living by improving the economic activities around them.

VIII. CONCLUSIONS

Development of rural telecommunications is an investment in the social and economic prosperity of the country. There is a need for rural communication in the world over and the right of the rural people to have at least basic telephony at their door step. It is the social responsibility of government of a country to earmark adequate resources, to ensure that all rural and remote villages are covered, with at least one village Public Telephone per village, by the beginning of next century. No doubt it is challenging task and very difficult, but it is worth trying and even if success is 90 %, it shall be one of the biggest contribution to vast majority of world population living in rural area of less developed countries.

The problem of rural telecommunications is not peculiar to India alone. A majority of the less developed countries of the world are in a similar situation. A number of studies and recommendations have been made by various groups and commissions set up by ITU in the past . But the progress on the ground is very slow. Though it is the prime responsibility of the government, but the private industry and non - government organisations have hardly made any contribution towards rural Telecommunications development . This needs to be channeled through a group , working under the umbrella of a non government , non profit organization involved in development of Telecommunication service.

What, remotely located, small sized villages need is basic telephone initially. Value -added services can come later when people are ready to use them. Other requirement of rural telecommunication in less developed countries is low cost of maintenance and operations, high reliability and affordable tariff. For achieving this, telecommunication planners, must keep an open mind, to try new technologies, at the same time system based on copper could still be used.

IX. REFERENCES

1. NewTechnologies for Rural Telecommunication - Concept Paper by Department of Telecommunication, Government of India

2. Network Planning for Rural Telecommunication by P S Saran, Member Telecom Commission,India.

3. Meeting Telecommunication Needs for National and Regional Economic Development by Dr S K Hajela, ITU, Area Representative for West & South Asia.

Return to Top View Full-screen

Rural Information Infrastructure: Myths and Realities

Heather E. Hudson

University of San Francisco, U.S.A

ABSTRACT

Many initiatives are currently underway to extend and upgrade telecommunications services to rural areas. This paper identifies key myths that are implicit in many of the planning and policy approaches that have been taken toward rural telecommunications. It contrasts these myths with realities from experience in both industrialized and developing countries, and concludes with lessons for planners and policy makers.

View Full Text

Rural Information Infrastructure: Myths and Realities

1. Introduction

Technological innovation as well as economic globalization and political restructuring have focused new attention on rural telecommunications. The advent of terrestrial wireless technologies for local loops and Internet access, fixed access through VSATs and mobile access through GMPCS (global mobile personal communications systems), and small digital switches are helping to reduce the cost of connecting rural customers. Concurrently, the demand for rural access to telecommunications is growing as unserved populations in the developing world clamor for service, and rural residents in industrialized countries request upgrades to enable them to access the Internet and use network features and services commonly available in urban areas.

Driving this demand is the growing need for information to be competitive in a global economy – for farmers, fishermen and trappers to obtain price information and arrange transportation of their produce, for rural information workers from writers to catalog sales clerks, and for rural schools and health care services seeking access to expertise and resources unavailable in their communities. Also, in many rural and remote regions, indigenous people are demanding more political autonomy that requires better communication within their jurisdictions as well as with major regional powers. Inuit in northern Canada, aboriginal people in Australia, and Saami (Laps) in northern Scandinavia are among such groups seeking greater autonomy.

Table 1 shows that tremendous gaps remain between urban and rural access to telecommunications in the developing world, with the greatest gaps in the poorest countries. However, although there is greater need for communication in rural areas, enormous unmet demand, and greater interest by telecommunications carriers and equipment suppliers to meet the demand, there are still many erroneous assumptions about rural telecommunications issues. This paper attempts to identify and rectify some of these misconceptions. The flaws in many of these assumptions are obvious once the assumptions are made explicit; others misconceptions are more plausible, but flawed upon more careful examination. Yet they are often implicit in system design, policy and regulatory decisions, and industry business strategies, as shown below.

Table 1: Access to Telecommunications

Country Teledensity

Classification	National	Urban	Rest of Country
High Income	48.8	51.7	48.5
Upper Middle	12.9	21.9	10.6
Lower Middle	8.1	19.0	6.8
Low Income	0.9	5.2	0.7

Derived from: ITU, *World Telecommunications Development Report*, 1996-97.

2. Rural Telecommunications Myths

Myth 1: Build it and They Will Come...

This strategy assumes that investment in telecommunications alone will result in economic development. Although clearly an oversimplification of the evidence on the role of telecommunications in socio-economic development, it underlies many business and policy strategies. For example, telephone companies in the U.S. have used a variant of this argument at the state and local levels to request concessions and subsidies; similar arguments have been made by carriers seeking entry or favorable treatment from developing nations. The current investment in telecenters by several development agencies and NGOs may also be based on the same flawed assumption.

However, the results of numerous case studies have shown that telecommunications is *necessary but not sufficient* for development; it is a *complement* to other development inputs. The reality is that there are many other factors that contribute to rural economic development, including:

- other infrastructure: particularly electrification and reliable transportation
- skilled workforce
- cost of operations including facilities and labor.

Rural regions where these factors are favorable may well be able to attract new jobs by encouraging investment in modern and competitively priced telecommunications. Nebraska in the U.S. and New Brunswick in Canada have attracted a thriving call center industry because of their combination of a reliable and relatively low cost workforce and high quality telecommunications. Western Ireland has become the "back office" for many U.S. companies, building on its assets of a well educated and comparatively low cost labor and high quality infrastructure, including telecommunications.

One policy implication is that where other favorable conditions exist, creating incentives for upgrading and competitive pricing of telecommunications may be an important development strategy. For example, Barbados in the Caribbean has attracted "back office" information processing jobs for U.S. companies because of its highly literate English-speaking workforce and attractive wage rates. Yet telecommunications in Barbados remains a monopoly, with prices for international traffic significantly higher than in competitive environments. Telecommunications revenue in 1995 amounted to an average of $535.50 per inhabitant compared to an average of $98 for all upper middle income countries, or 8.5 percent of GDP, compared to an average of 1.9 percent for all upper middle income countries. Countries such as the Philippines and India with low cost skilled and professional labor can compete globally for information work if their international telecommunications costs are low.

A second implication is that agencies supporting telecenters and other similar initiatives should carefully consider the above factors in identifying sites for these centers. Typically, a telecenter includes information and communication technologies such as telephone, fax, computer with modem, telephone circuits and Internet access installed in a community center, library, school, post office, coffee house or other accessible community location. However, for the telecenter to contribute to local development, other factors must be present such as the availability of electricity, community resource people with technological skills, and entrepreneurial activities such as women's cooperatives, commercial agriculture or small businesses that could benefit from increased opportunities to access or share information.

Myth 2: One Size – or Policy – Fits All.

It is often implicitly assumed that all rural customers have the same needs: this assumption underlies decisions on technology, services, and pricing. Yet rural customers are likely to have varying needs; not only are individuals and families likely to have different communications needs from businesses and organizations, but these latter institutional customers may have requirements for different types of services and/or different traffic patterns.

As shown below, planners that adopt a "one size fits all" approach may limit choices that rural customers would want, and may inadvertently limit their own revenues. In Appalachia, a rural telephone company implemented Extended Area Service (EAS) to enable rural customers to make unlimited calls to the nearest regional center for a flat monthly rate. While this package was a popular option with many customers who previously faced long distance charges to make these calls, it was a waste of money for people who made few such calls, including some residential customers who made few calls and some businesses whose community of interest to market their products was actually national or international rather than regional. An optional rather than mandatory EAS plan would have recognized that one size did not fit all.

Similarly, while the majority of rural customers may require only voice service, there are likely to be businesses and organizations such as schools and government agencies that require data services including fax, e-mail, and Internet world wide web access. In rural areas with vacation homes and home-based businesses, residential needs may vary as well, with some telecommuters working from rural homes, children and adults taking distance education courses, and farmers seeking price and crop management information from the Internet.

Myth 3: Rural Demand Is Very Limited.

In planning networks and projecting revenues, it is often assumed that there is little demand for telecommunications in rural areas. Such forecasts are typically based on solely on the lower population densities than are found in urban areas, sometimes coupled with the "one size fits all" fallacy that assumes all rural residents are likely to have lower incomes and therefore lower demand for telecommunications than in rural areas.

Rural population density, however, varies dramatically from one country to another, and often within larger nations. Rural population densities in some countries such as India, Indonesia and China enormously exceed rural density in Mongolia and Kazakhstan; rural densities in Rwanda and Burundi, and parts of Nigeria and Kenya are higher than the rest of rural subsaharan Africa, and much higher than the semiarid Sahel region.

Of course, income is a useful predictor, but there may be many other factors that generate demand. First, data on rural per capita income may be hard to come by; where it does exist, it is likely to mask significant disparities between areas with more resources or better organized economic activities and areas with subsistence level economies. In Rwanda and Burundi, for example, the rural population is very poor, but coffee and tea plantations need to communicate to order parts and supplies, check on international prices, and arrange transport of their produce to foreign markets. Entrepreneurial farmers in poor Nile delta villages use the telephone to fill orders for vegetables from markets in Alexandria. Tuna fishermen in poor, primarily rural provinces of the Philippines use cell phones to arrange cargo space on aircraft to get their catch to Tokyo.

In rural North America and Australia, the service sector is a major component of the rural economy, largely due to government services. In developing countries, governments are often assisted by NGOs . Thus, in addition to commercial activities, there may be significant demand from government agencies and NGOs operating in rural areas to administer health care services, schools, other social services, and development projects. Also, there may be significant demand for communication with family members who have gone to the city or overseas to work. For example, domestic workers from the Philippines and Indonesia call home from overseas; Mexican farm workers call their villages from the U.S.; North Africans call home from the Middle East; South African miners call their families in rural South Africa and neighboring countries.

As rural and remote peoples gain greater control of natural resources and demand more political autonomy, their needs for communication also increase. Organizing to build political pressure for land claims settlements required extensive communications over many years among remote communities and major political and economic centers in Alaska, northern Canada and Outback Australia. It is hard to imagine that land claims would have been settled without reliable communications to discuss strategy, lobby political and business leaders, and build public awareness and support.

The most dramatic example of political autonomy dependent on communications will be the new Canadian territory of Nunavut, that will come into being in 1999. Comprised of the central and eastern Arctic regions of the former Northwest Territories, Nunavut will have 20,000 inhabitants, 85 percent of whom are Inuit, scattered over a territory the size of France. While this may be Canada's poorest region, the demand for telecommunications to build and sustain Nunavut will far exceed traffic estimates based on per capita income. The very survival of Nunavut will depend on communications.

Demand for other communications facilities and services may give an indication of pent-up demand for telephone service. Table 2 shows that the number of TV sets per 100 population is about the same as teledensity in upper income countries, but there are an average of more than twice as many TV sets as telephone lines in lower middle income countries, and more than 13 times as many TV sets as telephone lines in the poorest countries. These ratios are likely to underestimate the gap in rural developing regions. For example, in rural areas of Latin America, the glow of TV screens is visible in the evening from huts in areas without telephone service; in southeast Asia, satellite antennas and VCRs are found in apparently poor rural communities.

Table 2: Access to Telephone Lines and Television Sets

Country Classification	**Tel Lines/100**	**TV Sets/100**	**Ratio TV Sets/Tel Lines**
High Income Countries	54.1	61.9	1.1
Upper Middle Income Countries	13.4	26.3	2.0
Lower Middle Income Countries	9.7	22.7	2.3
Low Income Countries	2.5	13.1	5.2

Derived from: ITU, *World Telecommunications Development Report,* 1998.

Myth 4: Rural Traffic Goes only to the City.

It is generally assumed in planning telecommunications networks that communication in rural areas is only from village to city. While there is likely to be significant traffic to regional centers to reach businesses and government services, traffic patterns are likely to be influenced by a number of factors including family and cultural ties, economic activities, transportation links and political jurisdictions. In some border regions of provinces or nations, the major trading center may be across the border, while the major government administrative center may be much farther away. People in northwestern Ontario look to Winnipeg (Manitoba) for major commercial services, but contact Thunder Bay, Toronto, or Ottawa (all in Ontario) for regional, provincial and federal government services.

While a telecommunications network should be transparent to the user, who isn't aware how a call is routed to reach its destination, lack of understanding of these communities of interest may influence the cost and capacity of the network. For example, Telecom Australia (now Telstra) installed a digital microwave system for the Australian outback in the 1980s that employed "trombone trunking", i.e. switching for calls at regional nodes such as Alice Springs. This is an efficient design if traffic is destined for Alice or points beyond. However, a significant portion of traffic turned out to be between extended families in neighboring communities along the microwave link. These calls also had to be routed through Alice Springs for switching, thus using twice the circuit capacity over much of the network, and contributing to earlier than anticipated saturation of the network.

Cultural and political ties may create also create extended communities of interest. Aboriginal people across the north have shared concerns about the environment, cultural survival and political autonomy, and have established circumpolar contacts through conferences and organizations supported by telecommunications. The demise of the Soviet Union has resulted in re-established contacts between Inuit in Alaska and Siberia and Saami (Laps) in

Scandinavia and Russia. The recognition of shared developmental and cultural agendas and the benefits of sharing information and expertise on topics ranging from tropical medicine to rain forest ecology to cultural preservation has led to greater demand for south-to-south communications across the developing world.

Myth 5: Rural Customers Require Only Basic Voice Services

As noted above, while the majority of rural customers may currently require only voice services, there is increasing demand for data communications including fax, e-mail and Internet access, particularly to the World Wide Web. The U.S. and Canada, as well as many other industrialized countries in Europe and the Asia-Pacific have plans to extend Internet access to schools, including those in rural communities. Under the Telecommunications Act of 1996, the U.S. has implemented subsidies for rural health care services to access the Internet. These goals are increasingly shared by developing countries; for example, both the Philippines and South Africa have information insfrastructure initiatives that include Internet access in rural areas. Also, as noted above, rural entrepreneurs ranging from consultants and researchers who have taken up year round residence in rural communities, attracted by the qualify of life, to summer cottagers and "snowbirds" in winter vacation homes may demand the telecommunications services they would use in the city.

Yet, even in industrialized countries, basic rural service is typically considered to be voice service, often with lower reliability – as well as higher prices – than would be found in urban areas. In northern Canada, rural residents and organizations representing them have repeatedly emphasized in recent hearings on High Cost Service Areas that basic voice service is not enough.

Myth 6: Nonvoice Services Require Broadband Channels.

While there is likely to be growing rural demand for greater bandwidth for Internet access, bandwidth available for voice circuits can be used for many nonvoice applications, facsimile and e-mail being common examples. However, medical applications such as telestethoscope for heart sounds, EKG, and patient record data can be transmitted over single telephone circuits, while videoconferencing and medical imaging such as for endoscopy, dermatology and ophthalmology may require as little as 128 kbps (e.g. a basic ISDN channel).

Myth 7: Fixed Links Will Meet All Rural Requirements.

Telecommunications planners may assume that rural settlements are permanent, and therefore, installing facilities in these settlements will meet their telecommunications requirements. While this assumption may be valid in agrarian communities, it may be erroneous for hunting and fishing communities and for migratory populations. In Australia, the digital microwave network linked what were apparently permanent settlements; however, many families chose to leave the settlements and go back to the land, where once again they had no reliable communications. In Labrador, Bell Canada provided telephone service to isolated settlements, but fishermen pointed out that for four months a year, everyone moved to camps nearer the fishing grounds, where they had no communications. In northern Ontario, the Wawatay Native Communications Society began in the 1970s to rent portable two-way radios to hunters going out to the traplines, who used the radios to summon help in emergencies and to stay in touch with families in the communities, many of which had only radio telephone links to the outside world. Although the permanent settlements now have telephone service, Wawatay still rents two way radios to trappers.

Myth 8: High Costs are Unavoidable.

It is typically assumed by both carriers and regulators that the costs of providing telecommunications in rural areas are unavoidably high, and, coupled with low demand, render rural services necessarily unprofitable. While costs per line are bound to be higher than in high density urban areas, creative strategies for design and implementation may reduce costs, while, as noted above, revenues per line may be greater than in urban areas.

Topography and climate are also important considerations in system design. A microwave network may be an appropriate solution for the Kathmandu Valley, but it will be extremely costly to site and maintain microwave towers in the Himalayas to reach remote villages (and yet terrestrial microwave is widely used in Nepal). Microwave repeaters are also being installed in the mountainous hinterland of Sabah and Sarawak, whereas VSATs could be installed in communities to operate with Malaysia's Measat satellite.

Designing for such conditions as well as for existing transportation facilities and labor can also reduce costs. For example, VSATs built by Scientific Atlanta for operation by GCI in Alaska villages are designed to be flown into villages in Cessna Caravan aircraft. Maintenance and troubleshooting are to be done by bush pilots who regularly fly into the villages. Bell Canada trains local technicians to do basic telephone installation and troubleshooting in northern communities. Such approaches may not only improve responsiveness and reduce downtime, but reduce travel costs of sending company technicians from regional centers.

Modular design that allows for adding capacity when required will also reduce costs of upgrading service. Demand may increase not only with population growth, but also if there are changes in the economy or demands for new service. The digital microwave system installed by Telecom Australia in the Outback reached capacity much earlier than expected not only because of the trombone trunking design (described above) but also because of unanticipated demand for fax and then Internet access. Upgrading the network required a complete overbuild. In the Marquesas in the South Pacific, satellite earth stations have been installed for telephone service and TV reception, but circuit capacity is very limited. When asked whether additional capacity could be added if demand grows (for example, with more use of Minitels or demand for Internet access for schools), a site engineer said "There will never be more demand here."

Flexible design based on an understanding of cultures, life styles, and sources of income can also reduce cost of extending services. For example, terrestrial wireless or satellite systems can easily be moved if people abandon their settlements; service can also be added via wireless or satellite if people migrate for seasonal fishing, hunting or herding.

Myth 9: Rural Benchmarks must Be Set Lower than Urban Benchmarks

This is the "something is better than nothing" policy that is often assumed to be either all that is technically feasible or economically justifiable for rural areas. However, technologies such as digital switching and terrestrial wireless and satellite technologies make it possible for rural services to be comparable to urban services.

The U.S. Telecommunications Act of 1996 sets a standard of reasonable comparability: rural services and prices are to be *reasonably comparable* to those in urban areas. Developing countries should also resist the temptation to set rural benchmarks too low. In the Philippines, after extensive discussion, both government and industry representatives agreed on rural benchmarks including digital switching, single party service, and line quality sufficient for facsimile and data communications. The industry representatives stated that those specifications were met by the new networks they were installing in rural areas, and that older networks should be brought up to those standards.

Myth 10: A Carrier of Last Resort is the Best Model to Guarantee Rural Universal Service.

Many countries use a "carrier of last resort" model in which the designated has the obligation to provide service if no other carrier will. Typically, the dominant carrier has this obligation and is entitled to a subsidy to provide the service. However, this approach can be flawed if it provides no incentive for the carrier with the USO to use the most appropriate and inexpensive technology and to operate efficiently. It can also serve as a justification for the dominant carrier to be protected from competition because it has additional costs and obligations not required of new competitors.

Rather than designating a single carrier of last resort, some countries are introducing bidding schemes for rural subsidies. In Chile, a development fund was established in 1994 to increase access for the approximately 10 percent of the population in communities without telephone access. The regulator estimated the required subsidies, distinguishing between commercially viable and commercially unviable, and put them out to competitive tender. There were 62 bids for 42 of the 46 projects. Surprisingly, 16 projects were awarded to bids of zero subsidy; as a result of preparing for the bidding process, operators were able to document demand and willingness to pay in many communities. Once completed, these projects will provide service to about 460,000 people, about one-third of the Chilean population without access. Peru is introducing a similar program.

Myth 11: Infrastructure Is All You Need.

An implicit assumption of many information infrastructure initiatives is that installing infrastructure alone will solve rural communications problems. In fact, many ongoing issues will need to be addressed. User concerns include the need for training in using the technologies and budgeting for equipment such as computers and local networking. The implementation of subsidies for Internet access by schools in the U.S. required schools to prepare a technology plan stating how they would deal with these issues.

There are also likely to be ongoing policy issues such as the need to ensure that quality of service meets specified targets, that pricing is affordable for rural customers, and that benchmarks are reviewed and revised when necessary. Regulatory authorities in the United States and Canada, for example, have instituted proceedings on special subsidies for high cost rural areas.

3. Lessons for Planners

The above analysis of myths and realities suggests several lessons for rural telecommunications planners:

- **Involve the Customers:** Many misconceptions about communities of interest, service requirements and local conditions can be avoided by consulting with the people in the area to be served. Regional development or cultural organizations may be also be able to provide valuable information on the region.
- **Foster Innovative Strategies:** Encourage the industry to explore innovative and cost effective means to provide rural services such as those described above. Others include use of voice messaging to provide "virtual telephone service" where lines are not available (e.g. TeleBahia in Brazil) and leasing of payphones to local entrepreneurs who are open for long hours and take care of the equipment (e.g. Rwanda, Indonesia, India).
- **Make Organizations a Priority:** Make access for important community institutions a priority such as businesses, NGOs, clinics, schools, libraries, businesses and NGOs.
- **Start with Community Access:** Where services are new or costs are high, begin by providing access to the community through publicly available facilities such as pay phones, kiosks, post offices, telecenters.
- **Design for Expansion and Growth:** Design systems that are modular so that more customers and new services that require intelligent features or greater bandwidth can be added incrementally.
- **Design for Intrarural Connectivity and Traffic Patterns Based on Communities of Interest:** Ensure that the networks are designed for communiation from village to village, and to and from areas with high communities of interest. For example, do not require long backhauls to central switching locations, and use mesh rather than double-hop satellite networks.
- **Ensure Network Reliability Is High:** Fax and data services require high reliability. Carriers should be required to meet high standards for reliability. Sanctions can range from financial penalties to loss of license.

References

Hudson, Heather E. "Converging Technologies and Changing Realities: Toward Universal Access to Telecommunications in the Developing World." *Telecom Reform: Principles, Policies, and Regulatory Practices*. Lyngby, Denmark: Technical University of Denmark, 1997.

Hudson, Heather E. *Economic and Social Benefits of Rural Telecommunications: A Report to the World Bank*. March 1995.

Hudson, Heather E. *Global Connections: International Telecommunications Infrastructure and Policy.* New York: Wiley, 1997.

Hudson, Heather E. "The Significance of Telecommunications for Canadian Rural Development ." Testimony on Behalf of the Public Interest Advocacy Centre et al., Canadian Radio Television and Telecommunications Commission Hearing on Telecom Public Notice CRTC 97-42, Service to High-cost Serving Areas, April 1998.

International Telecommunication Union. *World Telecommunication Development Report 1998.* Geneva: ITU, 1998.

Kayani, Rogati and Andrew Dymond. *Options for Rural Telecommunications Development.* Washington, DC: World Bank, 1997.

O Siochru, Sean. *Telecommunications and Universal Service: International Experience in the Context of South African Telecommunications Reform.* Ottawa: International Development Research Centre, 1996.

Parker, Edwin B. and Heather E. Hudson. *Electronic Byways: State Policies for Rural Development through Telecommunications*, second edition. Washington, DC: Aspen Institute, 1995.

Saunders, Robert, Jeremy Warford, and Bjorn Wellenius. *Telecommunications and Economic Development*, 2nd edition. Baltimore: Johns Hopkins University Press, 1994.

Telecommunications Act of 1996. United States Congress. Public Law 104-104, February 8, 1996.

Return to Top View Full-screen

Inverse Cross-Subsidization (Rural-Urban): Paradox And Evidence

Darío M. Goussal and María Sandra Udrízar Lezcano

GTR UNNE, Argentina

ABSTRACT

For many years, the provision of telephone services to subscribers living in small communities and rural areas had been considered as wholly unprofitable or unfeasible. The accomplishment of the Universal Service Obligation (USO) to such areas, in relation to the 20% penetration goal established during the ITU Regional Development Conference (Acapulco, 1992) was regarded as a matter of subsidization. A traditional assumption was the apparent transfer of resources from urban to rural customers via the tariff structure, in order to allow their connection to the network. Nevertheless, some evidence on the paradox of inverse subsidization -from rural to urban customers- has been found in South American countries.

In this paper we will examine the nature and the dimension of inverse cross-subsidization mechanisms, with reference to real case studies. There are differences in effective quality of service (QOS) -detected among neighboring urban and rural service areas- merged with tariff imbalances, or expansion approaches requiring up-front funding and additional contributions from prospective rural customers to subscribe.

The raising gap in access and consumption is fueled by new services of the Intelligent Network (IN) and Internet connectivity status. The facts illustrated in this report support the need for Copernican changes in telecommunications policies and regulatory measures with broad vision on development trends, aiming to counteract the current drift of resources affecting small local areas and rural communities.

View Full Text

Inverse Cross-Subsidization (Rural-Urban): Paradox And Evidence

I. INTRODUCTION

Inverse cross-subsidization mechanisms in the provision of telecommunications services (from rural to urban subscribers) have proved to be real and effective in many regions of the world (1). Such regressive trends exist regardless of the size of service areas or the nature of providers (private or state-owned PTTs). The consequences seem to progressively worsen, as long as the evolution of networks creates regional imbalances favoring urban areas. In recent years, such effects were prompted by services related to the Intelligent Network (IN), the access to distributed data networks and the Internet. This report aims at enlighten how customers living in rural areas have been paying extra costs compared with urban residents served by the same telephone network, including examples of visible and hidden aspects.

The argued unprofitability of rural areas has been early demystified whenever right calculations and suitable technologies merge onto proper-scale projects (2). As in the concept of Melody, "rural areas should be considered as sources, rather than recipients of subsidies". To a large extent, inverse cross-subsidization in telecommunications services arises from expansion and operations strategic plans pursued in the network. The first type is related to *access* policies and the second lies on the *consumption* of the provided services. Regulatory measures can counteract negative trends leading to unbalanced provision of the services, as explored in other papers (2, 3).

One particular case was studied and documented in a rural area of the province of Chaco (Argentina) in the 1980s, referred to inverse cross-subsidization in the *access* (First type). In addition, examples of the *consumption* subsidies (Second type) currently found in the same region and another locations were briefly summarized as well.

II. THE NATURE OF INVERSE CROSS-SUBSIDIZATION (RURAL-URBAN)

Unlike other goods or services, the consumption of telecommunications services is characterized by the distinctive presence of a network. In the case of the basic telephone service, at least a two-party arrangement is required at both the origination and destination sides and consequently, the economic welfare of both parties is affected when a call is successfully completed (call externality). Moreover, each new subscriber added to the network also implies a small increase in the economic welfare of all the existing ones (network externality). A network is essentially a dynamic entity: it is constantly changing and moving itself since the subscribers join, change address or category and come out.

Prior to make any consumption, the consumer has to get an access to the network: residential or business lines, public phones, cellular lines, etc. Within the theoretical framework of telecommunications demand, there is a separation and at the same time a relationship between aspects of usage and access to the services provided (Taylor, 1994)(6). The potential benefits to be derived by the user from any consumption behavior, given the actual size and coverage of the network, leads to the decision concerning a particular access status (residential or business lines, cellular lines, public phones, etc).

From the provider side, these aspects include marginal costs and revenues. The consumption behavior & surplus is important from the consumer's side. Between them, either in monopolistic or liberalized markets the regulatory framework, along with the tariff policy deserves consideration. In order to understand the nature of the drawbacks affecting current and prospective customers in rural areas, we may distinguish the same aspects in the access and the use of network services. In addition, we should take into account different time-span levels roughly expressed as contingent or strategic issues.

The existence of inverse cross-subsidization (ICS) is related to differences in cost or quality of the services affecting rural customers with respect to the urban ones in the same network, in such way that the first group is penalized just for living or working out of town (5,9). Such differences arise from expansion and operations policies, either in explicit or hidden modes and beyond the provisions established for the Universal Service Obligation (USO) and other regulations.

Usage differences are related to the operations policy -namely the scope, the cost and the quality of the services provided-. Aspects such as availability, reliability and transmission technology are inherent to the communication in itself. Key points like billing, operator assistance, maintenance and repair resources, number and location of commercial offices, etc. have been also noted. Some of them are regarded as of a contingent nature, e.g. longer time to repair outside plant in a rural region affected by floods. Others entail strategic differences, such as the limited bandwidth available to wireless lines, or the conservation of old analog exchanges, banished from main cities to serve small towns on a several-year operations basis.

Access differences are related to the expansion policy of the network in relation to the location and priority pattern envisaged for a given service area (a country, a province, a town or an administrative district). Again, this involves contingent gaps such as the placement of new public phones or local switches in locations within the service area, but it may also encompass strategic changes, like rate-rebalancing initiatives affecting the structure of access charges (1). In this paper we will discuss just the strategic differences of both use and access nature.

III. INVERSE CROSS-SUBSIDIZATION AND UNIVERSAL SERVICE OBLIGATION

Still today, unreliable or noisy SSB-HF radiotelephone calls are yet the only mean of communication for most isolated areas in the world (5). Although these services were originally installed to fulfill special needs -e.g. aid for public health care in remote areas, or for temporary/ backup purposes, they often became the main system for public use. Yet such inexpensive but limited infrastructure tailored for low-income or nomadic users, accounts in most countries for USO coverage statistics, despite their differences in quality and inherent lack of privacy. Though the ITU has distinguished between *Universal Access,* referred to the availability of a telephone not so far from each household or working place (walking distance), and *Universal Service,* involving a telephone line for each household, nationwide; non-discriminatory access, and generalized affordability (31). Due to technological change, the definition of Universal Service is now regarded as a moving target in terms of the particular bundle of services to be provided (Hudson, 1995) (8).

Due to tradition rather than genuine reasons, in every discussion about Universal Service it is assumed that rural areas are unprofitable anyway, regardless of the scale and subscriber scattering pattern of the network, the scope of the services provided and the switching-transmission technologies adopted. Then, local providers should qualify for any kind of subsidies or allowed to bill extra-charges for rural customers. The problem is that incumbent operators have utilized as well the USO concept as a weapon to discourage challengers' entry. In monopolistic markets, this has been serving as an effective flag to claim for massive subsidies supposedly necessary to bring services to rural locations. This lobbyist assumption has been early demystified by Melody and others (9) at the same time that wireless last mile or LEOS platforms became a piece of design within cost allocation models based on forward-looking criteria (4,25,30).

Almost every regulatory framework in current liberalized markets boasts some provisions intended to ensure a non-discriminatory treatment for rural customers (16,21,22), but those provisions are neither precise nor uncontroversial. In the 1996 US Telecommunications Act (Section 254) it is mentioned that services and rates in rural areas should be "reasonably comparable" to those available in urban areas. The FCC has been entitled to reviewing periodically the definition of the bundle of services included in the USO in such a way that encompasses "an evolving level of telecommunications services taking into account advances in telecommunications and information technologies and services" (24,26,28,29).

On the other hand, the European Commission has addressed the point in the Full Competition Directive (1996), the Interconnection Directive (1997) and the newly proposed *Voice Telephone Directive*, currently under examination (15,16, 25). Concerning the scope of USO, the 1995 Green Paper skips an exhaustive bundle of items to be provided, but a "negative list" has been established containing the maximum bundle of services eligible for funding through USO by each EU country member:

- Voice telephony
- Fax Group 3
- Low bandwidth data services (modem communications)
- Emergency services
- Operator assistance
- Directory services

Clearly, such maximum bundle aims to limiting the financial burden imposed to competitors wishing to enter the national markets, thus preventing the blame of USO as a barrier by the incumbents (Kiessling & Blondeel, 1998) (15). The ITU has established specific goals for USO (31) until the year 2010, as depicted in the Table:

	Lines / 100 inhabitants		*Lines / 100 households*		*Public Telephones/ 1,000 inhabitants*	
	1996	*2010 Forecast*	*1996*	*2010 Forecast*	*1996*	*2010 Forecast*
World rates	12.80		34.4		1.55	

Developing Countries	5.07	10	16.3	>50	0.84	2
Low Income Countries	2.44	5	8.5	>20	0.57	1
Low Income Countries excluding China	1.22		4.1		0.21	
Developed Countries	54.03		94.3		5.19	

Suppose that a hypothetical provider of services including POTS is granted a license, good for an area comprising urban and rural settlements. Suppose that the regulatory framework contains directives for the Universal Service Obligation (USO), then customers living in rural areas would enjoy such minimum set of services available at their single switched lines. Under these conditions, the provider would react maximizing the profit by handling just two managerial variables: the cost and quality of the service. Experience has shown that such reaction will encompass both explicit and hidden sides, as analyzed in the few examples summarized hereto (17,18,19,20).

IV. RURAL URBAN DIFFERENCES IN THE QUALITY OF SUBSCRIBER LINES

Usage ICS is related to (I) the *real* bundle of services available to the final customer; (II) the *real* quality of the services provided and (III) the *effective* cost involved in such provision. A typical, residential line is normally connected via any transmission infrastructure to a local switching unit, whose types and gender will largely influence the quality of the POTS service (Fig. 1).

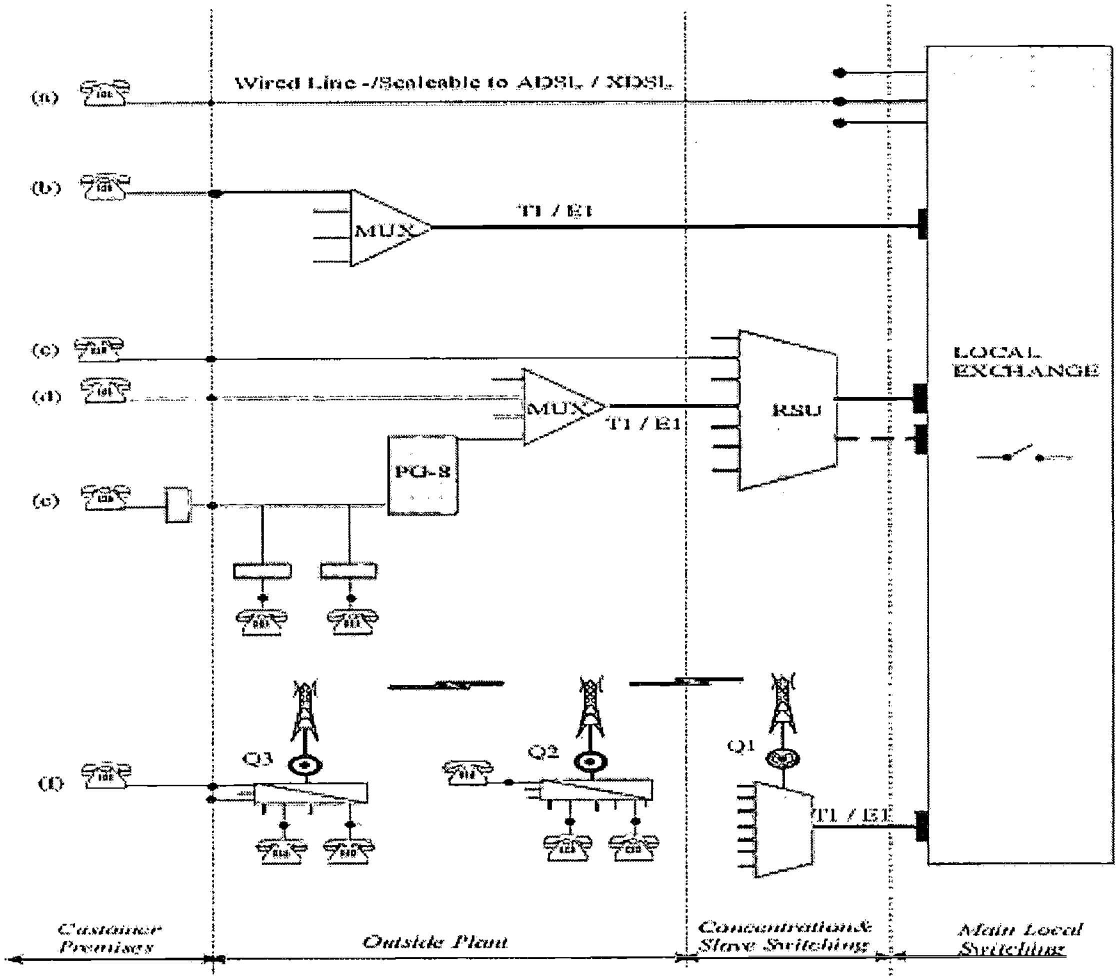


Fig. 1 GTR-UNNE 1999

Customers in downtown areas often enjoy digital lines directly connected to a main exchange with short wired loops, suitable for modem transmission and scaleable to ADSL/XDSL (a). Suburban wired lines need either long loops (now limited to 18,000 ft. in USA)(29) or most likely, through intermediate devices such as digital multiplexers (MUX)(b), or remote subscriber units (RSU) (c). MUX devices are often connected to RSUs in a sort of cascade arrangement, aiming at extending the coverage area (d). Wherever copper pairs are scarce, last mile is usually implemented via shared or temporary equipment like line carrier or pair-gain multiplexers (PG-8)(e). Rural clustered subscribers can get access through branched (tree-like) microwave concentrators with cascaded relay/subscriber stations and wired last mile (f). Scattered rural subscribers, in most cases require star UHF/microwave concentrators. In some cases, wireless local loop interface cards (DECT, PHS, CDMA) perform the last mile function in the previous topology, thereby replacing the wired distribution network from the relay station of the area to each individual subscriber (6).

We have assumed that all these subscribers are connected to a digital exchange through seamless digital transmission devices, although there are still a lot of analog infrastructure serving rural areas in the world.

If the (a), (b)...(f) subscribers are connected to the same exchange, e.g. a digital unit with IN-capabilities- the measured quality for voice communications has to present scores alike. These customers seemingly enjoy the same quality of service (digital), but they really don't: it is not difficult to understand that (a) will achieve better reliability, better availability and better expectancy of access to value-added services than the others. A regular wireless loop cannot support efficiently V.90 modem transmission, simply because the bandwidth and C/N ratios of both of them are different. Not to mention such rural customers expecting to log in the net through medium-speed datalinks, at the same cost and with the same performance respect to ADSL cards provided to citizens. Regarding to quality parameters, the Universal Service Order in USA (1997) specifies that any network model should not "impede the provision of advanced services". In USA the, FCC has disallowed a model's use of loading coils because their use impede high-speed data transmission (29).

The availability for (a) and (b) subscriber lines is also different respect to (c) (d) (e) or (f). To place a call the latter have to contend for a time slot into a TDMA frame at the RSU, according to typical concentration ratios (for example, 512 subscribers every 30 voice channels on E1 frames). The former (a) and (b) do not have concentration out of the main switch and consequently, these lines have full availability. Due to this, RSUs and rural concentrators usually have a priority setup control, which enables a particular subscriber line to access to whatever time slot available in the TDMA frame (or not). For example, lines exposed to high traffic loads e.g. business or government offices could have access to the 30 slots in the E1 frame, while a single residential being limited just to 20 or 25. It is clear that in such a case, different customers of the same RSU would find different values of blocking probability. We should accept that a slave-switching unit like the RSU is just a peripheral device with concentration capability, not a single stand-alone exchange. Although the RSU distributed-processing technology has evolved in the sense of performing more autonomous functions (smart RSUs), the traffic pattern of every RSU serving 500 to 2,000 lines - as usual- would show a large share of external calls, on account of their modest capacity. Then the effective availability of RSU suburban lines, under these conditions will be related to the availability of idle trunks in the master switch route at a given time.

Finally, the way a particular subscriber is connected to the main exchange has influence on the reliability profile of the line, in terms of the Medium Time Between Failure (MTBF) and the Medium Time to Repair (MTTR). If the digital concentrator relays the TDMA frame by using "foolish" subscriber stations -unable to perform on-site switching- the overall reliability of this line will depend on the conditional reliability of the whole microwave trunk, from the subscriber station to the main unit (Fig.1-e):

$$p\,(q_n) = p\,(q_1).\ p\,(q_2).\ p\,(q_3).\ ...p\,(q_{n-1})$$

where the reliability ratio of any particular stage $p\,(q_i)$ also depends on the reliability of the preceding stations of the Point-to Point (PP) or Point-to-Multipoint (PMP) concentrator -microwave, power systems, antennas, etc-. In addition, due to RSU location and housing -street shelters or unattended booths- they are more exposed to accidents, damage or vandalism, and as in the case of rural relay stations of a PMP microwave system. Both figures will undoubtedly decline with respect to typical averages of urban lines directly connected to the main local exchange. Likewise, the effective availability of rural or suburban lines will undoubtedly decline with respect to (a), to the same extent that more resources are required to have a call initiated or established at a given moment.

These constraints illustrate the differences affecting rural and suburban users within a *digital environment* and consequently, a relatively favorable network development context. Matters get worse in the case of analog or in-transition network environments, as in low-income or developing regions. Transmission devices such as FDMA radio multiplexers require UHF/VHF channels each to be shared by 8 to 12 subscribers (typical). The maximum cell capacities (62 subscribers with 8 radio channels) should be limited in practice just to 4-5 channels to reduce mutual intermodulation, overpropagation, noise and co-channel interference. A rural system with 4 UHF channels and 2 % of loss probability can handle just 1 Erlang, and thereby is limited to arrange up to 15 subscriber lines at 0.066 Erlang per subscriber. Nevertheless, such UHF cells use to work crowded, with more than 40 subscribers (4).

As in the base station MUX concentrators are connected to the local exchange on a line-per-line basis, whenever a call is conveyed by the switching unit to or from the rural subscriber, -depending on the gender of the switch- it has to overcome a second level of concentration in the local exchange system. Except in the case of true non-blocking digital units, this means that a limited number of internal circuits will be available to transfer the call, with a subsequent downgrading in the effective loss probability.

The downtown client does not have to share his copper line or the RF spectrum, so he has full service grade and scaleable features such as ADSL/ XDSL modem capabilities. As the line is directly wired to the main exchange it always has full availability. For the same reason, with less and simpler elements in the transmission path exposed to failure, those subscribers enjoy inherent better reliability.

These differences, briefly summarized herein are hardly reflected in lower tariffs for rural/ suburban areas, on recognition of the lower quality effectively delivered to most of them, leading to an implicit ICS behavior.

V. RURUAL URBAN DIFFERENCES IN THE SERVICES

A customer survey carried out by GTR in 1996 in northern Argentina over 1,857 individuals revealed that the main problem -perceived as "serious" or "very serious" (60.7%) was *the lack of telephone service in rural areas*. Even when at that time just a part of the respondents were living in rural locations, it was confirmed that a great proportion of people living in villages or cities need, but cannot communicate with such regions. In small towns and isolated spots already served, the problem is greater. Not only the quality is different from urban areas, but also the range and the level of the services provided. The point is that, even when rural monthly rentals used to be similar or higher than urban ones, there are less services available or reduced options to access such services. (3)

For example, the province of Chaco (Argentina) has 52 areas with basic exclusive automatic service, almost all of them from digital switching units -local exchanges, remote subscriber units (RSU) or digital subscriber multiplexer systems (DSMUX-. 4 villages are served by small local cooperatives and other 48 by Telco Norte (Telecom Argentina). However, only 30 of them have access to Direct International Dialing (DID) and to basic facilities like call follow-up, conference call and toll-ticketing billing (July, 1998). After the service was privatized in 1990, Telco Norte kept sales offices in 7 main villages of the province, but after successive downsizing operations they were reduced to 6 in 1995, to 2 in 1997 and currently there is only *one* fully-fledged facility left, located at Resistencia. Customers in the remaining 47 locations should dial to a remote call center to get serviced. Otherwise they have to travel long distances, as in the case of new subscriptions, billing verification-payment, directory ads publishing or access to the complaint registration book. Telcos´ sales offices usually open only in the morning, so customers living in communities far away are exposed to time-consuming, burdensome attending behavior.

The advent of current services of the Intelligent Network (IN) and a strong demand for Internet accesses or next broadband connections, tend to broaden the differences. Although a full range of premium IN services -including e.g. audiotext, televoting or massive calls does little sense to rural areas, the need for regular features, commonly available to urban households such as toll-ticketing, low speed data communications, emergency & special rate calls has not been met. The remote access to toll-free numbers (0-800) or to Internet Service Providers (ISP) (0-610) has been particularly difficult. 0610 numbers have a reduced tariff for long Internet sessions (discounted rates apply only for calls >15 minutes) but they are available just at main villages. Residential householders in the interior, wishing to get logged in the net have to overcome two drawbacks: 1) Lack of 0610 special-rate for Internet sessions through registered ISPs, thereby forcing them to place such calls at regular voice prices. 2) Lack of locally based ISPs, thus requiring placing inter-urban instead of local calls. Concerning access to 0800 (regarded as critical for emergencies or request for government offices, public assistance, regulatory bodies, etc), as in the case of toll ticketing and other IN services, it is not allowed from all local service areas. Access to 0-800 and collect calls is neither possible from most franchised public call offices and payphones, even in large service areas.

Conversely, small telephone cooperatives have been maneuvering well with these issues. As locally headquartered firms, to a large extent their business ventures have been more customized, nimble and open to social expectancies. The experience in Argentina has shown that many small providers have high responsiveness to technological changes, and to emerging IT services. The first digital local exchange in Argentina (a NEAX-61 device) was installed in 1971, during the telecommunications state-owned era, although not by ENTel -to time the nationwide incumbent operator- but by a local cooperative (Pinamar = 400 Km. away from Buenos Aires). Likewise, the first software-controlled local public switch in the province of Chaco (analog SPC) was released to service by the small cooperative of San Bernardo -about 260 Km. away from the capital city, Resistencia-. In both cases, their customers early enjoyed as regular, free computerized toll-ticketing, abridged dialing and other features that large urban areas achieved just several years later, and by paying extra charges to their normal subscription rates.

These facts banish the myth of the supposed unfeasibility or irrelevancy of the provision of similar range of services for both rural and urban households. It has to be taken into account that rural-urban differences also encompass installation-maintenance & repair delay, whereas the quality of service indicators such as the mean time to repair (MTTR), are related to greater displacement times of I&M brigades headquartered at main villages, each time they have to work on rural customers' premises.

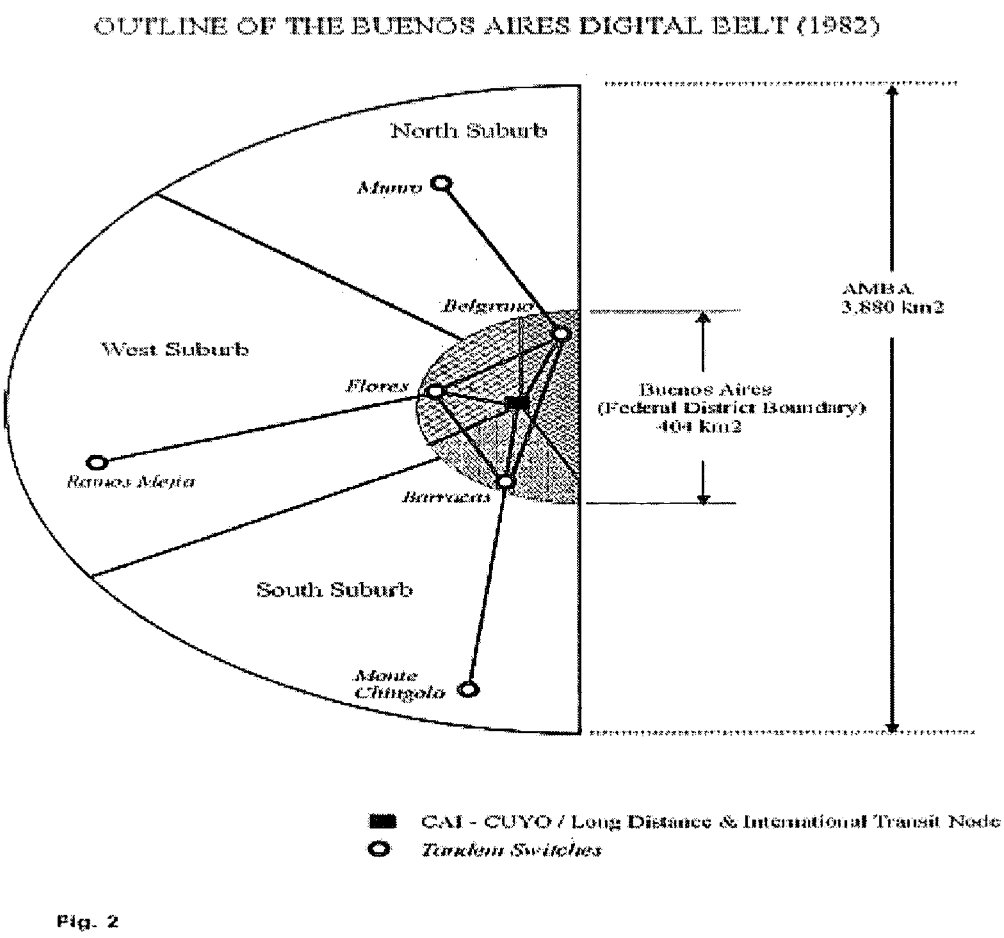
VI. INVERSE CROSS-SUBSIDIZATION VIA ASYMMETRIC USAGE TARIFFS

Except for the local calls placed by customers of town cooperatives, in Argentina there is not anymore a flat-rate tariff framework since the 1960s, when the former state-owned PTT (ENTel) shifted to a measured local service. Notwithstanding that policy, contemporarily adopted to overcome O&M expenditures and chronic shortages in the capacity of analog EMD exchanges, remains the same nowadays, in spite of huge changes occurred in technology and cost-allocation criteria.

In this chapter we will examine ICS mechanisms related to usage tariffs. Until the 1997 Rate Reforms (1), communications in Argentina between every two neighboring villages in the interior were rated as short distance calls, even when locating just 5 Km. apart. In 1996, local calls required 1 impulse every 2 minutes but short distance communications required 4 impulses per minute (+ 700 %). A reason is still valid: there are two local exchanges (not one) and any transmission link between them, working to have such calls established. After the Rate Reforms, the range for local calls was extended to 30 Km. except for the Buenos Aires Metropolitan Area (AMBA) whose privileged users remain enjoying >60 Km. calls rated as local. Although everyone recognized the tariff ICS via asymmetric distribution of toll impulse consumption (54 % in Buenos Aires against 80-100% in the interior), the question facing these reforms was: why should the interior have to subsidize them?

At the interior, local area boundaries hardly surpass 400 Km2. The Buenos Aires Federal District has 404 Km2 and the municipal area of Resistencia and neighboring is about 337 Km2, from which the inhabited area occupies only 57 Km2. But the Buenos Aires Multiple Service Area (AMBA) is an enormous 3,880 Km2. zone comprising the Nation's capital and densely-populated neighborhoods gathering a 49.3 % of lines in the country (Fig.2). Of course, it looks like a single area for their residents, but it really isn't. To understand why the AMBA has been -and still remains- subsidized by the interior, we should go back to 1980 when ENTel embarked in a $ 200 M. project called CIDIBA (Buenos Aires Digital Belt) intending to solve chronic traffic shortage (10,11).

Fig. 2



CIDIBA entailed the construction of an entirely new digital overlay network for the AMBA including 6 fully-fledged main buildings (14,000 m2) with 100-m. antenna towers; 6 main digital tandem exchanges; 12 (1+1) redundant digital microwave transmission links covering more than 100 Km; new tunneling and piping infrastructure (40 Km.) a 340-Km. optical trunk platform, and conventional cable laying (314 Km). The overlay tandem ring linked over 100 exchanges in 4 geographical zones: Buenos Aires Federal District (FD), Northern Suburbs (NS), Western Suburbs (WS) and Southern Suburbs (SS). Each suburban zone had a tandem node and the FD held 3 tandem nodes and one International/ Interurban Transit Node (CAI). Every trunk connection from digital local exchanges to neighboring peers or to their tandem switches was replaced at that time by optical links and/or 140 Mb/34 Mb microwave radios. A new main O&M center, power and ancillary equipment were also provided (Fig. 2).

Calls within the AMBA routed through the digital belt should be different priced from the local ones. This is not on the grounds of distance, but because the CIDIBA implies a second level in the switching hierarchy and consequently, the use of more resources. In essence, each communication in the AMBA-depending on the location of the origin and destination points- should be rated either as "local" (same switching area), "urban-adjacent" (between adjacent switching areas) or "urban non-adjacent"(elsewhere within the AMBA).

In 1994, telcos submitted a proposal to CNC to split the AMBA in local, adjacent and non-adjacent zones. Whereas it was regarded as a way of raising the "local" tariffs existing in the AMBA, CNC discarded the proposal. Yet the purpose was not exactly to raise tariffs but rather to short the mean time of AMBA calls to 120, 80 and 40 seconds per pulse in order to prevent peak-time congestion. In strict terms, we should label as *local* only the calls between two lines connected to the same main exchange (1). A call between two adjacent zones requires links and switching in the second hierarchy (a tandem exchange). In this case, there are 3 exchanges (2 local and 1 tandem) and 2 trunk links working to have the call established (Fig. 3) Calls between two non-adjacent zones are more complicated because they require 4 or 5 exchanges and 3 trunk links at least, depending on the congestion status of the whole route (Figs. 4,5).

Fig. 3:

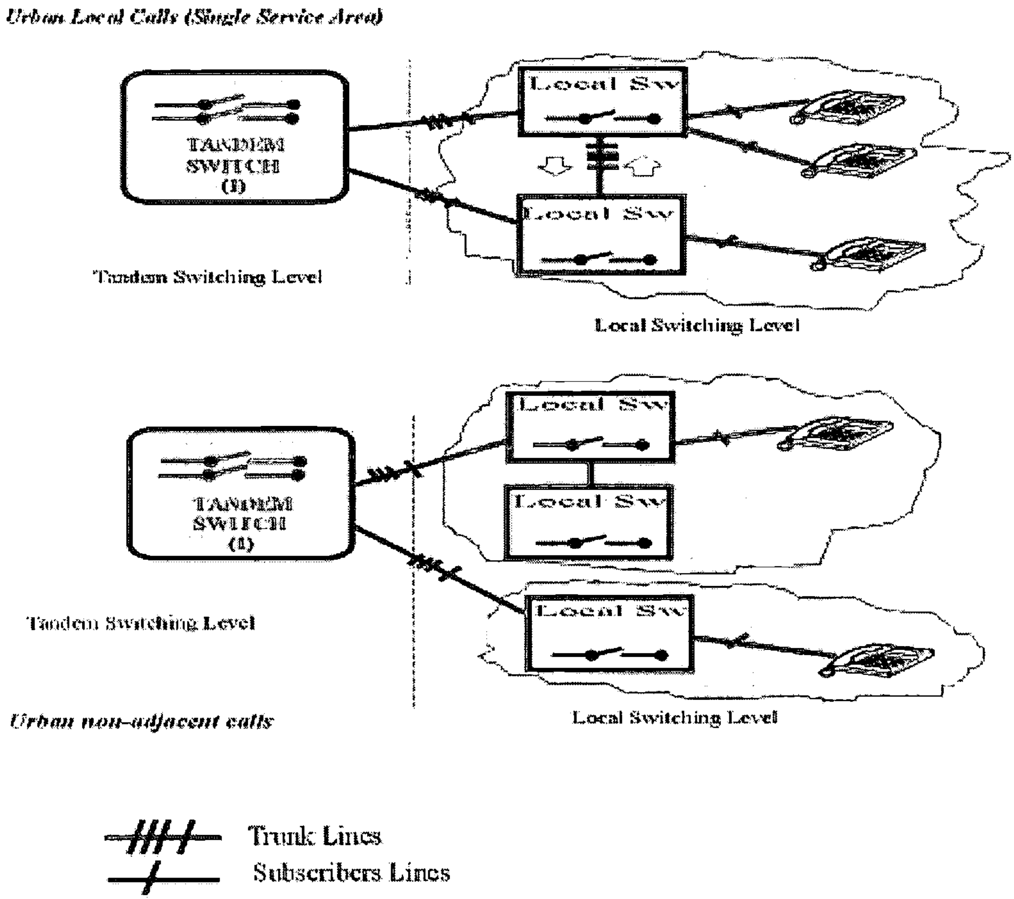


Fig. 3 GTR-UNNE 1999

Fig. 4:

Urban non-adjacent calls

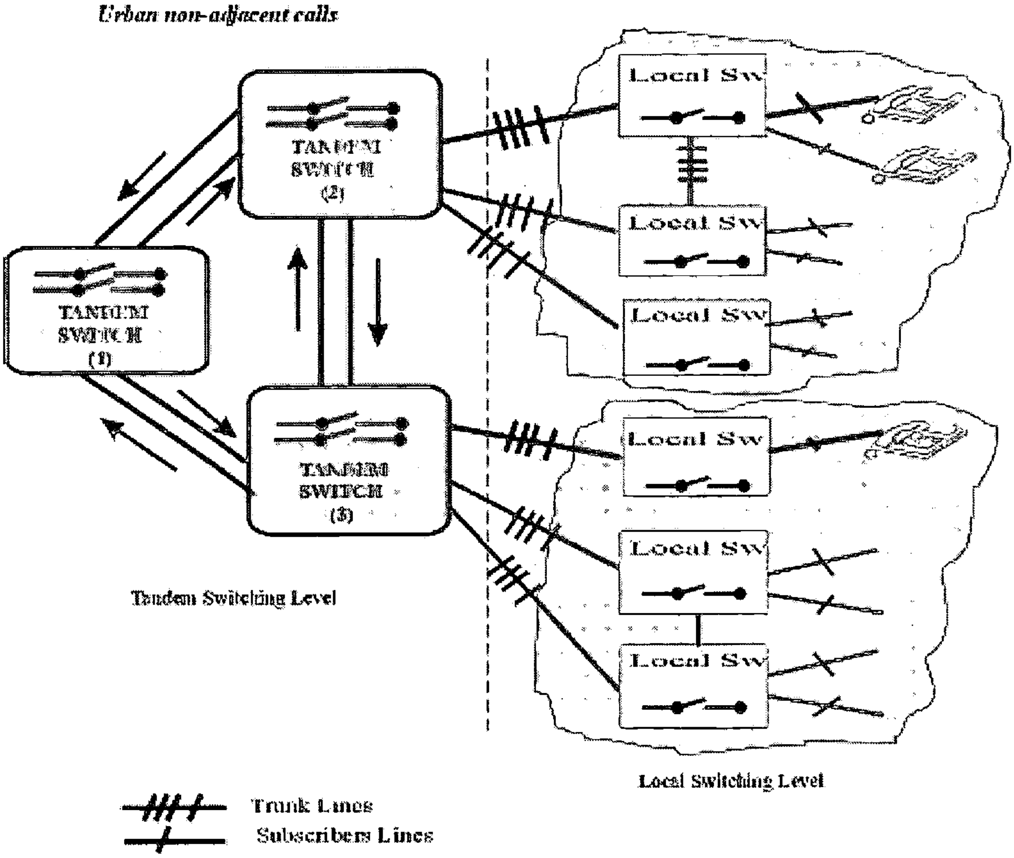


Fig. 4

GTR-UNNE 1999.-

Fig. 5:

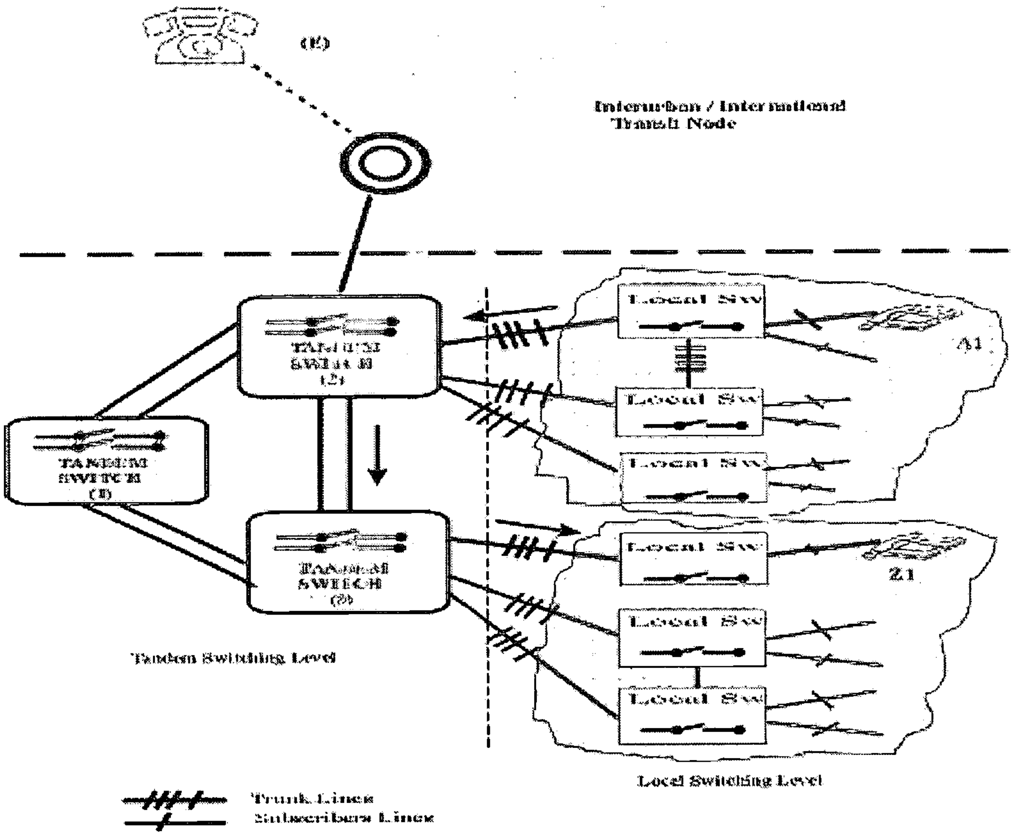


Fig. 5

GTR-UNNE 1999.-

If more devices and resources are required to get the calls established, it is evident the need for more investment, with inherent depreciation and O&M costs. Tariffs should have reflected such differences, but they ultimately didn't: the cross-subsidization favoring the AMBA remains active.

VII. INVERSE CROSS SUBSIDIZATION VIA ASYMMETRIC ACCESS TARIFFS

Although the CIDIBA project was undoubtedly necessary to keep pace of technology and to cope with strong traffic loads, it should be remarked that the whole investment was made at no cost for AMBA subscribers, but instead financed from ENTel's general budget. No extra charges or different tariffs were applied to access rentals and calls within the AMBA. But in reality, the provinces supported the CIDIBA project: as they were not high priorities for ENTel, most regions experienced delayed expansion, investment shifts, lower quality of service and technology discrimination. In 1980, in the province of Chaco (99,633 Km2) there were only 6 automatic local exchanges (EMD type) serving some 15,000 subscribers. The regional tandem exchange located at Resistencia was another analogic switch. In 1981/1982, while *digital* exchanges and *optical links* were being deployed in the AMBA, ENTel placed *analog* exchanges in the interior. New local exchanges to serve e.g. the villages of Villa Angela and Charàta were of EMD type.

An example of the rural-urban subsidization mechanism during the state-owned telecommunications era was studied in Hermoso Campo, a 50-year old rural town mainly devoted to agriculture in the province of Chaco (1). Until the divestiture of ENTel, small towns had two options to get telephone service connected to the national network, both of them requiring big community endeavors. The first approach referred to the constitution of a public services cooperative, to be entitled as exclusive provider upon construction and further operation of the local network at own risk. The second one was a sort of donation called "Financial Collaboration Agreement" benefiting ENTel with real estate assets transferred by the community-a building fully equipped and furnished, suitable to host a 400-line (analog) switch. ENTel was supposed to supply the switch, deploy the outside plant and connect the town to the network within the next 12/18 months; in the case of Hermoso Campo, the project lasted for years. (12)

In 1984, the local prefecture granted a property to build the office, and 170 candidate users agreed to contribute with monthly payments, building parts or raw materials (sand, bricks, etc.). But in 1985 ENTel changed the rules, by introducing a pre-paid access plan (Megatel). New subscribers nationwide were required to pay the connection fee (around $ 1,000) in 42 monthly installments, regardless of the ongoing Collaboration Agreements. In the case of Hermoso Campo ENTel had been granted not only the building, but also retained a MUX UHF radiolink provided by the Provincial Government for trunk connection to the main network. Just in 1990 while privatization process in Argentina was over, the exchange was placed and the outside plant deployed by ENTel. It was expected the network to become operative the same year, but ENTel was sold out beforehand, so the service got started just in December, 1991 and last connected to the network of a private telco, after 18 years of community endeavor.

From this historical example we can see a cross-subsidization mechanism via asymmetric access costs, where rural communities in the provinces paid effective installation fees 2 or 3 times in excess respect to urban subscribers. Early customers in Hermoso Campo estimated that each local line was worth $ 3,500 in average when including the values of real estate, building and other assets transferred to ENTel, in addition to Megatel installments -instead of $ 1,000 paid at that time for Megatel lines in the AMBA-. Consequently, subscribers of large urban areas benefited from shorter installation terms and better quality of service from digital exchanges or fiber optic transmission, without a high degree of commitment from their communities to get a telephone line. Hermoso Campo was connected years later, at a cost per line considerably higher respect to the AMBA, and finally was equipped with a new -but anyway obsolete- analog exchange.

In 1982, the $ 200 M. CIDIBA project comprising infrastructure such as optical links, digital switching and 14,000 m2 of new buildings started serving the 1,275,000 AMBA subscribers in the nation's largest city at no cost for them, even when representing an investment equivalent to 16% of the price of new residential lines (referred to values further adopted in the Megatel plan). Conversely, residents in the rural town of Hermoso Campo were required to build and purchase the access infrastructure on their own, in addition to regular connection fees, thereby comporting an effective access inverse subsidy of about 250% (1,2).

VIII. REGULATION ALTERNATIVES

The regulation of tariffs and interconnection agreement policies worldwide has given rise to studies facing the next open competition era. In Argentina, according to the Executive Decree N° 264/98 (March, 1998) a transition period has been established until full open competition -intending to start in October, 1999 (13). In April, 1998 a study document on tariff regulation alternatives for basic telephone services, including a methodology approach based in the experience of the UK regulatory office (OFTEL) was released by Secretaria de Comunicaciones de la Nación (Res. N°

1079/98) (14).

In essence, the proposal argues on the need of regulating only such service items where competition is inexistent or weak, via setting-up of maximum prices and the computation of a Total Productivity Factor (TPF) into a price-cap regulation. The general expression for such maximum prices is:

$$T_t = T_{t-1} * (1 + I - X) \pm Z \pm Q \pm K$$

where T_t = *Price in the* t *period*

T_{t-1} = *Price in the* t-1 *period*

I = *Inflation Rate*

X = *Total Productivity Factor*

Z = *Net Adjustment due to factors out of the provider's control.*

Q = *Net Adjustment due to Quality Factor.*

K = *Net Adjustment due to Investments.*

Even when the setting-up of maximum prices exceeds the purpose of this paper, it is interesting to remark the influence of *Q* and *K*, on recognition of the contingent differences from one provider (or region) to another. In the case of telephone lines subscription, the price should be weighted as well by another factor (BWA) tracking the ability of a particular set of main lines to carry out -as regularly- an effective bandwidth (Khz) or data bit rate (Kbps), according to a minimum grade of service or maximum call loss probability. Likewise, the ability of the particular provider to deliver a specific, minimum service basket as a regular part of the subscription (S) -for example, by including or not analog/digital exchanges, toll ticketing, 0-800 and other IN services- should weigh as well the subscription price level to enable cross-provider comparisons and interconnection charges:

$$T_t = T_{t-1} * (1 + I - X) \pm Z \pm Q \pm K \pm BWA \pm S$$

where

BWA = Net Adjustment due to effective bandwidth/data bit rate and effective grade of service or

availability.

S = Net adjustment due to effective basket of services available as a part of the subscription price.

Obviously, the computation of BWA and S coefficients, in addition to Q and Z is just a first step towards a transparency and it is not enough to avoid rural-urban ICS. As explained in other reports, we are in favor of tariffs based in forward-looking cost models, according to bottom-up engineering criteria (1,2,5,25). In USA the Universal Service Order adopted a forward-looking economic cost methodology (30) for the support system and the determination of eligible carriers. The FCC devised a plan to estimate forward-looking cost allocation in two stages. In the first one, the model platform establishes the framework of the approach with reference to the aspects that are essentially fixed e.g. the design of the network, network engineering and permanent characteristics such as soil and terrain. In a further stage, the FCC will select inputs for the model, like the cost of cables and switches, on account of appropriate benchmarks. A model platform for estimation of forward-looking costs in relation to High Cost support for Non-Rural local exchange areas (LECs) was recently released by this regulatory body (28). Such operators will begin receiving federal support based on that methodology on July, 1999 as a part of the program established by the Congress to ensure the availability of telephone service in rural and high cost areas. The adoption of a forward-looking cost estimation model contributes to the creation of a reference framework to avoid inverse subsidies, but additional rules should be specified by regulators facing the next competition era. (17,18,19,20,26,27) .

IX. CONCLUSION

Inverse cross-subsidization (rural-urban) involves explicit and hidden mechanisms detected in both access and usage differences. The discrimination in the access starts as early as the initial phases in the evolution of a telephone network, leading to what is called "Network topological memory"(4). Furthermore, explicit price asymmetries and other hidden sources are put in operation: incomplete, second-level or limited switching and transmission facilities, use of obsolete or recycled technologies, delayed or constrained investment, deferred renewals and abuse of temporary or backup infrastructure (second carrier lines, pair-gain multiplexers etc.).

Usage problems currently found in rural areas arise from differences in the quality, as well as the range and degreel of the services provided, including back-office functions: poor operator-assisted services, information and billing managing/updating; lack of commercial offices and repair brigades in towns, lack of rural public phones, booths out of order and so on. Insufficient or low training scores of the field personnel, lack of tools, vehicles and instruments often affect the maintenance and support out of large cities. Voice-quality, interconnection constraints and other QOS problems were also reported in recent studies on interconnection agreements in developing countries (Yan, Pitt & Levine, 1997)(23).

Quality differences are also related to bandwidth and C/N transmission profiles and the nature of the local loop (wired/ WLL, grade of service, overall MTBF, etc). A second kind of asymmetric provision affecting rural subscribers is the range or the scope of the services brought to end-users via the telephone line. Besides technical and infrastructure constraints in the last mile limiting the maximum bit data rates and/or the call loss probability, differences in the service comprise the unavailability of features such as toll-ticketing & billing control, access to 0-800 and other IN services. In this case, the ability of a particular set of lines to achieve specific values of effective bandwidth and grade of service parameters, has not been set upped on a transparent way, in order to avoid inverse cross-subsidization.

Regulatory bodies will have a hard work with ICS in the transition to the next open competition era, in order to ensure more transparent and realistic parameters in association with the Universal Service Obligation and the interconnection agreements, regarding potential imbalances and decompensation affecting rural customers. In Argentina like in other countries, this specifically refers to the overconcentration of resources in large areas and the paradox of inverse cross-subsidies detected in the national system. **

XI. ACKNOWLEDGEMENT

The authors wish to extend special thanks to all the historical witnesses, Municipal Government and former members of the Pro-Telephone Commission in the community of Hermoso Campo (Chaco), as well as to Mr. Luis Uechi, for helpful cooperation at gathering the necessary documents and data for the case study.

XII. *REFERENCES*

1. Goussal, D. M. & Udrízar Lezcano, M.S.: *"Network Decompensation and Regional Imbalances in Rate- Reform Processes: a Case Study in South America". Proc. XII ITS Biennial Conference (ITS-98).International Telecommunications Society (ITS). Stockholm, Sweden 6/1998.*

2. GTR-UNNE-Rural Telecommunications Research Group. School of Engineering. Northeastern University at Resistencia.: *"Recomendación Técnica para el Rebalanceo de las Tarifas Telefónicas". Presented at the National Public Audience on Telephone Rate Restructuring.* CNC-Comisión Nacional de Telecomunicaciones .Posadas, Argentina 5/XII/1996.

3. Goussal, D. M. & Udrízar Lezcano, M.S.: *"Customer Trends and Post-Privatization Behavior in Mid-Size Emerging Markets: a Survey in Northern Argentina". Proc. IX European Regional Conference. International Telecommunications Society (ITS). Leuven, Belgium 8/1997.*

4. Goussal, D.M.: *"Unrestricted Counterline Expansion in Large Rural Systems".* Proc. VI EuropeaN Regional Conference. International Telecommunications Society (ITS). Khania, Crete (Greece) 9/1994.

5. Goussal, D. M. & Udrízar Lezcano, M.S.: *"Rural telecommunications: Devising a Contemporary Policy Framework". Proc.20th Annual Pacific Telecommunications Conference (PTC-98) Honolulu, USA 1/1998*

6. Goussal, D.M.: *"Local Loop Reconfiguration and Rural Service Availability".* Proc. 17th. Annual Pacific Telecommunications Conference (PTC-95).Honolulu,USA 1/1995

7. Taylor, L:*"Telecommunications Demand in Theory and Practice"* 2nd.Ed. Kluwer Publishers USA,1994.

8. Hudson, H.: *"Converging Technologies and Changing Realities: Universal Service in the Information Age". Proc. 17th. Annual Pacific Telecommunications Conference (PTC-95).Honolulu,USA 1/1995*

9. Melody, W.: *"The Overlooked Opportunity: Rural and Remote Area Telecoms".* Pacific Telecommunications Review. Vol.15, N°2. Honolulu, USA 12/1993.

10. SIGEP (Sindicatura General de Empresas Públicas) *"Informe de Gestión Anual 1987- ENTEL.* 1987.

11. ENTEL - *Memoria y Balances 1985 - 1986 - 1987.-*

12. ENTEL/ Municipalidad de Hermoso Campo - *Convenio de Colaboración Financiera* - Buenos Aires, 10/1986.-

13. Secretaria de Comunicaciones de la Nacion: *Decreto Nacional Nr. 264/98.* Boletin Oficial Nr. 28856. Buenos Aires, 3/1998.

14. Secretaria de Comunicaciones de la Nacion: *Resolución Nr. 1079/98.* B.Oficial. Buenos Aires, 4/1998.

15. Kiessling, T. & Blondeel, Y.: *"The EU Regulatory Framework in Telecommunications- a Critical Analysis" Proc. XII ITS Biennial Conference (ITS-98). Stockholm, Sweden 6/1998.*

16. Latzer, M.: *"Toward an Integrated Regulation for the Mediamatics Sector: the case of Universal Services policies" ibid.*

17. Kontkiewicz, H. & Kubasik, J.: *"Emerging Liberalized Telecommunications Market: Interconnection and Tariff Policy in Poland" . ibid.*

18. Cracknell, D.: *"Telephone Usage and Demographic Trend*". ibid.

19. Meyer, W.: *"Local Competition and Telecommunications Network Cost".* Proceedings, GN-97 (Global Networking 97 International Joint Conference). Calgary, Canada 6/1997.

20. Falch, M.: *"Cost Characteristics of Telecom Networks and their implications for Market Structures".* ibid.

21. Choi, S.K. * Kim, H.C.: *"Universal Service: Myth and Truth".* ibid.

22. Hayashi, K.: *"Universal Debate in Japan".* ibid.

23. Yan, X.; Pitt, D. and Levine, N.: *"Interconnection: a Bottleneck for Future Chinese Telecommunications Deregulation" ibid.*

24. Zajac, Edward: "*The Telecommunications Act of 1996-a Policy Analysis Test Bed"* ibid.

25. Gallo, E.; Morganti, F. and Passamonti, L.: "*Does a right level of interconnection prices exist? - Some Guidelines for Europe from the US experience". ibid.*

26. Tardiff, T.J.: *"Costing and Pricing for Local Exchange Competition: Experience Under the US. Telecommunications Act" ibid.*

27. Songhurst, David & Kelly, Frank. *"Charging Schemes for Multiservice Networks".* Proc. ITC-15 (15th. International Teletraffic Congress. Vol. 2b. Washington, DC. USA 6/1997.

28. FCC-Federal Communications Commission: *Fifth Report & Order* in CC Docket Nºs. 96-45 and 97-160, FCC 98-279. Washington DC, USA October 28th., 1998.

29. FCC--Federal Communications Commission. *Memorandum Opinion and Further Notice of Proposed Rulemaking. FCC 98-278. Washington DC, USA October 26th., 1998.*

30. FCC-Federal Communications Commission: *Report & Order in the Matter of Federal-State Joint Board on Universal Service. FCC 97-157 (Ammended 6/4/97) Washington DC, USA May 8th., 1997.*

31. ITU-BDT: *"World Telecommunication Development Report 1998-Universal Access"*. Geneva, 3/1998.

(*) Grupo de Investigación en Telecomunicaciones Rurales/ Rural Telecommunications Group (GTR)

Universidad Nacional del Nordeste-Resistencia / Northeastern University at Resistencia (UNNE)

Resistencia, Argentina. http://ing.unne.edu.ar/gtr.htm

Av. Las Heras 727. Resistencia, Chaco (CP. 3500). Republica Argentina

Tel /Fax: +54 722 28106.

E-mails: dgoussal@ing.unne.edu.ar, sudrizar@ing.unne.edu.ar

IMPORTANT: New Telephone Numbering Plan after January 24th, 1999: +54 3722 428106.

Return to Top   View Full-screen

Insuring Universal Service: What's A PTO To Do ?

Mike Heller

Cisco Systems, Inc., U.S.A

ABSTRACT

Universal service, defined as the provision of telephone service to every resident of a country, has long been a tradition and goal of the telephone industry worldwide. But it has often proven difficult to achieve. Perversely, the residents who are situated in areas with high provisioning costs (e.g., rural, mountainous, or island areas) frequently are farmers or others with low incomes, with little to spend on telecommunications services.

While exact techniques have varied country to country, a common thread has been the actions of both the Private Telecommunications Operator (PTO) and the government agencies involved in telecommunications to find an effective combination of technical and economic ways to extend (at least basic) service to more of the population.

View Full Text

Insuring Universal Service: What's A PTO To Do ?

I. THE LONG STANDING GOAL OF UNIVERSAL SERVICE

Universal service, defined as the provision of telephone service to every resident of a country, has long been a tradition and goal of the telephone industry worldwide. But it has often proven difficult to achieve. Perversely, the residents who are situated in areas with high provisioning costs (e.g., rural, mountainous, or island areas) frequently are farmers or others with low incomes, with little to spend on telecommunications services.

Approaches to this problem have been seen in both the economic and technology areas. Various subsidy schemes can help cover the higher construction and operations costs. These are often buried in the Public Telecommunications Operator (PTO)'s rates, but may be explicit, as in the Universal Service Fund "tax" added to all long distance bills in the United States. On the technology side, techniques such as public phones or public telephone offices in villages, satellite and point-to-point radio systems for rural areas, and public voice mail systems available to those without conventional telephone service are examples that underscore the desire of PTOs everywhere to continue to move toward this goal.

While exact techniques have varied country to country, a common thread has been the actions of both the PTO and the government agencies involved in telecommunications to find an effective combination of technical and economic ways to extend (at least basic) service to more of the population.

II. CHANGING TIMES BRING NEW THREATS

The traditional environment of PTOs has been changing for some time. There are three key trends, separate but inter-related, causing a new telecommunications business environment to emerge.

The first is the deregulation (or at least lessening of regulation) that is occurring around the world. By the end of 1998, more than 85% of the world's telephone lines will be in markets with mandated competition, compared to only 10% in 1984. [1] New competitors, whether PTOs from other areas or entirely new entrants (including cellular and wireless operators, cable TV operators, new packet-switched data networks, or even the electric utilities and railroads) are challenging the traditional carriers, with the result of a reduction in customer loyalty and the average revenue per customer. (This last point occurs because often the first to take up the offer of a competitor tend to be the largest users of telecom services.) For example, in the United States, by the year 2002, traditional telephone companies are likely to experience revenue declines of about US$ 100 billion or about 25% of total revenues at that time. [2] It can also be observed that the introduction of competition, coupled with the more wide-spread adoption of telecommunications in business (described below), has raised the expectations of users regarding higher standards of service and lower levels of cost.

[Before continuing, it is interesting to note that this trend, of the three, is perhaps the longest running. At the Pacific Telecommunications Council conference in January of 1984, a speaker observed, in part, "I predict that both domestic and international communications in the Pacific regions will be opening up to increasing opportunities for competitive supply."[3]]

The second significant change comes from the computer industries, and increases the importance of telecommunications to businesses and government organizations. As the old main-frame computer installations increasingly give way to "client-server" architectures, and as PCs spring up on every desk, and business functions once on paper are handed using telecommunications (e.g., bank Automatic Teller Machines), data communications changes from a small specialist activity to something that is necessary for practically any business to succeed.

Third in this list of 'change agents' is the amazing growth and acceptance of the Internet. On a worldwide basis, the number of Internet users is increasing 15 to 20 percent per month. [4] Another way to describe this growth is quoted in the 1998 report from the U.S. Commerce Department's entitled "The Emerging Digital Economy." The report notes that while it took over 38 years after launch for 50 million people to tune in to a radio program, and 13 years for that many people to watch a television program, it took only 4 years for the Internet to reach 50 million users.

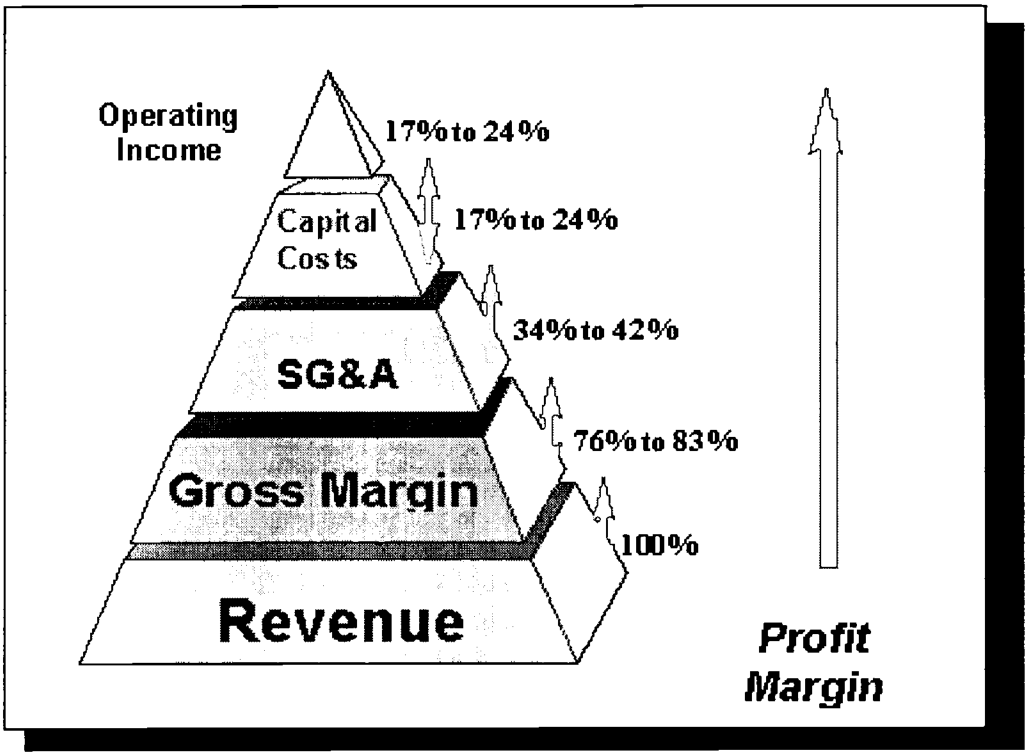
Corporations and other large organizations continue to increase their use of PCs, and most new PCs sold today come Internet-ready. Looking through the advertising in magazines today reveals many more companies whose ads list their World Wide Web addresses than those that don't include this. The Internet "browser," from Netscape or Microsoft, has become the PC user software of choice for all new software developments and applications in most IT organizations around the world.

For all these reasons, the demand for networking services of the PTOs is soaring. And taken all together, these trends have a single net effect upon PTOs – a reduction in the revenues traditionally used to fund universal service (the so-called Universal Service Obligation).

III. THE CHALLENGE, AND THE OPTIONS

The impact of these trends upon service providers, although varying by country, has been immense. The following chart (Figure 1) highlights studies done by Bloomberg Financial on the annual financial reports of different types of service providers. The figures vary, depending on whether the service provider studied was a local PTO, an international carrier, or an Internet Service Provider, but the pattern is the same for all.

Figure 1: Typical Service Provider Operating Income



Source: Bloomberg Financials: comparison of financial statements 1993 to 1997

While individual circumstances cause these differences in financial results, a common factor was that gross margins have declined 5 to 10 percent during the study period.

In recognizing this significant impact on their financial future, PTOs need to address several issues at the same time:

- Influence government regulatory and competition policies (to insure obligations are consistent with capabilities and resources)
- Pay careful attention to service quality and meeting customer demands (e.g., eliminate waiting lists)
- Develop new sources of revenue, usually increasing attention on the development of new differentiated services and bundles of solutions for both existing and non-traditional customers
- Focus more on efficiency of engineering, operations, and sales to make each revenue dollar go further

The first two issues will be left to other authors. On the services front, PTOs are finding that they must become less dependent on providing transmission and leased line services (which are the most likely to become commodity-like in a competitive environment) and better able to provide services with greater value to their customers. This also means moving new or enhanced services to market more quickly, without the lengthy field trials and careful experiments typical in a monopoly situation.

Service providers must optimize technologies and effect the best partnerships, to minimize the risks involved in a shortened implementation/testing time window. As will be discussed later, reducing the number of vendors involved can significantly reduce time to market by lessening the time it takes to built and test interfaces between multivendor equipment, by reducing training requirements, and by using consistent software controls that enable centralized network management.

IV. ANALYZING THE OPERATING BUDGET

Efforts to increase revenue, such as introducing new services and bringing them to market more quickly, are important elements in the overall profitability puzzle for a PTO. Equally important, however, is an increased focus on costs which, in a monopoly environment, are often thought of in budgetary terms rather than as a competitive tool for management.

The remainder of this paper will review the key elements of a PTO's cost structure, and suggest approaches to gain increased efficiency.

Operating costs at a service provider, which must be covered by revenues before any profit – or funds for universal service subsidies - are available, consist of several key parts. The most important areas are:

- Wages for operations and maintenance staff, and related costs (e.g., training)
- Capital expenditure for network and other equipment
- Wages and other costs for sales and office staff

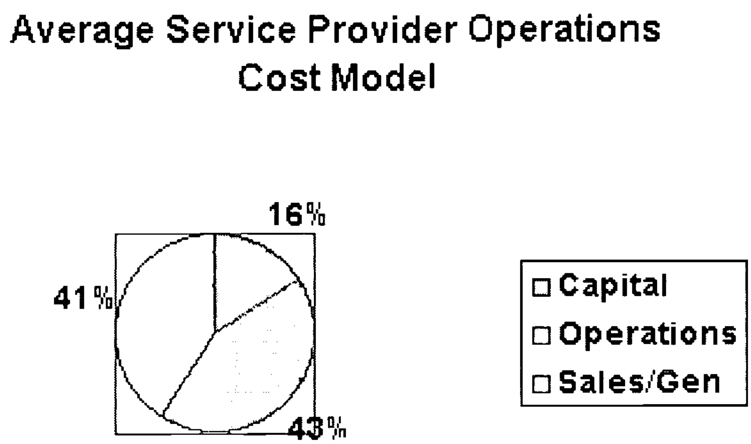


Figure 2. Average Service Provider Operations Cost Model

Figure 2 shows that, for PTO networks that support local-area, wide-area, and remote access services, capital-related costs are often the *least* significant portion of the total operations budget. Far greater cost percentages are attributable to staffing and facilities costs, both on the operations and sales/service sides of the operation, which collectively can account for more than 80 percent of the total.

V. **Complexity – A Hidden Cost**

While many readers will wonder exactly how a PTO can actually make many changes in staffing, wage levels, etc., it turns out there is a factor common to many of these costs that is quite within the reach of PTO management to change, and that is complexity of the network.

Network complexity is a function of both **scope** of the network (i.e., the number of nodes and exchanges, equipment locations and distances between locations, etc.) and **diversity**. Diversity is measured by seven complexity drivers: number of vendors, network management applications and agents used, software server platforms (e.g., operations support system computers), types of equipment, network protocols/standards used, and the presence of network-centric applications (such as Java applets). See Figure 3.

Figure 3 – Complexity Drivers

Complexity Drivers	Initial Cost	On-going Cost

Number of Vendors	4	0.9
Management Agents	2.2	0.7
Management Applications	2.2	1.2
Server Platforms	2.8	1.2
Equipment Types	2.3	0.8
Network Applications	2.1	2.5
Protocols Used	4.2	2

In the areas of types of equipment and the number of vendors, the traditional approach of procuring and building new infrastructure —issuing multiple requests for proposals to many different vendors in an attempt to find the lowest capital price and the best available product features— has several drawbacks in today's environment. In addition to slowing down the introduction of new revenue-generating services, significant added costs can be added to the operations budget.

There are two stages of complexity driver impact—an initial year impact (*initial cost)* and an ongoing life-cycle impact (*continuing cost).* In both cases, the impact can be represented as opportunity cost and the units are typically support staff person-months. The average opportunity costs that were found in research by The Registry, Inc. on a per-year/ per-driver /per-support staff basis are shown in Figure 4. This study compared public network operations costs for networks with three different vendors with those for networks with just a single vendor's equipment installed.

In each column, the number of vendors is shown multiplied by the complexity factor, discussed earlier, to produce cost figures expressed in man-months.

Figure 4

A. Three-Vendor Scenario

Complexity Driver	Initial Cost	On-going cost - one year	Total cost over three years
Mgmt Apps	3*2.2 = 6.6	3*1.2 = 3.6	6.6 +10.8=17.4
Mgmt Agents	3*2.2 = 6.6	3* .7 = 2.1	6.6 + 6.3 =12.9

Equipment Types	3*2.3 = 6.9	3* .8 = 2.4	6.9 + 7.2 =14.1
No. of Vendors	3*4.0 = 12.0	3* .9 = 2.7	12 + 8.1 =20.1
Total ManMonths	**32.1**	**10.8**	**64.5**

B. One-Vendor Scenario

Complexity Driver	**Initial Cost**	**Ongoing cost - one year**	**Total cost over three years**
Mgmt Apps	1*2.2 = 2.2	1*1.2 = 1.2	2.2 + 3.6 = 5.8
Mgmt Agents	1*2.2 = 2.2	1* .7 = .7	2.2 + 2.1 = 4.3
Equipment Types	3*2.3 = 6.9	3* .8 = 2.4	6.9 + 7.2 =14.1
No. of Vendors	1*4.0 = 4.0	1* .9 = .9	4.0 + 2.7 = 6.7
Total Man-Months	**15.3**	**5.2**	**30.9**

While this complexity model, originally developed by The Registry, Inc.[4], optimistically depicts incremental complexity to be linear, the support staff at several service providers profiled in this paper believe that multivendor complexity is actually exponential in its impact.

The vendor complexity driver clearly constitutes one of the highest impacts, particularly for initial year implementation, during which integration, training, and testing costs are most significant. Of course PTOs have always been concerned about this issue, as can be seen in the fact that very few telcos have more than 2 or 3 vendors of PSTN switching equipment, although there are certainly more vendors in the marketplace.

As can be seen in the above industry research, network complexity that results from even modest diversity of vendors can result in significant unplanned costs that affect both service time to market and long-term service quality perceptions. Any small gains achieved in reducing initial capital costs are eliminated by the higher long-term cost of ownership (CoO) of a multivendor network.

To put these differences in man-months into perspective, consider that for traditional telcos in the U.S. and Europe, recent studies have shown fully-loaded annual costs (includes wages, taxes, medical and pension benefits, etc.) for network technical support personnel to be US$ 175,000 to US$ 200,000 per person per year. (For U.S. Internet Service Providers, this annual expense figure is between US$ 88,000 and US$ 148,000.) While labor-related costs in the Pacific Region vary greatly from country to country, the financial importance of seemingly minor decisions on selection of vendors is strikingly seen.

[Note: taking *only* these network support costs, and given the average revenue per employee at the telcos studied is between US$ 150,000 and US$ 325,000 per year, the likelihood of a shortfall in monies for universal service is apparent. And over time, staff costs are sure to increase, and competitive pressures on pricing are sure to continue, which can only make the situation more critical.]

On the maintenance front, common terminology goes a long way to eliminating misunderstandings on service orders and trouble tickets, and the PTO staff spends less time in training classes, studying manuals and documentation, etc. Operations managers have found that installing heterogeneous point solutions and equipment for specific services or facets of their network backs them into a corner. The expertise and experience of operations and engineering staff is a critical resource, but if it cannot be flexibly applied to operating and maintaining the entire network, efficiency of the whole organization suffers. Analysts have referred to this situation as the "Balkanization" of network management - where skills become so compartmentalized that each technician becomes responsible for a specific set of equipment. Every time a new type of equipment is added, the learning curve starts all over again.

With common technologies and interfaces, on the other hand, these operations problems are avoided. The network can be more effectively managed and service levels and reliability increase. At a time when hiring and retaining competent technical staff is a challenge (this is especially a problem in many Pacific Rim countries), the ability to amortize the skill sets of individuals over the maximum range of network equipment and services is a compelling reason to apply consistent technology throughout the network.

Another factor to consider to increase profitability is the reduction of the number of disparate networks that are service-specific. For example, many PTOs, starting with the PSTN, added separate equipment to offer X.25 data services. Later, other equipment was installed for frame relay services. Yet another set was added for Internet services, and so on. Decisions on new capital expenditures are usually a trade-off between leveraging current investment and optimizing new capital investments for new scaling requirements. Many service providers are now working to reduce the number of these disparate networks in order to achieve support economies of scale across a broad range of service offerings. As just one example, another study from The Registry, Inc., found a 33 to 52 percent cost-of-ownership advantage was found for products that provide integrated remote access, routing, and CSU/DSU functions for managed network and Internet services delivery. [5] For example, PTO's can now acquire a single products that deliver Internet access, Voice/IP, Frame Relay, ATM, and managed network services required at the edge of a multiservice transport network.

Multivendor complexity drivers also affect customer support, sales, and marketing costs, which, unmanaged, translate into increased training costs and decreased proficiency. Decreased proficiency among sales and customer support leads to lower revenue-per-person ratios and higher Mean Time to Repair (MTTR).

VI. CASE STUDIES

1. SITA and EQUANT, global joint providers of high-quality managed data and voice communications services for global corporations, have launched a new ISDN-based remote access service for businesses. Called PPP Dial (ISDN) Access, the service enables telecommuters to dial into corporate LANs from PCs or from remote office routers at connectivity rates up to 128 kbps. This new Virtual Private Dialup Network (VPDN) service is a cutting edge complement to their extensive asynchronous (X.28) dial services already in place in over 164 countries.

SITA and EQUANT achieved significant operational cost savings in the first year of the global rollout of the new service. As a direct result of using the same vendor for both the backbone routers and dial-in aggregation devices at their points of presence (POPs), equipment sparing costs were reduced by 20 to 30 percent the first year. Other first-year operational savings reported by SITA and EQUANT included:

- Rollout procedures to 150 global help desks and 15 network control centers: 100 percent savings in installation manuals and training
- Network management and administration: 200 percent savings in training and in integrating different management platforms and network views
- Operations: 100 percent savings in configuration and support

2. Digex, an East Coast based Internet Service Provider and a subsidiary of Intermedia Communications, Inc., shifted its focus to providing Internet services at the premium end of the market. To facilitate this strategy, the company redesigned its backbone architecture and moved from a multivendor to a single-vendor environment. "DIGEX's MTTR and average service response time have reduced substantially after moving to a single vendor environment. The DIGEX sales force now confidently sells customer service and support as primary differentiators vs. its competitors, citing the fact that DIGEX consistently achieves 99.99 percent network uptime, with a customer satisfaction rating of 95 percent. DIGEX has increased revenue 300 percent annually, while effectively raising its service pricing by 50 percent over 1995 levels.

This move enhanced the expertise of DIGEX's sales and customer service organizations, according to Sheryl Richeson, Executive Vice President-Customer Service for DIGEX. "By focusing our training on a single product line which scales to meet a variety of customer requirements, we have been able to build an expertise that we can extend to our customers in terms of technical support, access to product experts, and use of unique debugging tools."

3. Based in Redwood City, California, ***@Home Network*** distributes high-speed interactive services to residences and businesses via its own network architecture and its transport options, including the cable industry's hybrid-fiber coaxial infrastructure, telco circuits, and broadband wireless. @Work, the business-focused division of the company, differentiates itself as a next-generation network application platform. The primary competitive differentiation of @Home and @Work is their focus on the turnkey provisioning of highly scalable bandwidth to an individual or commercial client. An additional key advantage of @Work's network strategy is end-to-end management. Every @Work connection is proactively monitored from the customer's site throughout the company's network. This set up allows @Work to take responsibility for dynamically identifying and addressing network quality, service, and performance issues.

@Home has been able to achieve a 20 to 30 percent reduction in service delivery cycle time *by dealing with a single rather than multiple vendors for its network infrastructure.* For many service providers, this saving translates into potential service life-cycle revenue as much as 1 to 3 percent. According to Don Hutchison, Senior Vice President and General Manager of @Work, @Home Network, "@Work is well differentiated in its ability to deliver high-speed performance and value-added service to our customers. Cisco shares our vision that the IP network is the foundation for delivering intelligent business solutions, providing customers with strategic competitive advantages. In our opinion, no other company gives you the kind of flexibility you need to run the core of your backbone system in the Internet space that Cisco does."

4. Worldcom Advanced Networks (formerly CompuServe Network Services), which specializes in network service delivery to large firms that have business critical applications, has seen its traffic grow over 1000 percent in the last three years. Previously, because of the multivendor nature of their managed services network, as many as 22 independent revisions of router software required support by the CNS technical staff. Today, by adopting a primary vendor solution, they have reduced that number by an order of magnitude down to two, reducing operations and change management costs in range of 15 to 20 percent. These savings affect both the network management and the customer support staffs and therefore enable CNS to avoid the 10 percent erosion in gross margin that has occurred with many other service providers in recent years.

VII. CONCLUSIONS

Today's business environment is straining the ability of many PTOs to maintain funds for universal service (and other such obligations). Regulatory and competitive pressures will likely continue this situation, so both revenue opportunity and cost containment strategies are important. The key business targets for the service provider leaders of the future will be a combination of (1) technology migration, (2) effective service development and delivery, (3) complexity management, and (4) service fulfillment innovation and excellence. Given the rapid degree of change that is already in motion, service providers that are oriented toward meeting these targets and both short- and long-term competitiveness are implementing programs of strategic vendor selection and implementation. No longer should network equipment vendor selection be based solely on first-cost equipment or service pricing considerations.

The research reviewed by the author shows that unmanaged network complexity can significantly and negatively affect the achievement of these four key objectives. An effective approach to achieving them is the careful consideration and management of unwanted and unplanned *network complexity* within a PTO network.

VIII. REFERENCES

1. Salomon Smith Barney. 1998. Gyrus – *Telecommunications: The Search For Value In Global Telecommunications.* Salomon Smith Barney Inc. , New York, New York, July 28, 1998

2. French, Michael. 1998. *And Now The Bad News.* America's Network Magazine, June 15, 1998

3. Jasper, H. 1994. *Does Competition In Telecommunications Have Any Natural Boundaries?* Proceedings of the Pacific Telecommunications Council Sixth Annual Conference, PTC '84, Honolulu, Hawaii, January 1984: 211-216

4. IDC Research, The Internet Report, April, 1997

5. The Registry, Inc., *Optimizing Service Provider Investment Return*, Newton, Massachusetts, January, 1998

6. The Registry, Inc., Op. Cit.

Return to Top View Full-screen

Global Access to Telecommunications:

Toward an Informed Choice Model of Universal Service

Jorge Reina Schement and Scott C. Forbes

Penn State University, U.S.A

ABSTRACT

This paper presents a detailed template of an Informed Choice Model of Universal Service. Merging a healthy blend of recent technology advances with democratic theory into a coherent policy recommendation, this model provides guidance to business and political institutions seeking to implement universal service policies. It highlights the changing communications landscape across the globe—particularly the United States and the Pacific Rim—and argues that while the telephone is still the primary link among an individual home, its surrounding community, and the global Internet, more recent technologies must be incorporated under the traditional umbrella of universal service to improve communication between individuals. Furthermore, people must be informed of all available items on the communications menu which are capable of connecting them to the rest of society, particularly in developing countries where widespread telecommunication networks are recent or merely proposed infrastructure additions.

View Full Text

Approaching the Net: Toward Global Principles of Universal Service

This paper was made possible by a gift from Bell Atlantic to the Institute for Information Policy in support of research on universal service. We are especially indebted to the support of Ed Lowry of Bell Atlantic for his advice and support. The paper reflects only the views of the authors.

Introduction

> "The Bell System was founded on the broad lines of "One System," "One Policy," "Universal Service," on the idea that no aggregation of isolated independent systems not under common control, however well built or equipped, could give the public the service that the interdependent, intercommunicating, universal system could give.

When Theodore Vail ushered universal service into the public consciousness with the famous phrase "one system, one policy, universal service," he set in motion a policy discourse that created the 20th century telephone monopoly of AT&T and connected Americans into the world's foremost telecommunications system. Now on the cusp of the new century, AT&T's monopoly no longer stands, yet the classic vision of interconnected homes and individuals communicating with each other regardless of distance still frames our sense of global telecommunications. To be sure, the telephone and its measure of performance—penetration level—remain benchmark telecommunications measurements and still allow crude multinational comparisons of the relative level of price, performance, and efficiency levels of communications networks. However, as telecommunications choices become more personalized and begin to rely more heavily upon Internet-centric digital technologies, the notion that universal service means only "a phone in every home" is antiquated and relegates countries without established telecommunications infrastructures to an inflexible development path insensitive to the potential of new technologies. Consequently, the purpose of this paper is to propose a conceptual framework for subscriber participation centering on an Informed Choice Model (ICM) of universal service. In proposing this model, we acknowledge the importance of cost and implementation questions such as subsidization and bandwidth constraints, respectively, but do not for the most part address them. Our intent is instead to present a generic template leading to global principles for worldwide universal service.

The Informed Choice Model of Universal Service

The Informed Choice Model (ICM) of universal service embraces the changing world communications landscape and recognizes that although the telephone remains the primary link for industrial households, newly developing technologies must be incorporated into the universal service concept if it is to remain a viable and worthwhile policy goal.

The ICM accommodates newly developing telecommunications networks to the varied circumstances experienced by the world's nations and peoples. The model's emphasis on endogenous preferences—individual choices as opposed to overarching political system directives—offers a standard applicable in all countries and the potential to respond to diverse national and cultural needs. For purposes of this paper, we will primarily rely on American data sources because of their availability. We suggest that lessons derived from this model are applicable to all countries, particularly those with large inner-city and rural communities such as India, China, and Russia.

Defining Universal Service and Universal Access

At its most basic level, "universal service" provides a system of socioeconomic support for a specific population or technology (e.g., railroads, post, education, roads and canals.). In traditional telecommunications policy terminology, universal service constitutes a fairly narrow set of ideas and refers to public policies whose goals are to provide households with functional telephone service. Universal service policies typically target individuals who are unable to pay for existing telecommunications services, such as isolated rural users, low-income populations, and designated educational or medical institutions . In the United States, the first two groups include significant numbers of African-Americans and Hispanics. Universal service presumes individual possession of a telephone and the establishment of an appropriate account relationship with which to purchase telephone service.

By contrast, universal access measures the availability of a telephone to a given individual or household without the presumption of choice. For example, offering telephone service in a country where a five-minute walk to a telephone is the established norm constitutes universal access, not universal service. Thus in universal access technology is publicly available, but the charge is levied at the point of purchase, and the user has little or no choice in determining the service.

Plain Old Telephone Service (POTS) is the baseline for American universal service policies, with all other technological options considered extensions of that base. The primary objectives plus standard and optional telephone service as they are typically categorized within the definition of universal service in the United States are listed in Table 1. Note that "standard" and "optional" services vary from country to country, depending on financial constraints, the agendas of political leaders, and the willingness of public carriers to promote telephone penetration.

Table 1: Universal Service Elements

Primary Objectives	Optional Services
Equitable Pricing	Information on Existing Technologies
Efficient Billing System	Training Programs
Extensive Network Coverage	Touchtone for Tele-services
Goal-oriented Subsidization	Companion Services
	Connection to Internet
Standard Services	Access to Public Electronic Databases

•Public Payphones	Digital Switching
Emergency Assistance	Advanced Data Transmission (ISDN, T-1, etc.)
Handicap Access	Video Transmission
Toll and Long Distance Calls	Electronic Commerce
Voice Transmission	
Data Transmission (via modem)	

The Measurement of Universal Service

Noticing that multiple groups of telecommunications users suffer from endemically low penetration of available technologies or experience slower diffusion curves than the national average, the UN in 1997 cited lack of cogent and effective universal service policies as a primary reason why there is unequal access to communications technologies.

> "We are profoundly concerned at the deepening mal-distribution of access, resource, and opportunities in the information and communication field. The information and technology gap and related inequities between industrialized and developing nations are widening: a new type of poverty—information poverty—looms. Most developing countries, especially the least developed countries, are not sharing in the communications revolution since they lack…policies that promote equitable public participation in the information society as both producers and consumers of information and knowledge…"

While some individuals in these groups may simply lag behind majority adoption patterns due to lack of opinion leadership or adherence to traditional patterns of technology usage or delayed market forces (Rogers 1995, Compaine 1997), it is more likely that systemic hindrances prevent the adoption of a communications in tune to the rest of society.

The Informed Choice Model argues unlike some communications scholars that universal service should be an active public policy that allows people to communicate—to send and receive information at a reasonable cost. From this perspective, the social value of the promise of universal service outweighs giving priority to any particular delivery mechanism, type of market, geographic location, etc. The value of universal service to many is far more than what people can afford. Often people can afford to pay very little but value the connection to their social sphere above all else. In addition, there are be benefits for the providers of universal service-mandated technologies. As Xavier (1997) notes, benefits to technology suppliers and operators of implementing a universal service policy include: improving corporate image, acquiring valuable customer information, and utilizing economies of scale to reduce cost and promote a proprietary technology.

Thus measuring the effectiveness of existing telecommunications policies and the subsequent progress of a revised universal service program is critical. For example, Sawhney (1992) mentions that areas of low population density regardless of sex or ethnicity tend to have lower telephone penetration coupled with widely dispersed demand requirements: a telecommuting worker may need high-speed Internet access, while a nearby neighbor may be satisfied with a rotary telephone reminiscent of the early 1900's. Measuring this demand for service and the communications technology penetration level is key to improving the status quo. Two measures in particular are internationally recognized measurements of telephone penetration that do not focus on households: number of main telephone lines (MTL) and main telephone lines per 100 inhabitants.

Figure 1 shows a country's total number of main telephone lines. Notice that only the United States has more than 100 million MTLs; Western Europe, Russia, India, China, and Brazil are the only other areas having more than 30 million telephone lines. These numbers are reassuring when viewed from the point of gross population numbers; the vast majority of the world's population live in these locales (Figures 3 and 4). What is disturbing, however, is that the majority of nations and territories possess fewer than 3 million telephone lines; only two countries on the continent of Africa have more than 3 million MTLs. This lack of gross numbers of MTLs greatly affects per capita measurements of MTLs.

Figure 2 shows MTL adjusted for population size. It is effectively the density of MTLs. On an MTL per capita basis, North American countries with the exception of Greenland and Mexico have over 60 lines per 100 people, or a 60% penetration rate. In contrast, the world average is 13.34%. South America, Europe, Australia, and most parts of Asia have penetration rates between 40% and 60%. Again, Africa as a continent suffers from extremely low penetration rates with an average of only two main telephone lines per 100 people Perhaps more alarming than Africa, India has one sixth of the world's population and only 1.82 MTLs per person.

The Case of the United States

In a country known for its intense dependence on its telecommunications infrastructures, specific groups of telecommunications users continue to suffer from endemically low penetration of available technologies or experience slower diffusion curves than the national average.

The United States uses telephone penetration—the percentage of households with telephone service in their homes—to measure the results of universal service policies. When 100% of all households who want telephone access have telephone access, then the goal of universal service is fulfilled. For example, households headed by ethnic minorities—not including Asians—have telephone penetration rates significantly lower than the national average (Figure 10). As researchers discovered that ethnic minorities as well as young and relatively transient people often defer telephone service for costs relating to usage, not access, new services such as separating local and long distance bills were implemented by the FCC, resulting in an improvement in minority telephone penetration rates . Progress needs to continue: the promise of universal service is itself empowering for these underserved groups, but results must at some point in time meet expectations. .

The Case of the Pacific Rim

According to the ITU's 1997 Telecommunications Report of the region, the Pacific is the fastest growing telecommunication market in the world. The annual average increase in the number of telephone lines here since 1990 has surpassed every other region. This is particularly true in the case of low income countries, which have registered growth of close to 30 per cent per year, far exceeding any other developing region. This increase in main telephone lines is particularly surprising since mobile cellular service is the fastest growing telecommunications segment in this region. In fact, the number of cellular subscribers in the Pacific Region has nearly doubled (84% increase), compared to a paltry 11% increase in fixed telephone lines. The number of Asia-Pacific cellular subscribers has increased by 40 million since 1990 and the region now accounts for one third of the global total, up from 15 per cent in 1990. For many, cellular services is the de facto means of connection to the public network: nearly 60% of all telephone subscribers were using either fixed or mobile cellular in May 1996.

Nevertheless, the Pacific region's dynamism in connectivity boils over a vast population that varies greatly in its levels of connectivity. Table 2 lists telephone penetration among the Asia-Pacific Economic Cooperation (APEC) countries. Telephone penetration varies from 60 phones per one hundred population in the US and Canada, to 2 phones per hundred in Indonesia, the Philippines, and Vietnam. Yet the average MTL per 100 people in APEC countries is nearly 28, more than double the world average. In the United States in particular, smaller household sizes (Figures 5 and 6) and therefore increased geographical distance between members of previously nuclear families and their desire to communicate with each other may account for willingness of subscribers to subsidize new infrastructure (MTLs) with their monthly payments. Taken together, APEC countries account for over 40% of the world's population and 50% of the main telephone lines and GDP. GDP is key; APEC GDP per capita—approximately $11,000—is more than double the world average of $5,000. Demographics are also increasing the importance of the Asian Pacific Area Asian Pacific immigration to the US doubled between 1980 and 1990, and people of Asian Pacific descent are the US's fastest growing minority. By 2020, it is expected that 20 million Americans will be of Asian-Pacific origin.

Clearly, no simple universal service policy will serve the goals and circumstances of these countries. Yet a policy perspective is certainly needed. The ICM is one such policy perspective.

Table 2: APEC Countries: Population, Gross Domestic Power, and Telephone Measures

Country	*Population 1997*	*Population Density 1997*	*GDP 1997**	*GDP Per Capita 1997**	*Main Lines 1997**	*Main Lines Per Capita 1997**
Australia	18.59	2	390.9	21348	9350	50.3
Brunei	0.31	53	5	17556	78.8	25.83
Canada	30.29	3	601.6	20075	18459.5	60.95

Chile	14.62	19	71.9	4987	2600	17.78
China	1260.57	131	697.6	566	70310	5.58
Hong Kong	6.5	6123	155.1	24578	3646.5	56.08
Indonesia	201.39	105	227.4	1146	4982.5	2.47
Japan	126.27	334	4599.7	36546	61525.9	48.88
Korea	46	467	484.6	10639	20421.9	44.4
Malaysia	21.67	65	99.5	4701	4236.3	19.55
Mexico	96.4	49	334.7	3521	9263.6	9.61
New Zealand	3.79	14	65.9	17889	1840	48.57
New Guinea	4.21	9	4.9	1205	47	1.07
Peru	24.37	19	60.9	2544	1645.9	6.75
Philippines	73.53	245	83.5	1162	2078	2.83
Russia	147.71	9	440.6	2982	26874.6	18.19
Singapore	3.76	6110	93.4	25858	1684.9	44.77
Taiwan	21.68	603	260.8	12240	10010.6	46.62
Thailand	60.6	118	167.5	2820	4815	7.95
US	267.9	29	7636	28766	170568.2	64.26
Vietnam	76.55	232	23.3	310	1587.3	2.07
TOTALS	**2506.71**	**701.86**	**16504.80**	**11497.10**	**426026.50**	**27.83**

-

-

Building the Informed Choice Model (ICM) of Universal Service

Below are the three basic tiers of universal access. Notice the conspicuous absence of choice in the basic and advanced tiers currently in use around the world. The ICM, however, inserts choice at the three levels of universal access by moving availability and connectivity away from location-dependent technology and services into a mobile Internet access account. Similarly, affordability of services incorporates more than just talking; it allows full interactivity and purchasing decisions using electronic commerce.

Table 3: Active Tiers of Universal Access

	Availability	Connectivity	Affordability
Basic	Local	Telephone	Domestic Toll and Long Distance
Advanced	International	Telephone	Optional Services
Informed Choice Model	Internet	Access Account	Electronic Commerce

The ICM merges the universal access grid with the notion of choice to create an integrated and systematic framework for universal service (Figure 11).

Availability focuses upon *mobility,* thus emphasizing both the access point of a technology and the fundamental technology. At this point in time, the Internet is the fundamental technology, and an Internet Service Provider, whether a university, government agency, or public company, provides the access point from which a personal computer or PCS system is utilized to connect to the Internet.

Connectivity, the second component of the ICM triangle, incorporates the notion of *transparency* into its nature. A communications network must, by the ICM definition of universal service, be able to work with a variety of technologies throughout the world. In addition, a network must be scalable to allow for future upgrades and needs.

Affordability is predicated upon successful availability and connectivity and is most concerned with *cost*. Of course there will be access and usage costs. Presumably access cost burdens will be ameliorated by subsidization, but what about usage costs? Should a newfangled "hot" application be immediately subsidized? Probably not. At what point is there enough critical mass in an application or communication technology to warrant inclusion into the universal service pantheon?

Choice, not surprisingly, highlights *individuality* as its key definitional element. The service profile of the user—what he wants to pay for in terms of service options—and payment options are the core of the choice component. A viable choice presumes the other three conditions for universal service have been satisfied.

These four elements are inseparable; without any piece of the triangle, the entire structure falls. This tight integration is what gives the ICM of universal service its potency: any mandate meeting the ICM's stringent requirements presumably has overcome the difficulties at each stage of development; its "bugs" have been worked out. What remains, then, is to study existing Internet and PC penetration data and see if these technologies are capable of providing the foundation for an effective universal service plan.

An ICM Example: PC usage and penetration in the United States

Personal computers (PCs) and the Internet leapt into the general consciousness of consumers and businesses with the privatization and subsequent mass marketing of the World Wide Web (WWW) browsers in the early 1990's. Previously a file-transfer system for academics and government researchers, the Internet has evolved into a mass communications medium faster than any technology in history. The ICM utilizes this dynamic medium as an example of how a global network can quickly, inexpensively, and effectively connect even historically underrepresented groups to a viable communications technology.

Traffic on the Internet is doubling approximately every four months. With hardware costs spiraling downward, consumers are even apt to purchase more than one PC, much like traditional media appliances. Riding the wave of public fascination with PCs, telecommunications companies and software developers are already developing low-cost technologies to allow home users to connect one computer to another and share a single Internet connection—a community within a home. These policies and markets are working; in four years 50 million people have been connected in the United States.

Table 4: Number of Internet Users 1998

World 65-75 million

US 40-50 million

Table 5: Number of Adult US Internet Users 18+ 1997

2nd *Quarter* 31.5 Million *Year-end* 41.5 Million

Over 100 million people worldwide are regular Internet users and about 60% are from North America, mostly from the United States. An estimated 320 million webpages existed in April 1998, and the rate of user and content growth will remain unabated well into the next century; the 1997 growth of US Internet users was 32%. The notion of 500 million people viewing 1 billion web pages by 2005 is not outrageous. Neither is it a stretch to assume that 500 million people could communicate effectively using a PC, providing that policies exist to connect their local, state, or national networks to the Internet.

Several demographic trends lend credence to the notion that the Internet can effectively connect those ignored by current technologies supported by universal service:

1. **Churn Rate.** About a fifth of all Internet users acquired access in the last six months, and almost all keep it: the churn rate is near zero—a rate far lower than that of groundline or cellular telephone subscribers.

2. **Closing Gender Gap.** Women constitute a significant portion of new users, and have a much higher ownership growth rate than men, not a traditional finding among traditional communications trends.

3. **Closing Ethnic Gaps.** Hispanic households, with an online penetration rate of about 30%, continue to outpace all other ethnic groups in terms of acquiring new users; they have doubled the number of computers in their homes in the last four years and are joining online services faster than the national average. The US Hispanic rate of growth of PC ownership between 1994 and 1998 is 130%, twice the US average. This uplifting finding demonstrates that a new technology can rapidly diffuse into a minority population faster than previous or "official" technologies.

4. **Declining Cost of Ownership.** In 1996, few computers sold in the retail market cost less than $1,000. In 1997, sub $1,000 PCs constituted 48.4% of retail PC sales, up from 1.2% in 1996. Computers over $2,000 now constitute less than 8% of retail PC sales. This huge reduction in the price of PC ownership is expected to continue and has encouraged rapid household penetration in the US. Over 80 million people in the US will be online in 2002, nearly one in three people, and more than half of all households. ActivMedia projects that the numbers will be even larger—it speculates 150 million people in the US will be online in 2000, over half of the world's total of 279 million the same year. Thus while cost is a limiting factor in PC penetration, PCs are quickly approaching the cost of a standard color television—a device boasting a 99% penetration rate in the United States and above 80% penetration rates in most Western countries.

5. **Worldwide Popularity.** PC shipments are expected to grow 14% worldwide, compared to 15% last year. North American markets for PCs will expand by 15% this year. While the Asian financial crisis has affected Latin American IT purchases, particularly in Brazil, approximately 800,300 PCs were shipped to Latin America in the first quarter of 1998. This number is not surprising; Latin America is home to the fastest growing number of Internet hosts (152%), double the growth rate of Europe (64%). All world regions are growing by at least 64% and the average world growth rate is an impressive 107%. Growth rates for PC hosts are expected to continue well into the next century. Ninety seven million PCs are expected to be shipped worldwide in 1998. Clearly location has not hindered PC diffusion to the extent that telephone penetration is still affected.

In short, the trends towards lower costs and increased functionality for diverse peoples groups should be an encouraging sign when contemplating whether the Internet-connected PC can act as the cornerstone for a new universal service policy.

Discussion: Toward Global Principles of Universal Service

People in all countries will continue to adopt more and different new information technologies, all the while inventing more and different uses for them. Still, for the foreseeable future, the emerging picture is not one of simple convergence, but of divergence with immense variations in capabilities. Thus the principles of universal service in a 21st century global must respond to these differences to be considered viable.

We should imagine the fulfillment of universal service as both micro and macro in its potential. At the micro level, comprehensive universal service policy can enhance access and the quality of life for individuals no matter how poor or marginalized or isolated they might be. At the macro level, universal service offers a potent policy tool to advance political participation, along with the economic development of an entire nation. By keeping both of these goals in sight as we engage in public discourse over global universal service principles, we will be in a better position to judge our collective opportunities and responsibilities.

Indeed, these are complex and critical issues facing the world's population at a historical juncture. To insist on framing them solely within the constraints of the short term needs of the corporate and governmental players is to miss the opportunity to build an equitable foundation for a global information age. Universal service should lead to free and open communications by all of the world's citizens. If we set ourselves the task of building a model of universal service sensitive to the varying needs of a diverse population, then political participation, economic development, and social empowerment through interaction will result.

In the past, it was been common to think of policies as statements whereby governments brought order and structure to the information environment of a particular technology. Under the old concept, universal service simply represented an intent to wire a nation. To suggest otherwise placed one beyond the pale. Now we suggest that the welfare of the World's people may be better achieved if people actively choose the configuration of their access. Granted, such a proposal still borders on the unimaginable; yet, as we increasingly balance the technological opportunities available to us against the burdens of shifting populations and poverty, we must stretch our imaginations.

Thus the key to an effective universal service paradigm—which can double as an effective business strategy—is to provide a menu of technology and payment choices to potential users whether it be offering ground line telephone service, wireless PCS subscriptions, a subsidized prepaid phone card, or merely an option to pay bimonthly. It is this movement away from the static notion of universal service and toward a dynamic choice model which can initiate a reconceptualization of the global universal service discussion in the next century. Emphasizing choice over cost or type of connection is an effective method of expanding the current levels of household participation in the webs of national and international communications networks.

References

Endnotes

AT&T, *1909 Annual Report* 18 (1910), found in Mueller, M. (1997). *Universal Service*. Cambridge, MA: MIT Press, p 98.

[2] An example of a universal access technology is a coin-operated pay phone.

[3] The term Plain Old Telephone Service (POTS) may give the impression of an unchanging primitive system as the base for all other enhancements; however, that would be misleading. In the US, POTS has evolved from live operators placing calls individually to a completely automated system that utilizes satellite relays and computerized switches. It may be "plain," but its technology has been ever changing.

[4] "The Changing Role of Government in an Era of Telecom Deregulation", *Report of the Second Regulatory Colloquium*. Held at the ITU Headquarters, 1-3 December 1993, International Telecommunications Union.

[5] Companion Services are user-oriented services native to the connecting technology which facilitate communication and information transfer. These services currently include voice mail, teleconferencing, email, and recently such innovations as

universal messaging and internet telephony.

[6] Electronic Commerce for our purposes includes those online services which require the Internet and the World Wide Web (WWW). It should not be confused with teleservices, an example of which includes remotely checking your bank account from a telephone.

[7] "World Telecommunications Development Report '98", Executive Summary, International Telecommunications Union. http://www.itu.int/ti/publications/WTDR_98.htm.

[8] According to the *Telecommunication Indicators Handbook*, a publication of the International Telecommunication Union, http://www.itu.ch/, a main line is a direct exchange or shared line telephone line connecting the subscriber's terminal equipment to the public switched network and which has a dedicated port in the telephone exchange equipment. This term is synonymous with the term "main station" or "Direct Exchange Line" (DEL) which are commonly used in telecommunication documents. The number of main lines does not measure the total number of users; one main line could serve several the telephone needs of several people. Main lines per 100 inhabitants is measured by: main telephone lines / population * 100.

[9] The Pacific Region for our purposes includes nations traditionally associated with the Pacific Rim and the Asia-Pacific area. Among the included countries are: Australia, Bangladesh, Brunei, Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea, Laos, Malaysia, Mongolia, New Zealand, Philippines, Russia, Singapore, Sri Lanka, Taiwan, Thailand, and Vietnam. China and Russia sometimes do not appear on lists of Pacific Rim countries.

[10] Taken from *Basic Telecommunications Indicators*, International Telecommunications Union, 1998.

[11] Taken from *Basic Telecommunications Indicators*, International Telecommunications Union, 1998.

[12] Abstracted from The Center for Pacific Rim Studies at UCLA's website, http://www.isop.ucla.edu/pacrim/.

[13] Taken from *Basic Telecommunications Indicators*, International Telecommunications Union, 1998.

* Some data is from earlier years. See *Basic Telecommunications Indicators*, International Telecommunications Union, 1998.

[14] Optional Services includes items such as: call waiting, call forwarding, voice mail, and various callback features.

[15] The notion of scalability is increasingly important, especially as we continue to see the effects of a Internet "bottleneck" during peak hours of use.

[16] "Computer-Industry Group to Pursue Home Networking," *Wall Street Journal*, June 22, 1998.

[17] The total estimated 1998 population of 270 million multiplied by the 24% of the population estimated online from sources listed in footnote 8. Also Special Studies: Electronic Commerce and the Role of the WTO, World Trade Organization, 1998, Chart 8.

[18] January 1998 Cyber Dialogue, *Business 2.0*, Premiere Issue (June/July) 1998, in "Numbers" section, p. 120.

[19] The Internet Index, Number 22, Inspired by "Harper's Index"*, Compiled by Win Treese, May 31, 1998

[20] The Internet Index, Number 22, Inspired by "Harper's Index"*, Compiled by Win Treese, May 31, 1998

[21] NetRatings, Inc. news release December 8, 1997 available at www.netratings.com/newsDec_8.htm.

[22] *Closing the Digital Divide*, Tomas Rivera Policy Institute, 1998.

[23] J. Kirchner, "PC Prices: How Long Can They Go?", PC Magazine Online, March 10, 1998 at http://www.zdnet.com/pcmag/issues/1705/283015.htm and "Expensive PCs Face Challenge" by Todd Wasserman, *Computer Retail Week* using International Data Corporation (IDC) data, June 15, 1998.

[24] "Warner Brothers Melds DVD, Internet, TV" by Andy Patrizio, Techweb, June 24, 1998.

[25] Special Studies: Electronic Commerce and the Role of the WTO, World Trade Organization, 1998, Chart 8.

[26] "PC Unit Growth Slowing to 13.4%", *Semiconductor Business News*, CMP Media, Inc, posted on March 30, 1998 and "IDC Reports Healthy 14% PC Growth" by Patrick Waurzyniak, *Electronic Buyer's News*, January 27, 1998.

[27] IDC Market Research: "Latin American PC Market Feeling the Repercussions of Asian Crisis", press release, available at http://www.idcresearch.com/

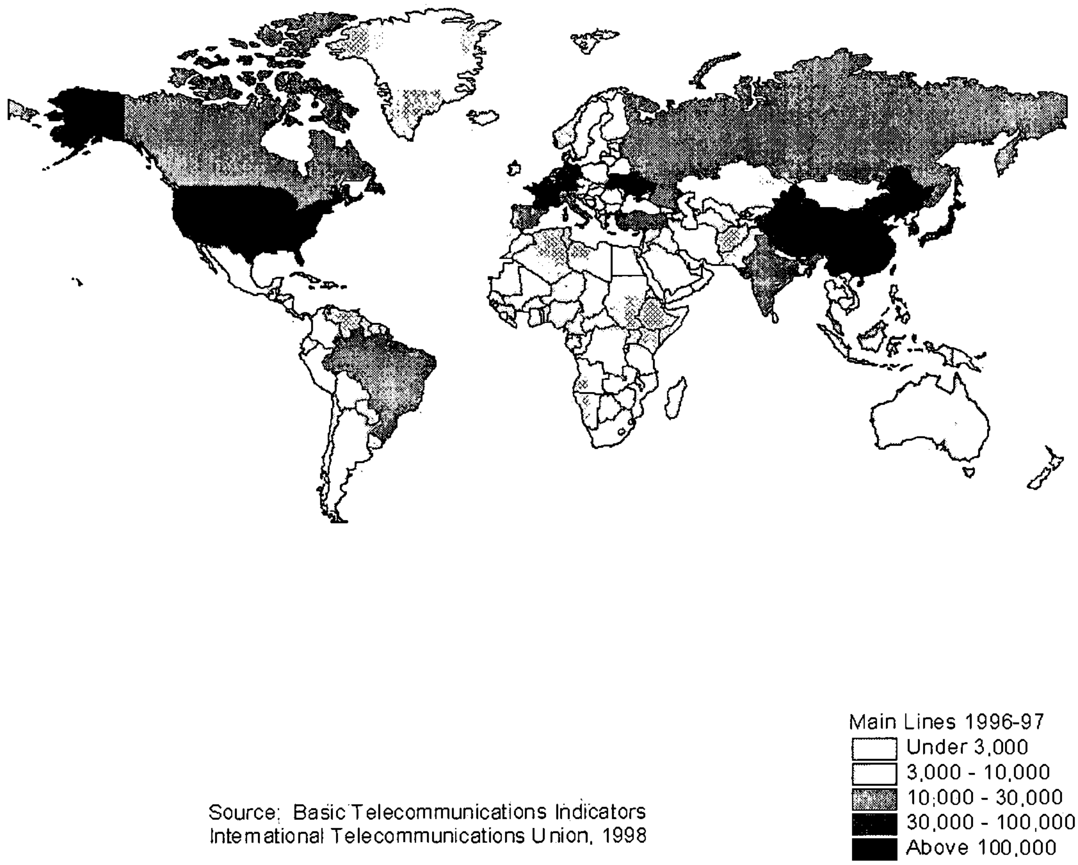
[28] Special Studies: Electronic Commerce and the Role of the WTO, World Trade Organization, 1998, Chart 7.

[29]Percentage was generated using the following sources: Pulse—Consumer Profiles: Changing in a High Tech World, Vol, 5, Issue 3, June 1998, CTAM. Inter@ctive Week, March 10, 1998.

www.zdnet.com/intweek/daily/980310d.html. Odyssey, March 13, 1998, Reuters News Story

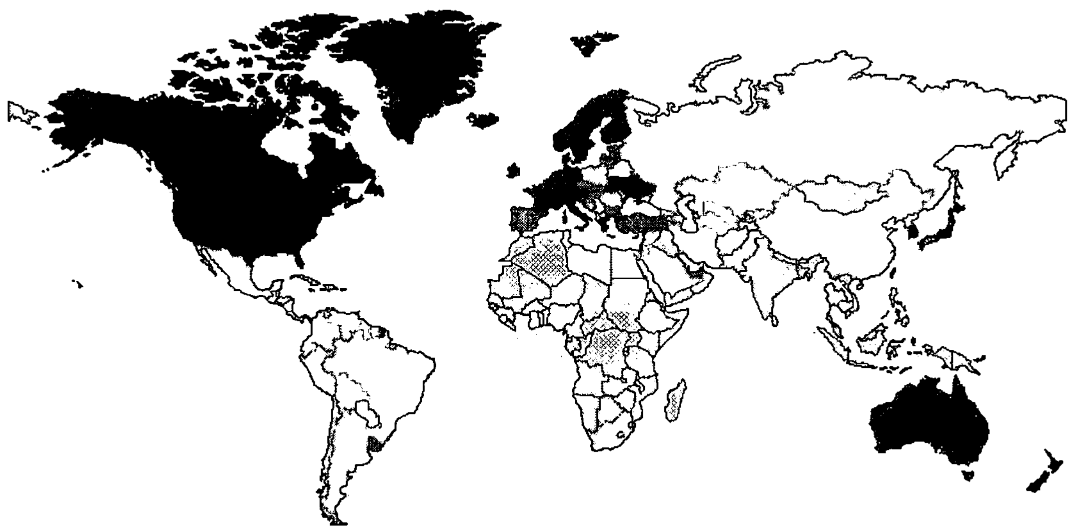
www.zdnet.com/zdnn/content/reut/0313/294224.html. Rhode Island Survey of Computer Ownership and Use at http://ritim.cba.uri.edu/RISurvey

Figure 1: Main Telephone Lines 1996-97 (in thousands)



Source: Basic Telecommunications Indicators
International Telecommunications Union, 1998

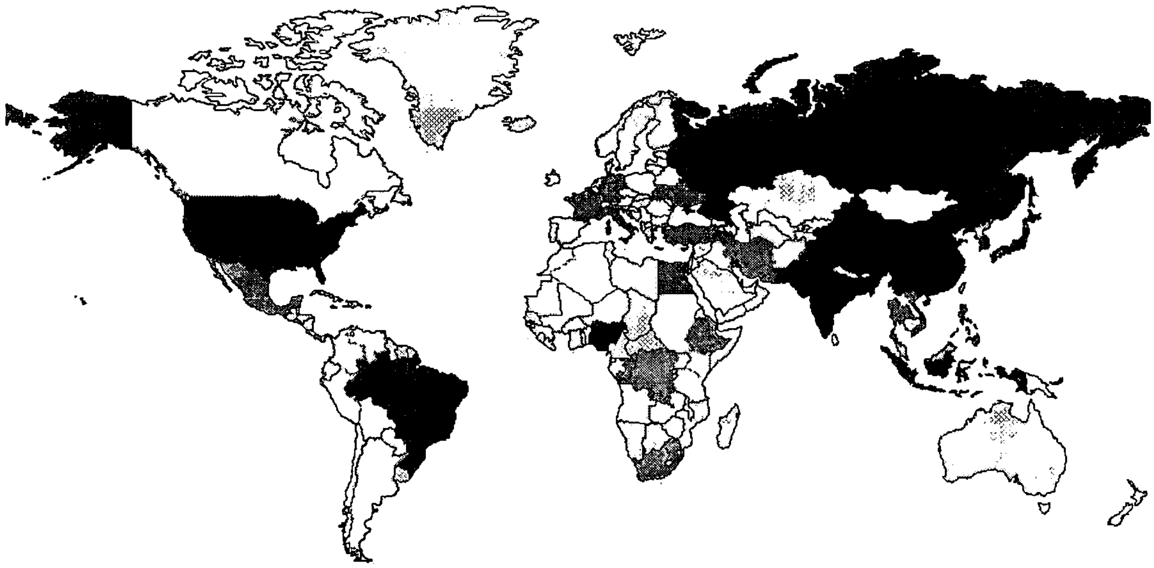
Figure 2: Main Telephone Lines Per 100 Inhanbitants 1996-97



Source: Basic Telecommunications Indicators
International Telecommunications Union, 1998

Main Lines Per Capita 1996-97
Under 5
5 - 20
20 - 40
40 - 60
Above 60

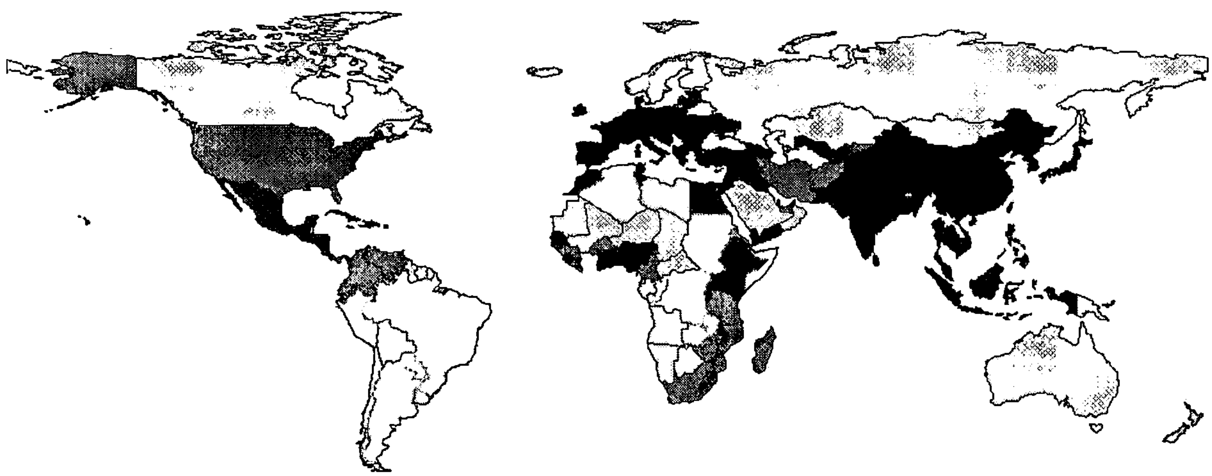
Figure 3: Population 1997 (in millions)



Source: Basic Telecommunications Indicators
International Telecommunications Union, 1998

Population 1997
Under 20
20 - 40
40 - 100
100 - 300
Above 300

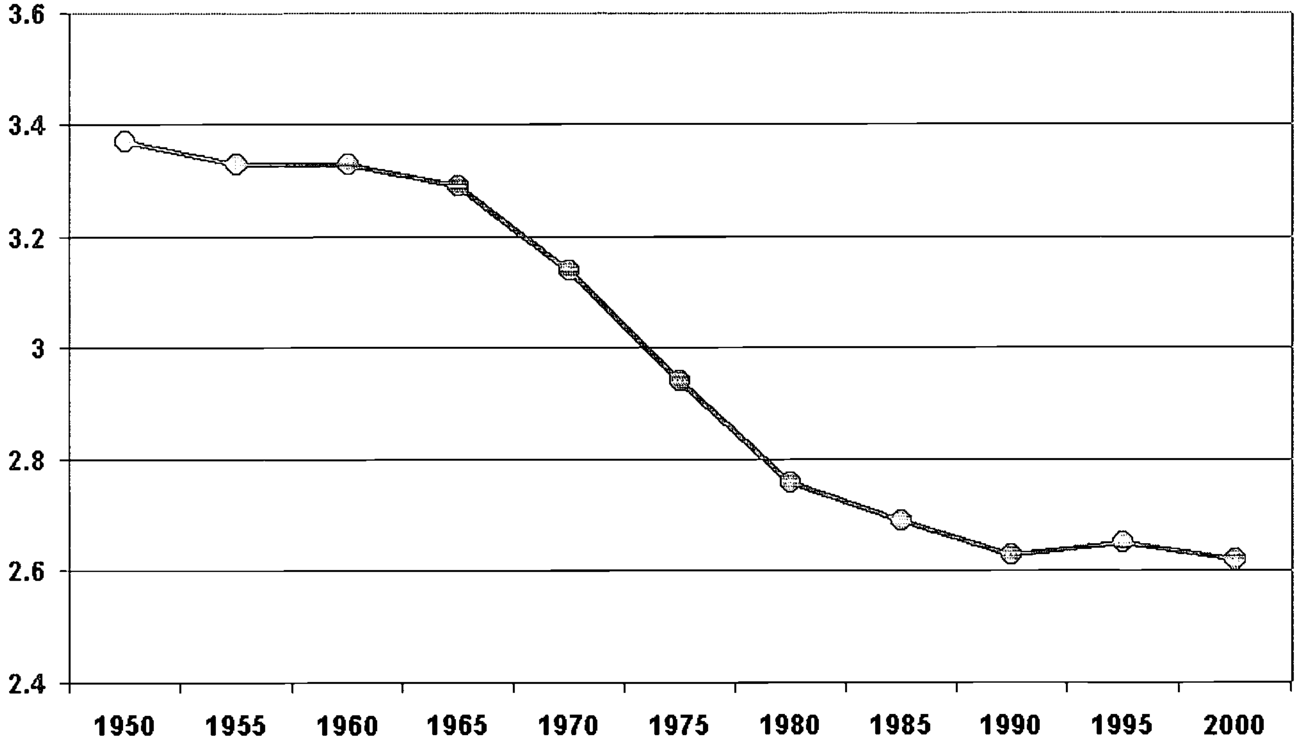
Figure 4: Population Density Per Kilometer 1997



Source: Basic Telecommunications Indicators
International Telecommunications Union, 1998

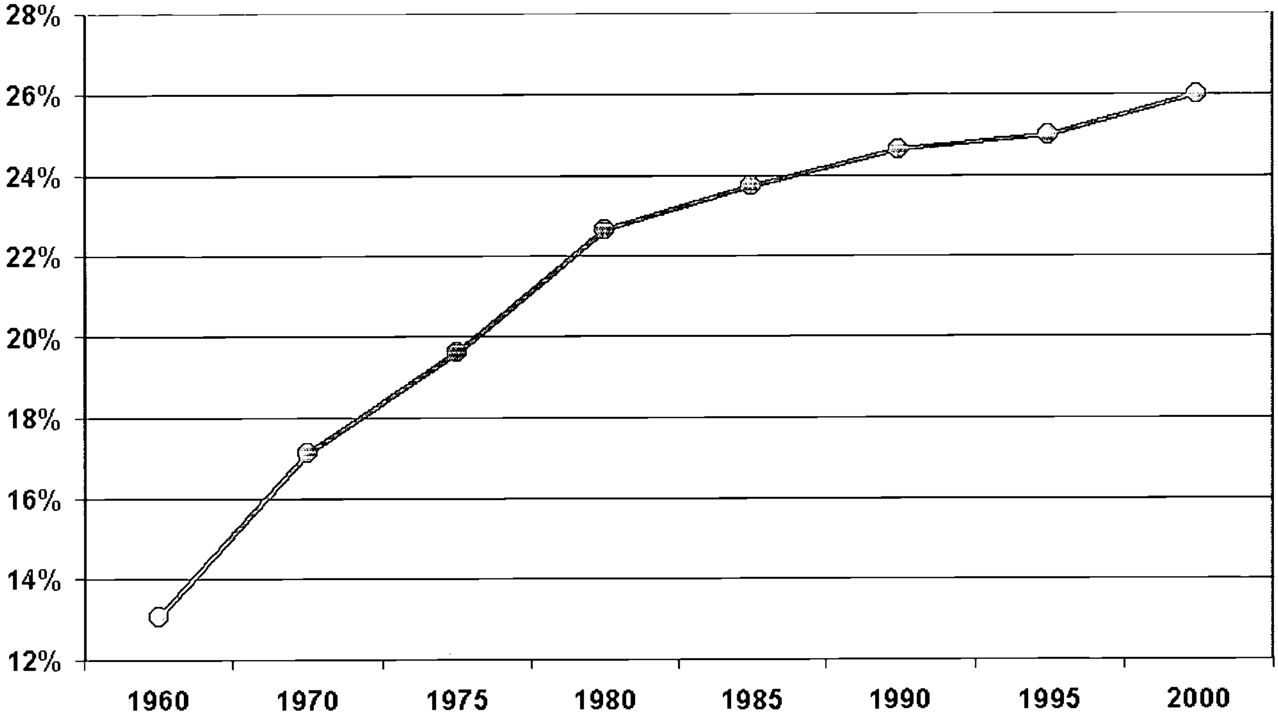
Density 1997
Under 10
10 - 20
20 - 40
40 - 80
Above 80

Figure 5: Average Size of US Household 1950-2000 (in persons)



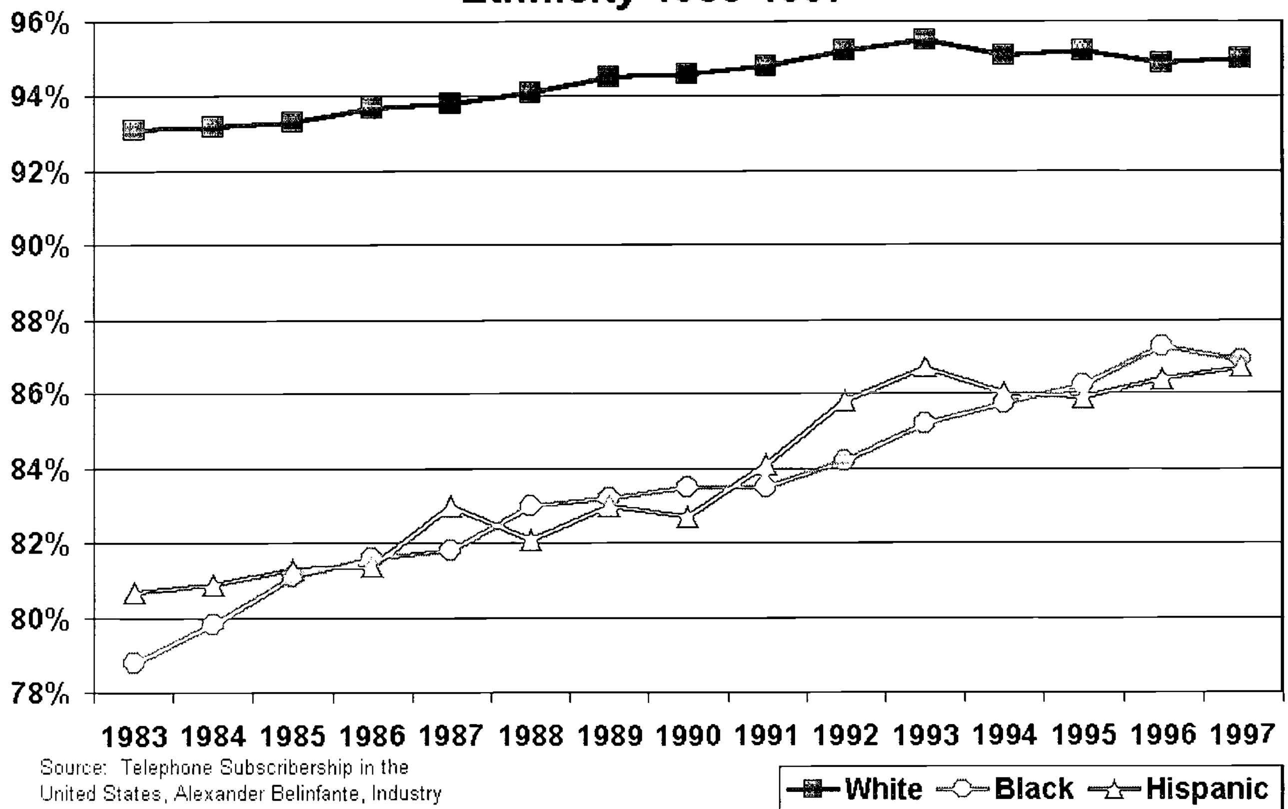
Compiled from 1992 and 1997 Statistical Abstracts, Tables 68 and 73.
Linear Trend Line used for Projections.

Figure 6: Single Person Households as Percent of Total Households 1960-2000



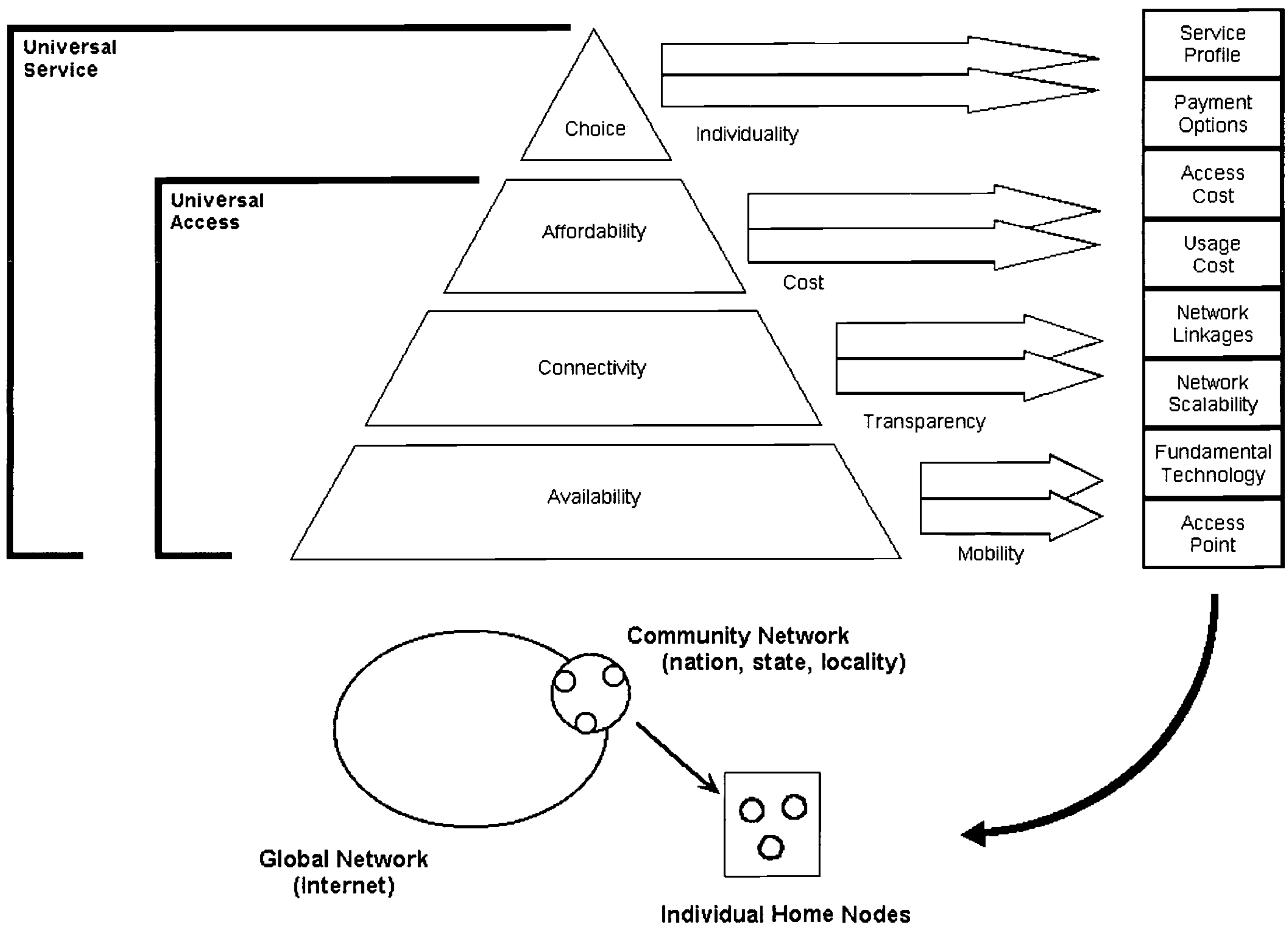
Compiled from 1997 Statistical Abstract, Table 70. Linear Trend Line used for Projections.

Figure 7: US Household Telephone Penetration by Ethnicity 1983-1997



Source: Telephone Subscribership in the United States, Alexander Belinfante, Industry Analysis Division, Common Carrier Bureau, FCC, Jan 1998

Informed Choice Model (ICM) of Universal Service



Return to Top View Full-screen

Key Predictors of Adoption of New Media:

A Report on Australia's Largest Diffusion Study

Mark Balnaves

Murdoch University, Australia

ABSTRACT

In order to broaden access to information it is important to understand the diffusion and adoption patterns of a society, especially when new forms of media are emerging.

This paper reports on the recently released results of Australia's largest diffusion study, conducted by the University of Canberra and the University of Wollongong in collaboration with Telstra Multimedia. The study, conducted in Gungahlin a new residential of Canberra, involved an intensive social-psychological analysis of everyday media used among over 1,000 residents with a view to identifying key factors in adoption of new media. A control group was also monitored as part of the study.

The study identified decision-making styles, specific processes of reasoning, as a key component in media choice and use. These decision-making styles are relevant to problems of estimating demand, especially where innovation is involved, and universal service, especially where equity is involved. The paper will draw on the data from the research to outline the demographics of the sample, media use and the influence of decision-making styles on diffusion and adoption.

The ability to reach all members of a society through a medium is an important outcome for any community into which an interactive medium is introduced. (Markus 1987).

View Full Text

Key Predictors of Adoption of New Media:

A report on Australia's largest diffusion study

Introduction

Broadening access to information is the aim of diffusion studies. Identifying key factors that enhance or inhibit diffusion and adoption of interactive services is critical in an age in which much of the world's knowledge and commercial transactions may be transferred to an online environment.

It has been estimated that up to 30% of the United States workforce suffers from computer anxiety and 5% of the U.S. population from 'debilitating computer anxiety' (Henderson et al 1995). Similar estimates have been made for countries like Australia. Negative attitudes towards computers among a large proportion of society will clearly affect adoption of new media. But what of the positive personality traits, or identity styles, that enhance adoption of new media? Are there particular identity styles that are more likely to make a person an early adopter of telecommunications or media innovations?

A detailed understanding of the role of personality in adoption of new media will assist in broadening access to information (Atkin 1993). The purpose of this paper is to provide a summary of the major findings from Australia's largest diffusion study conducted in Gungahlin, a new residential area of Canberra. The study was designed to:

1. Identify and understand the needs and expectations of Gungahlin residents of an information society

2. Identify the trends in information and communication usage by Gungahlin residents

3. Identify the major predictors that influence intended usage of new media.

The paper will provide a brief background to the study, the methodology used, and the results. Attitudes towards computers and identity styles were found to be key factors influencing adoption of new media. Identity styles (decision-making styles) directly influence perceived importance, preference and ease of use of advanced media services, but **not** use of common media services.

Universal service obligations (USOs) are designed to ensure that citizens of a modern state get access to **basic** telecommunications services. USOs are interventions in the marketplace to ensure that inequalities caused by geography or income or other impediments to access are compensated for. What constitutes access to 'basic' telecommunications, however, is being challenged by new technologies and new understandings about how people use telecommunications and media. The results from the study suggest that 'personality' is an important variable in definition of USOs and in the delivery of essential telecommunications to modern communities.

Gungahlin

In 1994 Australia's Telstra Multimedia, based on a report by Cole (1992), chose Gungahlin a new residential area of Canberra as a trial site for advanced multimedia services using a broadband network. Telstra Multimedia suspended the trial at the end of 1995, but not before initial data was collected.

Balnaves and Caputi (1997) reported on some of the initial results. This paper provides, for the first time in the public domain, an overview of the major results.

Gungahlin is an Aboriginal word 'Goongarline' meaning 'little rocky hill' or 'white men's house'. As Gungahlin is a new residential area of Canberra and has rocky hills and white men's houses the combination of meanings in the name is quite appropriate. It is located approximately 10-15 kilometres north-east of Canberra's city centre (Figure 1).

Gungahlin was an ideal test-site for modelling future telecommunications communities as it has the characteristics essential for new networked services. As Markus (1987) has pointed out, having high interest and high resource individuals among the early users of an interactive medium is highly favourable to the achievement of universal access in the community. Preliminary results below are based on returns of 1132 households out of approximately 1,800 households. The survey results showed Gunghalin to have a higher rate of diffusion of computers and other media compared with Canberra and the rest of Australia.

Figure 1: Gungahlin, Canberra

Gungahlin residents were invited to participate in Telstra Multimedia trial of online services. There were no significant differences by demographic between those who expressed a willingness to participate in the trial of new media and those who did not. Gungahlin residents have a higher level of education and a higher level of income compared with other regions of Australia. Tables 1 to 3 provide an overview of the Gungahlin population.

Table 1: General Characteristics of Gungahlin

	Frequency
▪ Number of Households:	1132
▪ Total Number of Individuals:	3151
▪ Number of Adults:	2175
Females	1117
Males	1058
▪ Ages of Adults:	
18-24 yrs	316
25-34 yrs	901
35-44 yrs	553
45-54 yrs	242
55-64 yrs	49
over 64 yrs	41
Prefer not to say	37
▪ Number of Children:	976
▪ Ages of Children:	
0-4 yrs	381
5-11 yrs	386
12-16 yrs	167
17-18 yrs	42

Table 2: Composition of Households

	Surveyed	Those Willing To Participate
▪ Couples with children	40.8%	40.4%
▪ Couples without children	26.4%	29.1%
▪ Single - living alone	13.1%	12.2%
▪ Group of adults	7.9%	8.4%
▪ Sole parent with children	6.0%	4.7%
▪ Group of adults with children	1.2%	1.2%
▪ Couple - retired	1.1%	0.7%
▪ Single - retired	0.5%	0.2%
▪ Other	2.9%	2.9%

Table 3: Qualifications

Qualification Obtained

	Surveyed Population		Those Willing to Participate	
Higher degree	157	(8.0%)	118	(8.3%)
Post-graduate diploma	108	(5.5%)	90	(6.4%)
Bachelor degree	505	(25.9%)	416	(29.4%)
Undergraduate diploma	63	(3.2%)	46	(3.2%)
Associate diploma	161	(8.2%)	117	(8.3%)
Trade qualification	339	(17.4%)	215	(15.2%)
High School	483	(24.7%)	336	(23.7%)
'Other' qualification	137	(7%)	79	(5.6%)

The research design involved 300 households chosen from the surveyed Gungahlin residents as the experimental group. 50 households were chosen from outside Gungahlin, in a residential area called Belconnen, as the control group. The results for the experimental group were based on a sample of 618. The mean age of the residents was 31 with 52.5 per cent of the residents male.

The major independent variables of interest to the study were gender, age, income, education, occupation, computer attitudes and identity styles. Swiss broadband trials found that traditional demographics did not appear to be good predictors of adoption of new media. There appeared to be specific personality dispositions associated with innovations (Rotach & Keller 1993). The research methodology for the Gungahlin study built on the Swiss work. Asking questions about 'computers' has been established as a good way of finding out about peoples attitudes towards new media in general. Eastlick (1993) found, for example, that attitudes toward the characteristics of videotex, particularly its relative advantage and compatibility with needs and experiences, were good predictors of intent to adopt. Cognitive ability has also been linked to computer experience and attitude towards computers, which in turn influences adoption and usage of computers (Igbaria & Parasuraman, 1991). The use of identity style scales, based on Berzonsky (1992), and computer attitude scales is consistent with the need to identify personality characteristics that influence adoption. These scales were used in the Gungahlin study.

The research methodology used specialised inventories to collect data on:

- time use
- household use of technology
- attitudes towards computers
- household expenditure and income
- social networks
- identity styles.

Computer attitudes were measured using the standard CATT measure, modified by investigators to include attitudes towards a range of media technologies and services. Dambrot et al. (1985) noted that negative attitudes towards computers usually results in resistance to using new media. The modified CATT allowed investigators to assess the extent to which this relationship holds for other telecommunications technologies and services and to assess the extent to which attitude toward technology is a predictor of usage.

Hirsch's *Social Density Scale* was modified to assess whether individuals have low-density/high-density networks. The more interactions a person has the more dense the network. Data was collected about the nature of contacts about innovations to identify opinion leaders and directions of influence. These and related indices are well established in the social network literature (Knoke & Kuklinski, 1982).

Identity style inventories were used to examine the processes by which personal decisions are made and problems are solved about new media such as the Internet. The major identity styles identified in the research literature include: *information orientation,* individuals who actively seek out, process, and evaluate relevant information before making decisions; *normative orientation*, individuals who will be more concerned with conforming to the normative standards and prescriptions held by others such as parental figures; and, *diffuse orientation,* individuals who tend to delay and procrastinate until situations and rewards dictate a course of action (Berzonsky, 1989).

These identity styles look similar to diffusion categories like 'innovator', 'early adopter', etc, and the role of opinion leaders. The Berzonsky scales, however, are a much more detailed measurement of the relationship between personality and information seeking. Identity styles are actual decision-making strategies that people use when making decisions about adoption of innovations (new products or new ideas). The 'information seeker' (information orientation) actively seeks out information about what he or she wishes to solve. In the case of new media an information-seeker is one who actively seeks information about new services before purchasing them and, if faced with problems about such services, will seek solutions. The 'conformer' (normative orientation) actively seeks out information based on what they think is expected of them. Significant people in their lives are likely to have a great effect on whether or not they will adopt new services. The 'procrastinator' (diffuse orientation) will delay purchasing or getting involved with new media services as long as possible. He or she has the motto 'let's wait and see'. They will only act if the situation and circumstances force it - 'my boss has told me to use it so I better' or if the services are pleasurable and fun.

Results

Gungahlin residents' time use of media was consistent with Australian Bureau of Statistics household use of information technology surveys (1994).

Table 4: Time Use by Technology Type

(Minutes per Day)

	M	Mdn	Range
Computer	104.9	60.0	1-870
CD/Cassette	86.4	60.0	2-510
Television	79.4	60.0	5-720
Radio	74.2	40.0	5-1440
Video	42.0	45.0	25-120
Newspapers	35.3	30.0	2-240
Telephone	13.6	5.0	1-80.5

Computer Ownership and Use

Experimental results confirmed the high computer ownership rate in Gungahlin, compared with a national average of 35%.

Table 5: Computer Technology Used in the Household

	0	1	2	3	4	5
Portable computer	55.1	18.9	0.7	-	-	-
Desktop or PC	13.0	53.7	6.3	0.7	1.1	-
Combined desktop and portable	71.2	2.5	-	-	-	0.4
Dedicated WP	70.9	3.2	-	0.4	-	-
Other computers	71.2	3.5	0.4	-	-	-

18.6 per cent (52 households) said that a member of the household frequently used a dedicated games machine. 40 households (14 per cent) said they had one game machine, 4.2 per cent (12) households had two machines, and one household reported having six machines.

42.8 per cent of households reported spending per year $1-$1000 on games . 14.0 per cent spent $1001-3000, 2 households spent $3001-5000 on games.

70.5 per cent of households reported that at least one member of the household frequently used a computer at home. A high proportion, 70 per cent, of households with computers use computers for *work* related activities such as

- word processing
- university work
- graphic design
- publishing
- book keeping

- database

21 per cent used on-line services and 16.2 per cent had home-office connections. 21 per cent had home-based businesses (far in excess of national averages). Most residents used games, with 19 per cent (38 households) using for more than 10 hours/week. 56.8 per cent (162 households) spent $1-3,000 on games over the last 12 months.

Employers were the major source of training for computers.

Gender

There were no statistically significant differences in gender use of media. Women tended to use different media technologies marginally less than men, as Figure 2 indicates, but these figures were not statistically significant.

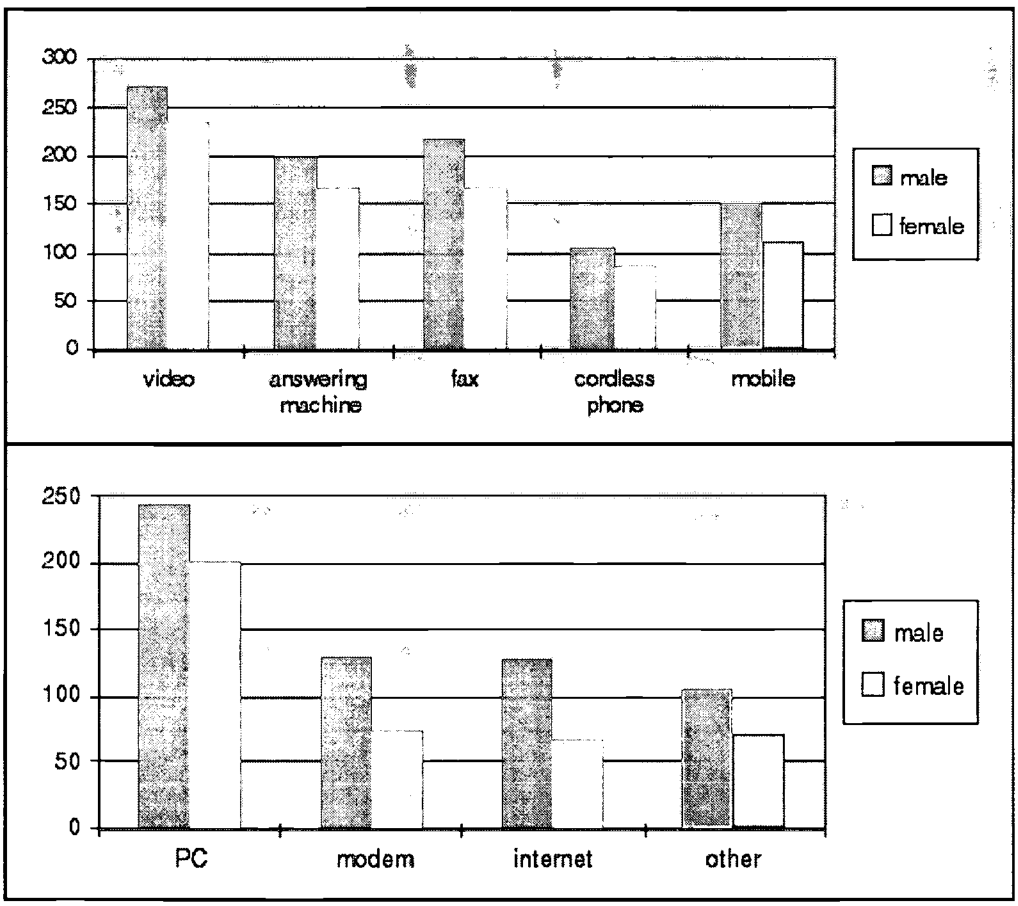


Figure 2: Gender and Media Use

Age

There were statistically significant differences among different age groups in use of media. The age groups of 26-35 and 35+ were more likely than other age groups to use answering machines, faxes, mobile phones and the internet.

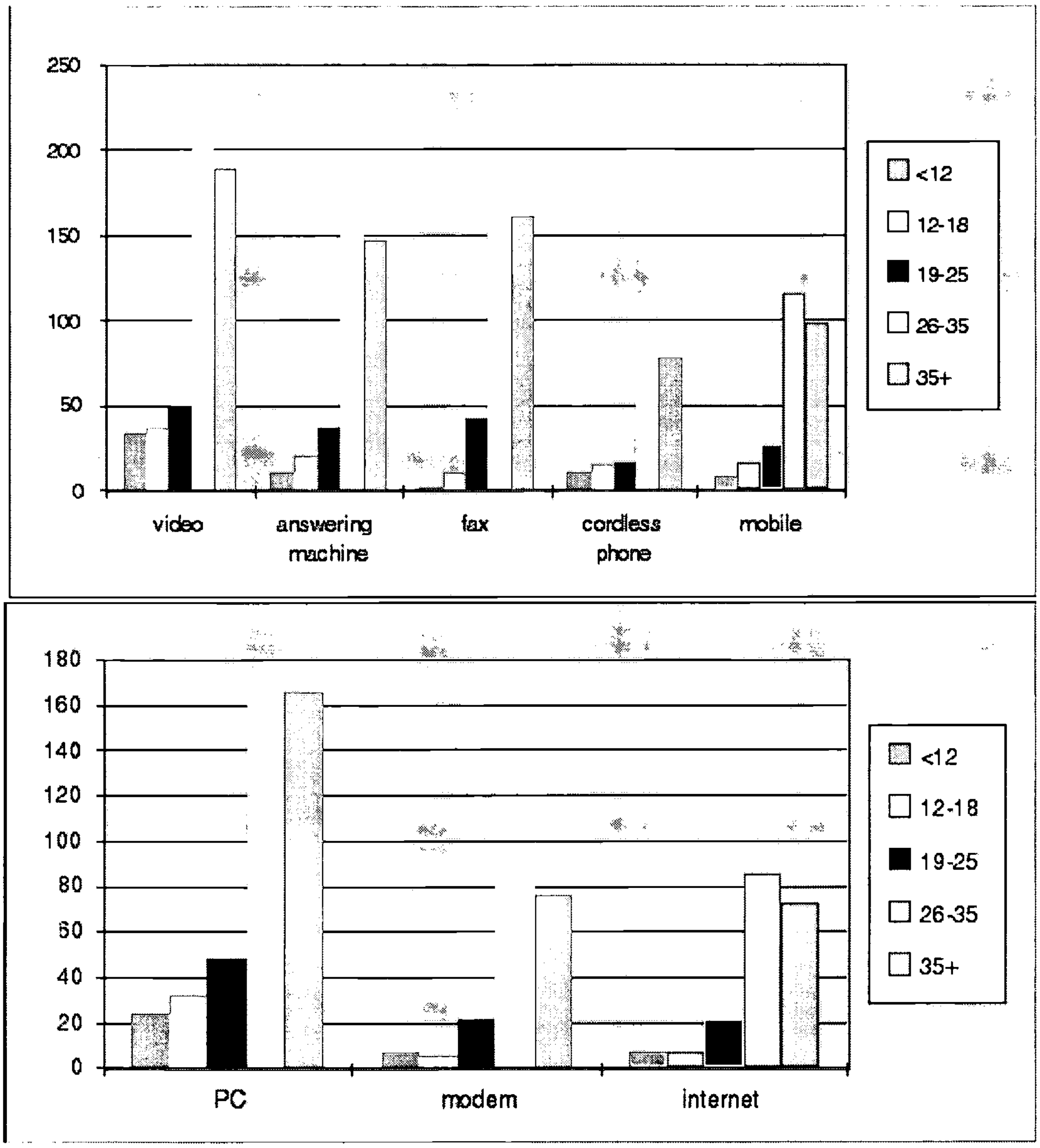


Figure 3: Age and Media Use

Identity Styles and Attitudes Towards Computers

The evenly spread ratio of people to identity styles as outlined in Table 6 enhanced the usefulness of using identity as a predictor of telecommunications and media.

Table 6: Experimental and Control Groups by Identity Style

Experimental Group (Gungahlin)			Control Group (Belconnen)		
Information-seeker	195	32	Information-seeker	32	31.1
Conformers	166	27.3	Conformers	32	31.1
Procrastinators	188	30.9	Procrastinators	30	29.1
	609	**100**		**103**	**100**

The statistics in Table 7 show that the Gungahlin experimental group generally had positive attitudes towards computers, with 105 the highest possible score on the computer attitude scale.

Table 7: Computer Attitudes by Identity Style Type

	M	SD	n
Information-seeker	84.85	9.21	195
Conformer	83.28	9.30	166
Procrastinator	81.45	11.13	188

Statistically significant differences **were not found between identity type and use of media that are already quite prevalent** in Australian households, such as video, answering machine and a number of the telephone services. However, 'information seekers' were more likely to use more advanced services at home and work, compared with other identity styles. This trend is borne out in rankings of the importance of media by identity style. Table 8 shows that while there is similarity in use of common technologies and services between identity styles in the first three rankings, 'information seekers' and 'procrastinators' diverge on the fourth ranking. This is consistent with the personality dispositions involved. Those with a 'diffuse orientation' in decision-making are more likely to prefer entertainment-oriented media.

*Table 8: Perceived Importance of Media Technologies/Services in a Family and Personal Context by Identity Style**

Information-Seekers		**Conformers**		**Procrastinators**	
1	Face to face	1	Face to face	1	Face to face
2	Telephone	2	Telephone	2	Telephone
3	Television Letters, notes & memos Email	3	Television Letters, notes & memos	3	Television Letters, Notes & memos Newspapers Music, stereo, CD
4	Newspapers Books Fax Internet	4	Newspapers Email Internet	4	Radio

*Values refer to modal rank (1 = most important, etc)

Significant relationships were identified between computer attitudes and use of media, in particular for using PC modem and the internet at home and at work. The general trend was that those residents with less positive attitudes are likely to use different 'clusters' of media compared with those residents with more positive attitudes. Table 9 shows that on the third ranking, after face-to-face and telephone, there is a difference between the higher and lower attitudes in perceived importance of services.

*Table 9: Perceived Importance of Media Technologies/Services in a Family and Personal Context by Attitude Towards Computers**

More Positive		**Less Positive**	
1	Face to face	1	Face to face
2	Telephone	2	Telephone
3	Letters, notes & memos Newspapers Email Fax	3	Television Letters, notes & memos Email
4	Radio Internet	4	Radio Newspapers Fax

*Values refer to modal rank (1 = most important, etc)

Time spent using media was correlated by the authors with age, gender, total income, decision-making style and computer attitude. Most of the correlations were low and non-significant. A person's age was related to time spent watching television, and reading newspapers. More specifically, the older the person, the more likely they were to spend more time watching television and more time reading newspapers.

There were no significant correlations involving either gender or total income. Identity style, however, correlated negatively, yet significantly, with time spent using the telephone. These results indicate that the individuals in the 'information seeker' group spent more time using the telephone than people with a 'procrastinator' orientation. Residents with positive attitudes towards computers spent more time using the computer.

Chi-square tests for relatedness were conducted between time duration for each of the technologies - computer, television, video, , radio, newspaper, cd/cassette and telephone - with computer attitude and decision-making style. Residents' responses for time duration on each of the media were subdivided into three categories, with 1 representing lowest time use, 2 = moderate time use and 3 = highest time use.

For computer usage, statistical significance was not found for attitude and time duration, although a trend in the results indicates that individuals who scored higher in positive computer attitudes spent more time using the computer than those people who had a less positive attitude towards computers. The results were, similarly, non-significant for identity style, with no obvious trend.

Individuals watching television in each of the three time brackets, low-medium-high, were equally comprised of lower and higher computer attitudes. Identity style type did not differentiate the time used for watching television.

Time spent watching videos was also unrelated to both computer attitude, and identity style type although there is an indication, from the results, that individuals with a more positive attitude toward computers preferred more video watching time than less, whereas the lower computer attitude group were equally split between the lower, moderate, and higher time durations.

Time spent on the telephone was undifferentiated amongst individuals with different computer attitudes and identity style. Trends in the results indicate that people with more positive computer attitudes tend to spend more time on the telephone.

Logistic regression analyses, Table 10, were performed to determine the predictors of online services, multimedia use and dedicated workspace (a place put aside at home for computer work). The independent variables in these analyses were attitude toward computers, the three identity styles, namely, 'informing seeking', 'conformer' and 'procrastinator', age and gender of residents and total income of the resident.

The results show that computer attitude and 'information seeking' identity style are the best predictors of intention to use online services. For multimedia services usage, the best predictors are age of participant, 'information seeking' identity style and computer attitudes. For dedicated workspace in the home, the significant predictors are the 'information seeking' identity style and age of participant. **These results suggest that a person's income and gender are not predictors of intended usage of services.**

These results support the importance of computer attitudes (which is correlated to attitudes to new media) and personality factors in predicting intended usage.

Table 10: Logistic Regression Coefficients

Variables			
Attitude	.0815*	.0689*	.0218
Information-seeker	.1177*	.0796*	.0753*
Conformer	-.0573	.0409	.0142
Procrastinator	-.0063	-.0673	-.0414
Age	-.0153	-.0463*	.0238*
Gender -	.0043	-.3313	-.1190
Income	.0000	.0000	

Identifying the role and relevance of identity styles in use of media is an important first step in identifying key influences in adoption of new media and intended usage. However, diffusion theory also deals with social networks - the role of groups in influencing the process of diffusion and adoption. The social network data collected for the Gungahlin study covered both the most important people in each resident's social network and the density of that network. Density is the resident's estimate of how often (at least once a week) people within that network contact each other and by what means (eg personal communication, telephone, letters, etc.)

The results showed a significant difference across identity styles for personal communication. 'Procrastinators' had higher density social networks than 'information-seekers' for personal communication. 'Conformers' density approximated that of the 'procrastinators'. However, there was no significant difference between the decision-making styles for telephone communication. The number of people in the social network was also correlated to decision-making style. 'Procrastinators' were more likely to have smaller numbers in their social network.

Summary

The Gungahlin study is one of the most intensive and extensive diffusion studies conducted in Australia. The results presented here are an overview of the Gungahlin residential use of media before the introduction of broadband networks. Even though a longitudinal study was not conducted in this case, the baseline data from Gungahlin provides sufficient data to identify key influences on adoption (and intended usage) of new media.

Most Gungahlin residents participating in the study had positive attitudes towards computers and could be grouped by identity style. This was of considerable benefit to the study because it was possible to isolate the most important personality factors affecting intentions to adopt. There is strong evidence in the analyses that personality or disposition is an important predictor of usage of new telecommunications and media services in Australia. Gungahlin residents rated high on attitudes towards computers in each of the three decision-style groupings. The differences between each group were significant.

The overall trends from the statistics suggest that:

1. Older people and not younger people are more likely to be receptive to new media,

2. People who are more receptive to new media are more likely to have lower density social networks,

3. People who are problem-solving oriented (information orientation) are more likely to have positive attitudes towards computers,

4. Women are more likely to have negative attitudes towards computers, and to use computers marginally less than men, but these negative attitudes do not stop women using computers and do not constitute a barrier to use,

5. Identity styles directly influence perceived importance, preference and ease of use of advanced media services, but **not** use of common media services.

The approximately equal distribution of residents among the three major decision-making styles in the Control Group acted as a useful validation of the findings from the Experimental Group in the Gungahlin study. How people cope, or deal, with choices, or use of, telecommunications/computers/media is more likely to be related to personality factors than to other demographic factors such as income. These personality factors, especially identity styles, become activated and relevant when new media, and innovation, is involved.

Gungahlin is technology rich, compared with its region and the rest of Australia. Australia is technology rich. Gungahlin is an 'early adopter' residential community, adopting media innovations at a greater speed than the rest of the population. The study of Gungahlin provides an insight into the extent of diffusion and use of media in a relatively high resource and high interest community in Australia. The Gungahlin example also provides insight into the value that Australians attach to their media.

Many of the findings from the Gungahlin study contradict popular conceptions about new media, especially the role of gender and age. While income is an obvious constraint on adoption of new media, it is not a key predictor. Any attempt to identify and to explain access and equity issues, or to define information poverty, must take into account the role of individual factors in adoption. Simple reductions of problems of access to new media to 'culture' or 'ideology' or 'gender' or 'income' are misleading and, potentially, damaging. Properly constructed diffusion studies should include an analysis of the role of identity styles.

The results from the Gungahlin study are directly relevant to definition of universal service obligations (USOs). Services that become the subject of USOs are those which are perceived as being socially and economically necessary, so much so that everyone in the community should have access to them, for example mail and the telephone. This paper demonstrates that personality is an important variable in understanding:

- What people perceive as basic in their media and telecommunications needs, and

- What people perceive as basic in their ways of giving and receiving information.

New media and new telecommunications raise issues about what is 'basic'. The key predictors identified in this paper are a guide to analysis of the social and psychological basis of USOs.

References

Atkin, D.J. (1993) 'Adoption of Cable Amidst a Multimedia Environment', *Telematics and Informatics,* 10(1), 51-58.

Australian Bureau of Statistics (1994) *Household Use Of Information Technology,* Canberra.

Australian Bureau of Statistics (1994) *How Australians Use Their Time,* Canberra.

Balnaves, M, Caputi, P. and Williamson, K. (1991) 'The Development of a Methodology for Assessing Telecommunications Needs: Preliminary Steps Towards an Index of Information And Communication Poverty', *Australian Journal of Communication* 18(3), 99-118.

Balnaves, M. (1993) 'The Sociology of Information', *Australia and New Zealand Journal of Sociology*, 29(1), 93-111.

Balnaves, M. and Caputi, P. (1993) 'Corporate Actors and Corporate Constructs: To What Extent Are Personal Constructs Personal?', *International Journal of Personal Construct Psychology,* 6(2), 119-138.

Balnaves, M., Caputi, P. and Williamson, K. (1991). 'The development of a methodology for assessing telecommunications needs: preliminary steps towards an index of information and communication poverty' *Australian Journal of Communication* 18(3), 99-118.

Balnaves, M. and Caputi, P. (1997) 'Technological Wealth: and the evaluation of information poverty' *Media International Australia*, 83, 92-102.

Barnett, G.A., Danowski, J.A, and Richards, W.D. (1993) 'Communication Networks and Network Analysis: A Current Assessment', *Progress In Communications Sciences*, 12, 1-19.

Berzonsky, M.D. (1989) 'Identity Style: conceptualization and measurement' *Journal of Adolescent Research*, 4(3), 268-282.

Bowles, D. (1995) 'Telephone Penetration: industrial countries vs. LDCs' in D.M. Lamberton (ed.) *Beyond Competition: the future of telecommunications*, Amsterdam, Elsevier.

Bureau of Transport and Communication Economics. (1995). *Communication futures project.* Final Report. Canberra, Commonwealth of Australia.

Chatman, E.A. (1996) 'The Impoverished Life-World Of Outsiders', *Journal of the American Society for Information Science,* 47(3), 193-206.

Cole, P. (1992) *A Proposed Televillage in Gungahlin, ACT.* Consultant's Report to the ACT Government and AOTC.

Dambrot, F. H., Watkins-Malek, M.A. Silling, S.M., Marshall, R. S & Garver, J (1985) 'Correlates of Sex Differences in Attitudes Toward and Involving Computers' *Journal of Vocational Behavior,* 27, 71-86.

Downs, G.W., and Mohr, L.B. (1976) 'Conceptual issues in the study of innovation' *Administrative Science Quarterly*, 21, 700-714.

Dutton, W.H., Rogers, E.M., and Suk-Ho Jun. (1987) 'Diffusion And Social Impacts Of Personal Computers', *Communication Research,* 14(2), 219-250.

Eastlick, M.A. (1993) 'Predictors of videotex adoption' *Journal of Direct Marketing*. 7(3), 66-74

Eveland, J.D. (1987) 'Diffusion, technology transfer, and implementation: Thinking and talking about change' *Knowledge*, 8, 303-324

Henderson, R., Deane, F., Barrelle, K. and Mahar, D. (1995) 'Computer Anxiety: correlates, norms and problem definition in health care and banking employees using the Computer Attitude Scale' *Interacting With Computers*, 7(2), 1002-1013.

Hirsch, G.J. (1979) 'Psychological Dimensions of Social Networks: a multi-method analysis' *American Journal of Community Psychology*, 8, 159-172.

Hoffman, E., and Roman, P.M. (1984) 'Information diffusion in the implementation of innovation process' *Communication Research*, 11(1), 117-140.

Hooper, R. (1994) 'Multimedia - mad or momentous?' *IIC Communications Topics,* 10.

Igbaria, M. and Parasuraman, S. (1991) 'Attitudes Towards Microcomputers: Development And Construct Validation Of A Measure' *International Journal of Man-Machine Studies*. 35, 553-573.

Keller, P. (1994) *Telematics And Growth*. IATAFI Conference, Bergen.

Knoke, D & Kuklinski, J. H. (1982) *Network Analysis.* Beverly Hills, Sage.

Markus, M.L. (1987) 'Towards a "critical mass" theory of interactive media: Universal access, interdependency, and diffusion' *Communication Research*, 14, 491-511.

Martin, A. (1987) 'Media and Social Change – with special reference to television' *Pacific Islands Communication Journal*, 15(1), 3-21.

Poole, M. S., & Van de Ven, A. H. (1988)'Methods for Studying Innovation Processes' In A. Van de Ven, H. Angle, and M. S. Poole (Eds.), *Research on the management of innovation*. Cambridge, MA: Ballinger.

Renaud, J.L. (1994) 'Superhighway, Super Demand?' *ATM: Advanced Television Markets*, 4: 4-11.

Rogers, E.M. (1962) *Diffusion Of Innovations,* New York, Free Press.

Rogers, E.M. (1992) 'Prospects For A Cooperative Extension System In Education', *Knowledge: Creation, Diffusion, Utilisation*, March 13(3), 248.

Rogers, E.M. (1995a) 'Interactive Communication Technology In Business Organisations' *Journal of Business Communication,* April 32(2), 175.

Rogers, E.M. (1995b) 'Lessons For Guidelines From The Diffusion Of Innovations' *The Joint Commission Journal on Quality Improvement.*, July 21(7), 324.

Rogers, E.M. and Kincaid, D. (1981) *Communication Networks: Toward A New Paradigm For Research,* New York, Free Press.

Rogers, E.M. and Shoemaker, F. (1973) *Communication Of Innovations,* Glencoe, Free Press.

Rotach, M.C. and Keller, P. (1993) *Telematik und qualitatives wachstum.* Institut fur Verkehrsplanung, Transporttechnik, Strassen-und Eisenbahnbau (VT). Zurich, Verlag der Fachvereine.

Royal Melbourne Institute of Technology (RMIT) (1992) *Basic telecommunications Needs: A Study Of Domestic Users,* Melbourne, Royal Melbourne Institute of Technology.

Schuler, D. (1994) 'Community Networks: building a new participatory medium' *Communications Of The Age,* 37(1): 39-51.

Simpson, M. and Madden, G. (1994) *Residential Demand For Broadband Service Subscription: Demand Estimation And Social Impact,* Curtin university of Technology, Institute for Research into International Competitiveness.

Stevenson, R.L. (1994) *Global Communication in the Twenty-First Century*, New York, Longman.

Valente, T.M. and Rogers, E.M (1995) 'The Origins And Development Of The Diffusion Of Innovations Paradigm' *Science Communication*, March 16(3), 242-273

Williamson, K., Balnaves, M. and Caputi, P. (1992) 'Information, Communication and Telecommunications: a pilot study of the behaviour of citizens' *Prometheus*. 10(2), 311-322.

Zimmerman, H.D. (1994) 'The Design Of Future Telematic Systems For Private Customers', *Electronic Markets*, 12, 11-12.

The authors thank Telstra Multimedia for the opportunity to publish the Gungahlin data.

Return to Top View Full-screen

Opportunity Out Of Adversity

Brett K. Worrall

Tyco Submarine Systems Ltd., U.S.A

ABSTRACT

In the submarine telecommunications industry, the Asian region has long been the rising star, promising massive developing market opportunities with consistently high traffic growth. Technological breakthroughs, industry competition and the explosion of the Internet are the fundamental drivers of change in our industry.

Recent cable activity has been enormous. Cable suppliers are rushing to adapt to an industry where next generation technology is being developed and manufactured before the so called 'old' technology is in the water. Our customer base has changed, and will continue to evolve, as fast moving carriers emerge from their domestic markets to become global carriers entering the race for control of the new horizons.

This race in Asia is currently under the cloud of the recent Asian economic meltdown. Will the Asian region's telecommunication market continue to sail before the storm, or will the regions' carriers and suppliers face a rough passage?

Using recent industry history as our guide, this paper will discuss the underlying market drivers, the players and attempt to outline the opportunities resulting from the 'new' Asian environment after the storm.

View Full Text

Opportunity Out Of Adversity

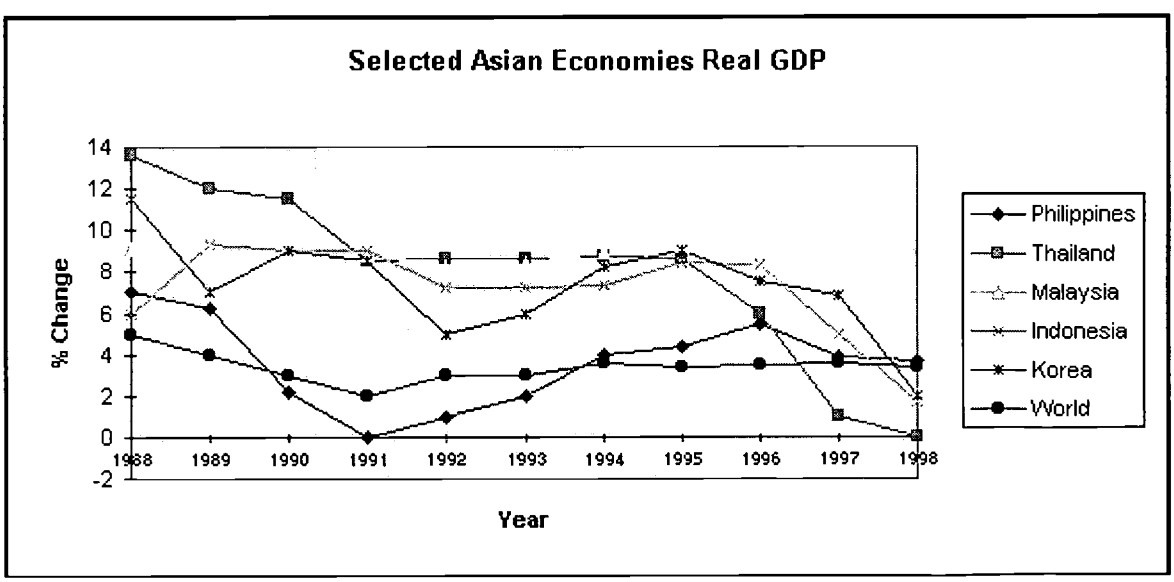
I. INTRODUCTION

The title of this paper "Opportunity out of Adversity", is meant to highlight that notwithstanding the current Asian economic turbulence, there are opportunities to be had for carriers and suppliers alike. The question that I hope to at least partially address is "What is the situation in Asia after the meltdown, and what does the future hold?"

In the first section of this paper I will explain briefly the recent economic changes that have affected the region and why such events will lead to a fundamental change in the way our customers and the submarine system suppliers operate in the region. In the second section I discuss the Asian region's characteristics and drivers. In the final section of this paper I will venture some suggestions as to what the future may hold and how the industry can or will have to adapt to the changes in the region. For the purposes of this discussion Asia refers collectively to the major south east Asian countries including China, Thailand, Japan, Malaysia, Singapore, Indonesia, The Philippines , Vietnam and Korea.

II. THE ASIAN ECONOMIC SITUATION

The Asian 'miracle' as it was dubbed is no more. Various theories exist that attempt to explain recent events in Asia, the ones I favour are cited as references [1,3]. Starting about July 1997 with the Baht, a wave of currency devaluations, high domestic interest rates along with a serious outflow of trade capital left Asia economically high and dry. As shown in the following graph, resultant GDP figures fell from their sometime double-digit levels to levels between 0 and 4% (predicted).



Source : IMF World Economic Outlook December 1997

How does this situation change the way our customers operate? The main changes that the region's carriers must deal with include the following:

- Tightening of the availability of capital as a result of the capital flight out of Asia
- Forced rationalisation and changes to companies via mergers takeovers and alliances
- General downturn in economic activity

These factors along with the industry drivers explained below, have imposed a period of change on our customers. The economic factors accentuate the imperative for change that would have been less dramatic given a stable economic climate.

III. AN INDUSTRY REVIEW FROM AN ASIAN PERSPECTIVE

1. *Technology Uptake (To Be The First)*

Walk down a street in Hong Kong or Singapore and look around you at the younger generation with handphones and pagers. You can easily imagine an information age within the next generation. Asians, if you can make the intellectual leap of grouping Ethnic Chinese, Malays, Thais, Filipinos, Vietnamese, Indonesians and others, into one group, have demonstrated their willingness to accept new technology. Maybe this is not an "Asian" trait but rather a human one, nonetheless, we can see in the Asia pacific region a strong propensity to leverage new technology for commercial gains.

2. *Undersea Technology As An Enabler*

In the few short years between 1988 to 1998, we have seen a revolution in regards to technology used in submarine fibre optic systems. Current technology (or old technology as some call it) N times 2.5 Gbps as used in Southern Cross, SEA-ME-WE3 and China - US cable projects, is now being surpassed by next generation WDM systems. New systems use advanced 980 nm pumping, LMF fibre and new line coding will enable line transmission at rates of at least up to 160 Gbps per fibre pair by the year 2000 as foreshadowed[5], by recent laboratory experiments. This technology is already being incorporated into the next generation of transpacific systems.

As discussed [8] , the technology available in the near term will allow:

- High upgrade capability through WDM
- More sophisticated network topologies via increased functionality in branching units and innovative use of WDM
- Improved network protection technology using next generation NPE (Network Protection Equipment) and integrated ADM/DXC (Add Drop Multiplexer and Digital Cross Connect)

equipment

- Available bandwidths moving in the future to an incredible 1 Tbs per fibre pair!

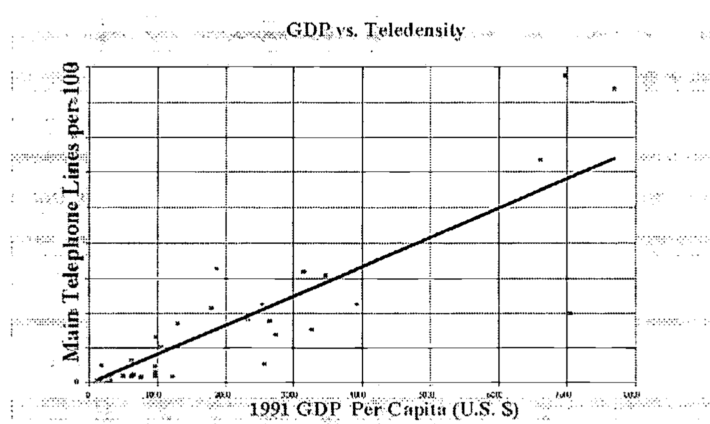
These technological leaps will allow the network designers of future networks to push back the application limits of their systems to the next threshold. In addition, unrepeatered WDM technology is set for a new technologically driven leap as the suppliers leverage their WDM repeatered capabilities into unrepeatered applications.

The enabling part of the picture is that the ability to deliver massive amounts of protected bandwidth is a key enabler for the redefinition of our industry. The resultant capability coupled with the rapid and irrefutable convergence of telephony, computing and broadcasting has set the stage for the next wave of telecommunication systems.

3. ***Teledensity***

No reasonable person could refute the long-term growth prospects for the Asian region. The reality today is, however, that the investment decisions are now (rightfully) put under the microscope before genesis. The fundamentals are still in place; the need to develop infrastructure and the need to provide basic telecommunication services to over 30% of the world's population. The constant issue is the affordability versus costs of provision, of those telecommunication services. A graph depicting the relationship between GDP and teledensity is shown below:

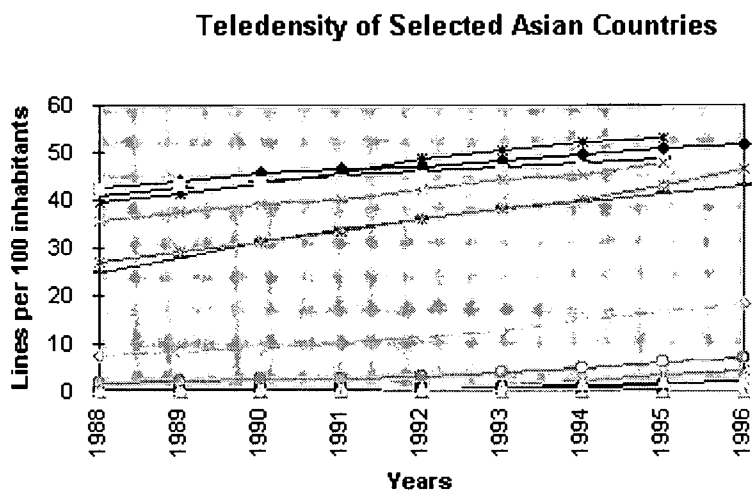
Jipp's Curve



Source : Reference 10

This relationship known as the Jipp curve supports the intuitive idea of a strong correlation between GDP and main lines per 100 inhabitants. The relationship is worth contemplating for a moment since we can draw at least two conclusions from it. The first and most obvious is that given a fall in GDP growth one can expect to see a drop in the rate of teledensity growth. The second, is that a well developed telecommunications infrastructure and a healthy domestic economy exhibit a positive correlation. What I would like to stress is the possible lost opportunity cost of not investing in telecommunications at appropriate levels acts as an inhibitor to economic growth[11].

Teledensities of selected Asian countries are shown in the following figure. Even within the Asian region itself one can easily see the disparities in penetration of even basic services, Plain Old Telephone Services (POTS). One could argue that opportunities exist for governments to invest now as a prerequisite to future growth in their telecommunications infrastructure to ensure they are not one of the countries at the bottom of the graph as indicated below.



Source : ITU World Telecommunications Indicators 1996

The argument for this logic is compelling particularly if one considers the theories for the cause of the meltdown[1,3]. Information intensive industries are one of the key areas where the economies of Asia must focus for the next great leap forward. Such industries increasingly will rely on telecommunications services to bind together geographically separate company units, partners, suppliers, customers and business associates. Telecommunications will become a key and even more important facilitator and enabler for national economic development in the Asian region.

Somewhat ironically for the system suppliers and carriers, these telecommunication services will come at ever decreasing costs to the consumer. This being a direct result of the enabler of advanced technology explained previously. As evidenced by the competitive situation evolving in the US, perhaps equally one could suggest a new competitive paradigm in Asia along with a host of new market opportunities.

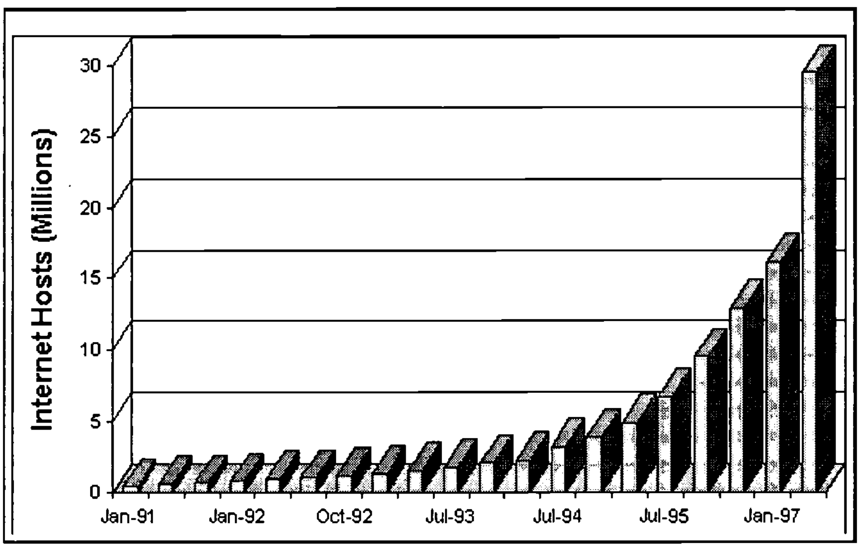
One could of course counter this argument with the view that the type of new and incumbent carriers will target high profit business focused traffic. While this is undeniably possible, the point remains that there is no technological roadblock to the provision of new services to the currently underserved. In fact, new technology is lowering those impediments. The main inhibitors that remain are the commercial and political factors that need to be reconciled by the local authorities in their licensing procedures and by the carriers in their network rollout plans.

A word of caution. Here we see one of the difficulties that face our customers. If we assume a traditional voice based model then teledensity is a well understood metric. If however we accept a less traditional model that comprises a combination of POTS and IP (Internet Protocol) based service provision, we can easily see that this metric will fall prey to oversimplification as it starts to misrepresent the actual penetration of non voice based services into the market. For example, if in some countries or regions within a country, service providers bundle IP telephony, Video on Demand and Internet access we would clearly see a demand substitution and access method switch away from POTS to the Internet. New metrics must be designed that accurately capture the total penetration of telecommunications services in this new regime.

IV. INTERNET AND CONVERGENCE

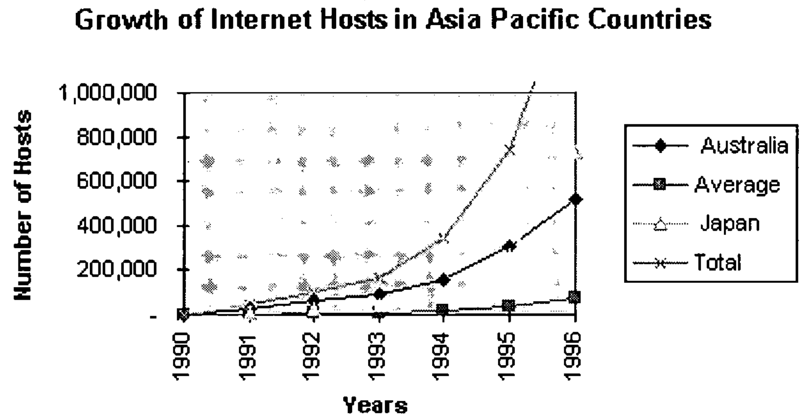
1. *The Internet*

The main drivers of the submarine system industry in Asia mirror those of the other parts of the world. These have been discussed in great detail by others [4]. The growth of the Internet, and I believe the pace of convergence is illustrated in the following figure which depicts the number of Internet hosts (any computer connected to the Internet capable of supporting the TCP/IP protocol and possessing a unique global address).



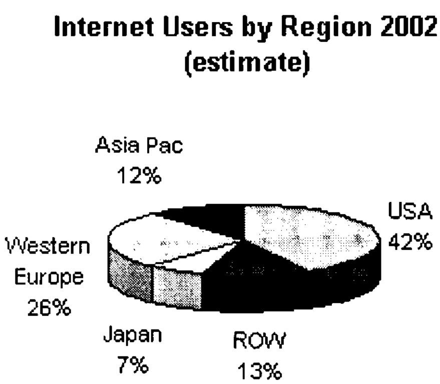
Source : Internet Domain Survey - Network Wizards - 1998

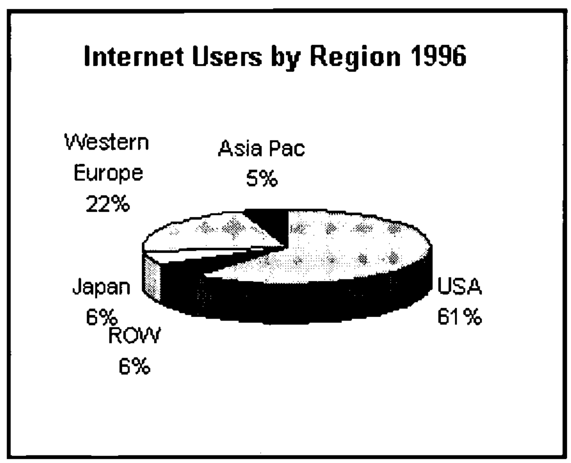
In Asia for selected countries the corresponding chart is shown below:



Source : ITU World Telecommunications Indicators 1996

Although not large numbers by world standards, the growth trends reflect those of the world exhibiting exponential like curves characteristic of the world based data. For the carriers these growth rates are notoriously difficult to predict or model. This is a fundamental difference with this demand driver as compared to voice traffic. Geographically, it has been estimated by IDC that the Asia pacific region will make up at least 12% of the world wide Internet users by the year 2002 as illustrated in the following charts. (Source : Reference 9)





One industry expert predicts[9] that the CAGR of Internet backbone traffic between now and 2005 will be 301% creating an astounding worldwide capacity requirement of 471 Tbps. This is an optimistic estimate. Even conservative estimates however predict Internet backbone traffic at CAGR's exceeding 125 % between now and 2005.

The magnitude of these capacity requirements, if one can accept them, clearly demonstrates what is driving our customers into the next millennium. Of particular note, the Asian region carriers would be extremely enthusiastic to keep as much Internet traffic intraregional as the number of local hosts ramps up!

V. CONVERGENCE

Along with the considerations of the Internet expanding like an exploding sun, we also have the issue of convergence as a demand driver. Various groups predict differing growth rates for Voice over Net (VON) or IP telephony varying from 11-30% of conventional voice and fax traffic by 2002. Various industry experts , in recent times have offered extrapolations that predict before the first decade of the new millennia ends, most, if not all, of their voice traffic will be carried over IP networks. Some suggest[9] that in the coming two decades we should be ready to support at least STM-1 level access into domestic housing using ADSL . Recent announcements of CDMA technology promising similar (and mobile!) access rates are just as exciting.

As examples of convergence, both Singapore and Hong Kong have projects (Singapore Magix run by SingTel and Interactive Media Service IMS by Hong Kong Telecom) which show the technical viability (if not current commercial success) of these models. Both projects are capable of providing full broadband Internet, video on demand VOD and applications such as virtual shopping malls over an IP network. IMS reports that since their official launch on March 23, they have had 75,000 applications for connection. Initially they had targeted 100,000 households in the entire first year of operation!

These examples are glimpses of our customer's future and reflect the new reality for them and for us. Recent announcements involving parallel and necessary technologies, NETTRUST (an electronic id system) and SET (Secure Electronic Transaction as jointly developed by Visa and Mastercard) have enabled the establishment of secure on line banking services in Singapore and are a precursor for full e-commerce applications over the net. It is estimated in Asia, that e-commerce currently in its infancy will grow to a 1.4 BILLION USD industry by 2001 and clearly high speed reliable telecommunication access is a necessity for such technologies.

VI. COMPETITION AND CUSTOMERS

To predict a probable competitive carrier situation in Asia, one can observe the US manifestation of the industry drivers namely; technology, convergence and competition. As the recent press has reported, the so-called "mega- mergers" of AT&T and TCI, MCI and WorldCom, Bell Atlantic and GTE ,reflect the "big is better" mentality. It also reflects the preparedness of the players to adapt their strategies to the new competitive environment facing them. New competitors in the US are offering one-stop services overlaid on completely digital broadband networks. These new carriers are marketing themselves as fast moving, innovative and most of all, *cheap*.

Recent public actions by some regional carriers including KDD, and SingTel to name only two, signal a similar trend (or at least the thinking of it) is set to sweep Asia. Most definitely the traditional carriers will be taking the opportunity of the meltdown to consolidate their positions and to defend in markets where they expect attacks from the new players. It is clear the carriers in better financial positions are preparing themselves to combat the new entrants and to scan the industry for commercial opportunities.

For the submarine system suppliers this clearly signals the entry of new carriers into the Asian market and the possible realignment of existing carriers. This should result in strong future business opportunities in the region as the new players attempt to extract market share from the incumbent carriers.

VII. RECENT AND PLANNED SYSTEMS

The following table summarises the recent and planned regional systems. Due to the long procurement lead times the recent economic events have not negatively impacted the major international cable system projects. The main impact as reflected in the table, is on the domestic or intraregional systems. The domestic systems as expected generally have been delayed due to IMF imposed conditions on the use of funds. Even World Bank loans currently do not guarantee a domestic project will go ahead as in the case of the Ambon - Jayapura project. Further, governments of the affected countries have trimmed down and reprioritised their investments across all areas of infrastructure with resultant delays in the domestic systems.

Nevertheless recent cable activity has been enormous as evidenced by the list of cable system projects under construction. Due to the minimum 18 month construction period of the larger systems, the Asian meltdown has had limited impact on system suppliers to date. In fact, as several major investment decisions were already taken subsequent to and during the meltdown, the suppliers are enjoying a current mini 'boom' in system construction through until at least mid 2000. There are of course examples of countries pulling out of international projects as their economic situations do not permit their participation.

Concerning future systems the situation is less certain. While almost all of the planned systems will go ahead (in some form or another), the timescales are currently unclear and new systems will perhaps overtake the ones listed below.

International Under Construction	**Comment**	
SMW3 - Extension	RFS - March 99	
China - US	RFS - September 99	
Southern Cross	RFS - August 99 - Phase 1 , August 00 - Phase 2	
PC-1	RFS - March-September 00	
Japan - US	RFS - June 00	
Guam - Philippines	RFS - March 99	
Domestic		
CAT Festoon	Tender closed July 98	
Ambon - Jayapura	Tender postponed	
Indonesia Packet 1,2	Under construction	
Malaysia - Philippines		
Vietnam Festoon		
Taiwan Domestic	Awarded	

UNICOM		
JIH	Under Construction	
Future		
SAFE	Tender Evaluation Oct 98	
SAT 3	Tender September 98	
OXYGEN	Financial Closing Dec 98	
APCN-2		
PTC		
TASMAN 3		

Table 1: Main Asia Pacific Cable System Activity

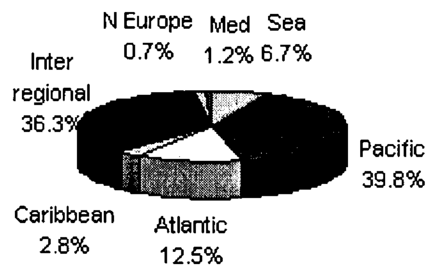
VIII. COMMERCIAL OPPORTUNITIES

Out of the current adversity will come opportunity. As previously described, although the current economic climate in Asia is no longer robust, the positive side to this situation is that assets in Asia are currently undervalued. Those with a long term view will most certainly be scanning for opportunities, particularly when domestic competition is perhaps weakened by the crisis.

In some circles, the view is that the meltdown has facilitated a difficult but necessary task of forcing some carriers to merge or to exit. The examples of Indonesia with twelve mobile carriers, Malaysia with seven, Thailand, South Korea, Philippines each with five operators, is a situation that was not believed to be sustainable for their given market size and investment requirements. In the international arena, we are yet to see such drastic changes. It is probable that we will witness some realignments that will be spurred by the economic and competitive forces at play. Some examples that signal this possibility are the KDD deal with Teleway in Japan, the OXYGEN project by CTR and the aggressive rollout of networks by Global Crossing and Worldcom, KDD, AT&T, NTTWN, and C&W.

Despite the dire economic scenarios painted by some, the telecommunications industry analysts are extremely bullish on our market potential. KMI reports[12], that in the period 1998 to 2003 they expect investment levels as shown in the following chart.

Investment Planned by Region 1998 - 2003
31.1 billion USD



Source : KMI 4th Submarine Symposium Estoril Portugal

The investment levels predicted above give us cause for optimism and reinforce the message of this paper that we should be confident in the Asian region's ability to bounce back. One very interesting area of our market development, is the market for upgrade of systems. Although this market is in its infancy, the system upgrade opportunities in the marketplace will in time form a strong market segment of their own.

IX. SOME PREDICTIONS

Before I contribute to the crystal ball gazing, let us first revert to the economists. When asked, "When will the Asian tigers return to the pre-meltdown growth levels?". The IMF in December 1997 said, "they were generally confident that the sharp downturn would end after one year". Events have certainly moved on since then. The severe conditions in Indonesia (with predictions of 100 million people below the poverty line in 1998-9), Korea and Japan had added to the crisis of confidence.

The predominant perception from within the industry is that generally 1999 will be a tough year, however we should start to see some signs of a recovery in early 2000. This view is heavily qualified by the assumptions that Japan and China do not dramatically change their directions or suffer further major dips in their economic situations.

So what is in store for our industry ? Out of the current adversity will come opportunity for some. I wish to imply a sense that organisations that view "the glass as half full" as the old saying goes, will find opportunities during this period. Clearly, the events since July 1997 have not been a short one year storm. In contrast a better analogy would be a long winter. The Asian miracle has stumbled, but only in comparison to, and as a result of, its own success!

The suppliers however will most certainly ride out the problems based on their current order backlogs.

The situation in terms of unbooked capacity to the end of 1999 and through early 2000 is too difficult to predict. One can say however, that the probability of a sharp resurgence in the Asian domestic submarine cable market is unlikely in this period. It is probable that additional transoceanic or other large international networks e.g APCN-2, OXYGEN may go ahead during this period.

As alluded to previously, we should expect a period of adjustment for our customers in Asia through to 2000. The fundamental drivers and assets (albeit undervalued) of Asia are still in place. The issue remaining is the return of market and industry confidence. We can generally be very positive about the prospects for the industry. Certainly in the short to medium term the suppliers have been buffered from the main economic factors by an unprecedented order backlog of systems.

Our traditional customers in reacting to the industry drivers are positioning themselves to maximise their traditional strategic market strengths while preparing to move into the new developing market areas. In the meantime, the new entrants e.g Worldcom, GCL and others are aggressively rolling out their new digital networks and looking for additional alliances in the Asian region. We can expect the deal making that has characterised the US reactions to the same forces to also be evident in Asia. This is already a trend that has been observed in the Japan - US cable network where you have a unique mix of traditional carriers e.g KDD and AT&T working with a major new carrier, Worldcom.

The evolutionary change occurring to our customer base is clearly here to stay. The result will be a myriad of new services and hopefully greater access to basic services to a currently underserved population.

X. CONCLUSIONS

This paper has explored the recent Asian meltdown within the context of its possible effects on the submarine systems industry. We have discussed the industry drivers and the current state of activity within the region. From this base we then discussed the changing face of our customers as they adapt to the forces of convergence, competition and the Internet. We then looked through our crystal ball into the future which predicts a generally optimistic view for the region for a recovery in 2000, subject to the status quo of Japan and China. We then suggested those with a sharp eye will find opportunity in the current adversity facing us in Asia.

XI. REFERENCES

1 Paul Krugman , "Will Asia Bounce Back?" , *"Speech for Credit Suisse First Boston", HongKong ,March, 1998*

2 IMF , "Continuing Response to the Asian Crisis", *IMF World Economic Outlook, December, 1997*

3 Paul Krugman , "Whatever happened to the Asian Miracle?"

4 Jean Devos, Tyco Submarine Systems Ltd, "Coping with an Explosion", *"4th FiberOptic Submarine Systems Symposium", June 16-18, 1998, Estoril Portugal*

5 W.C. Marra , F Kerfoot , Tyco Submarine Systems Ltd, "Past Present and Future",

6 "Asian Business", *Vol 34 No7 July 1998*

7 "The Economist Magazine"

8 Peter Runge , "Global Undersea Network Technologies", *"4th FiberOptic Submarine Systems Symposium", June 16- 18, 1998, Estoril Portugal*

9 W.B. Carter , Global Crossing Development Co , "Telecommunications demand Drivers into the New Millennium", *"4th FiberOptic Submarine Systems Symposium", June 16- 18, 1998, Estoril Portugal*

10 L.S Dadouris , M.C Singhi and S.H Long - AT&T Submarine Systems Inc., "The Impact of the Internet and Broadband Service Offering on Submarine System Cable Capacity Into the 21st Century"

11 Unknown author, "Socio -Economic Growth is a Function of Telecommunications Infrastructure Development in Developing Countries"

12 Mr John N Kessler President KMI Corporation, "The State of the Market for FibreOptic Undersea Systems", *"4th FiberOptic Submarine Systems Symposium", June 16- 18, 1998, Estoril Portugal*

Return To Top View Full-screen

Will China Embrace Competition?

Foreign Equity in Telecoms Hangs in the Balance

Ken Zita

U.S.A

ABSTRACT

It takes nerve to be an investor in China's telecom services market. China has steadfastly restricted foreign ownership, management or operations of telecommunications network services. The government has pursued a conservative approach to sector reform, protecting the interest of the dominant carrier, China Telecom, and maintaining maximum sovereign control over what it regards as strategic infrastructure assets.[1]. The ban confounds global investors. Investors have circumvented the prohibition on direct foreign investment policy by adopting legal, if tenuous, joint venture schemes with China Unicom, the nascent second carrier. The indirect financing arrangements, known as Chinese-Chinese-Foreign (CCF) structures, have funneled $1.4 billion into Unicom local joint ventures since 1994, providing nearly three-quarters of capital investment to date.

View Full Text

Will China Embrace Competition?

Foreign Equity in Telecoms Hangs in the Balance

It takes nerve to be an investor in China's telecoms services market. China has steadfastly restricted foreign ownership, management or operations of telecommunications network services. The government has pursued a conservative approach to sector reform, protecting the interests of the dominant carrier, China Telecom, and maintaining maximum sovereign control over what it regards as strategic infrastructure assets.. The ban confounds global investors. Telecoms services revenues have grown at an astonishing 40% annually in recent years, to approximately $24 billion in 1998, making China the sixth or seventh largest market in the world. Investors have circumvented the prohibition on direct foreign investment policy by adopting legal, if tenuous, joint venture schemes with China Unicom, the nascent second carrier. The indirect financing arrangements, known as Chinese-Chinese-Foreign (CCF) structures, have funneled $1.4 billion into Unicom local joint ventures since 1994, providing nearly three-quarters of capital investment to date. While imperfect, the CCF approach established the sole loophole enabling foreign participation in China's telecoms (see box).

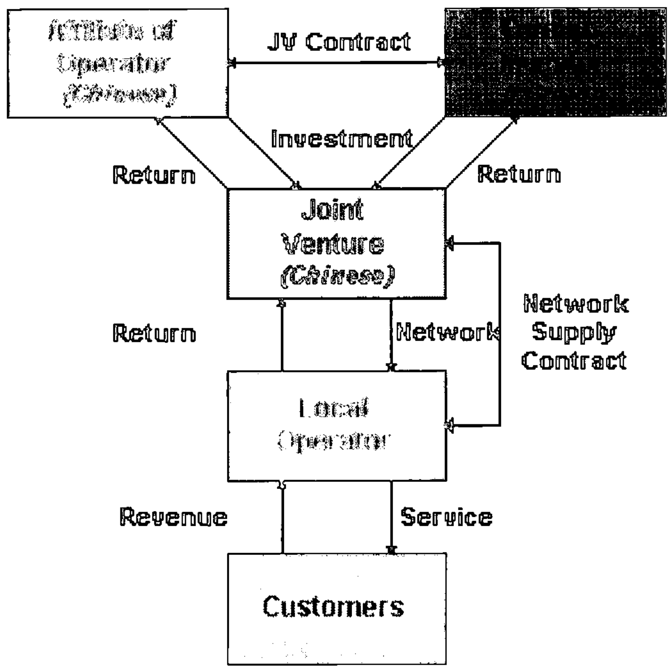
In October 1998 the central government dropped a commercial bomb. News spread that the government planned to terminate the CCF investment vehicle by 2000, effectively closing the door on foreign investment without offering a replacement. Minutes from a State Council session, known as Decision 98, began to circulate among a narrow circle of international observers. The document indicated Premier Zhu Rongji's intent to end the CCF mechanism. The story emerged obliquely, almost by chance. No official announcement was made. And no representative of the central government nor the Ministry of Information Industry (MII) issued a statement to announce what was fast emerging as a proposed sea change in national policy.

Investors in Unicom joint ventures were startled that China would take such abrupt action, without at least notifying foreign partners. Some were aware that discontent with the CCF policy was brewing among different factions in the leadership. The MPT and newly constituted MII had been intensifying its campaign to have CCF quashed. In March 1998, for example, the State Planning Commission issued a recommendation paper reflecting MII views, Resolution 405, suggesting that CCF arrangements be phased out. Few foreign firms were consulted about the SPC position, or subsequent discussions at the State Council. Indeed, many foreign Unicom partners only learned of the impending policy shift from the international press. Firms scrambled to make sense of the ensuing confusion, dispatching executives to Beijing, summoning ambassadors, and conferring with one another in effort to piece together yet another Chinese puzzle.

Chinese-Chinese-Foreign (CCF) financing structures were invented by Unicom in 1994 to circumvent China's long-standing prohibition on foreign ownership, operation and management of telecoms enterprises. Direct investment in telecoms is off limits to foreigners. With CCF, a Build-Transfer-Operate (BTO) or Build-Lease-Service (BLS) finance and management arrangement is created. A Chinese company licensed to operate a network such as a local Unicom branch creates a joint venture that serves as an investment clearing house. Complex 3-way management contracts between the operator (Chinese), joint venture company (Chinese), and investor (Foreign) combine equipment leasing, royalties, consulting and license fees in a network supply contract in lieu of direct equity investment. 44 CCF contracts with local Unicom contracts have been signed, of which about 20 are active. Major Partners include Bell Canada, France Telecom and Sprint. The Unicom have earned less than 5% cellular market share from China Telecom to date. See Figure 1:

Figure 1:

Typical CCF Revenue Structure



Source: Michael A. Aldrich, Baker & McKenzie, Hong Kong, February 1997.

Rumors -- the quasi-official channel for the leadership to test new ideas -- permuted wildly. *Foreigners would be kicked out. Foreigners could stay if contractual capital commitments were paid in. CCF over-extended China in the WTO negotiations, forcing the government's hand. Investment positions in JV companies would be capped at 25%. Unicom could stay in mobile, but not in local or long distance.* Sources of all stripes had contrasting interpretations of events. Official silence from the government only fed speculation that investments made through CCF vehicles might not be protected.

Policy on the Fence

The circumspect manner in which the government position became manifest, through leaked impressions of a policy shift, has made explicit simmering ambiguities surrounding China's telecoms. Indeed, with the

CCF crisis, the historical absence of transparency in telecoms policy, which has been discounted as culturally 'inscrutable' in the past, has increasingly emerged as a tangible political risk to foreign investment.

Faced with a cloud of doubt, a group of 16 Unicom venture partners sent a letter to Minister Wu expressing concern about the CCF matter. The letter was copied to key decision-makers in the senior leadership. This multi-firm, multi-lateral effort is unprecedented in the telecoms sector in China. For the first time, foreign investors acted in unison to obtain clarification of government policy; the effort became, in effect, a collective appeal from shareholders to protect their interests. Reports suggest that the letter had a significant impact on Zhu, who directed MII to explore a solution that serves all interests involved.

The letter and government reaction reveals a new sophistication in the marketplace. The leadership under Zhu has demonstrated a new willingness to enter into a dialog with investors on fundamental policy issues (albeit after the fact). There is also tacit acknowledgment that resolution of the financing question for competitive telecoms infrastructure is an extremely difficult matter. The leadership seems prepared to consider the experience of its foreign partners to help resolve asset valuation and equity conversion issues. From the foreign perspective, investors are taking a more assertive role in influencing government decisions, rather than simply waiting for policy missives from Beijing.

From Indirect to Rational Financing

As the financial lifeline for China Unicom, CCF is more than a creative solution to financing new telecom ventures: it has become the symbol of competition in the domestic marketplace. Like high yield debt in the West, it has provided ample funding for new service providers intent on competing with the entrenched monopoly. Other aspiring carriers, including companies controlled by the People's Liberation Army, broadband cable television networks operated by the former Ministry of Radio, TV and Film (MRTVF), and fledgling entrepreneurs, all expected to employ CCF to launch competitive enterprises. Terminating this financial mechanism thus becomes an attack on market deregulation itself.

CCF pioneered competition in China's telecommunications sector, but the scheme has not really satisfied anyone. China Telecom opposes the arrangements on principle, as an affront to its administrative authority. Chinese operating companies, while thankful to be in business at all, are afraid of running afoul of ambiguous regulatory rules. Foreign partners resent being treated like commercial banks, with little opportunity for leverage. Most important, CCF is not specifically protected under existing statutes. The system was due for change. See Figure 2.

The worst fears about the wind-up of CCF – that foreigners will be summarily dismissed from the market, or forced to sell existing positions – will almost certainly not come to pass. Beijing no doubt recognizes the liability of abruptly changing course and will not risk losing face by abandoning over a billion dollar trust that has been built with telecom investors over the past five years. The danger is that conservative voices responsible for creating the CCF crisis will continue to command the internal debate on the role of foreign investment will play in China's telecoms.

Figure 2

Contrasting Views on CCF

	Pro	Con
MII & China Telecom	• Has stemmed introduction of equity investment in competitors	• Threat to administrative authority • "Violation" of investment rules • Encourages unfair extension of private network operating rights • Encourages redundancy of network assets • Enables cream-skimming of most lucrative urban areas
Unicom & PLA	• Enables access to foreign technology and capital • Virtually risk-free borrowing • Network assets revert to Chinese partner at end of term • No explicit management obligations to foreign partner	• No regulatory protection • No legal recourse without Telecoms Law
Central Government	• Brings investment without surrendering equity or management control • Enables limited introduction of competition • Keeps telecom profits at home	• Interim structure that does not serve long-term reforms • No control over individual contracts at local level • Source of continual conflict between MII and other ministries
Foreign Investors	• Only vehicle enabling investment in telecom services sector	• No equity • No direct management control • Minimal regulatory protection • No clear routes for exit • Double taxation

The most insular factions question why China needs to engage foreign equity at all. They cite a long list of home-grown achievements that justify keeping the market closed: China Telecom's spectacular success modernizing its network; recent advances in domestic high tech manufacturing; the buoyancy of internal sources of capital even in the wake of the Asian financial crisis (at least for the monopoly, China Telecom). Further, they reason, even if competition is to be speeded up why should foreigners be allowed to reap the rewards of market deregulation? These opinions typically come from within China Telecom and the MII, and from party stalwarts who believe in the economic rationality of preserving monopolies – or at least Chinese dominance – in strategic sectors. Significantly, telecoms modernization is one of the most visible success stories of the economic reforms. Nationalist pride in the sector serves the leadership's domestic political agenda as proof of its mandate to positively transform society, and capacity to lead the nation through the Information Revolution.

Though a one-party political system, China is anything but a command economy. No one entity has absolute ability to dictate the direction of an industry, including the MII which has unquestioned administrative oversight of telecommunications. Instead, a bargaining takes place between traditional forces and reformers. Indeed, this is how Unicom got started. Unicom was created over the strenuous objections of the former MPT. Unicom's founding shareholders earned the right to provide limited telecom services in 1976, and extended these mandates to incorporate as an alternative carrier in 1994. The PLA and the rump MRTVF followed a similar course. China's "policy of exceptions" allowed numerous instances of competitive services. CCF is a direct evolution of this ad hoc policy environment. That is, an official ban on foreign direct investment has always been in place but CCF allowed legal exception to the rule by employing indirect capital flows.

Options for Transition

The hoped-for resolution to the CCF crisis is that the government will use the intensity of debate to rationalize telecoms investment policy and allow the lease-oriented CCF contracts to be converted to equity positions. Reappraisal of CCF presents an excellent opportunity for the government to permit direct foreign investment and accelerate the transition to a market economy. Investors clearly prefer equity – to enable multiple returns on investment, a voice in management, legal protection, and a tangible exit strategy. While leading the MPT, Minister Wu repeatedly indicated the government's willingness to allow foreign investors an opportunity to reap "equity-like" returns through creative financing schemes. To date, "equity-like" has referred only to profit sharing based on proportional investment and has stopped abruptly short of actual ownership of local telecommunications enterprises. Pessimists speculate that the timing of the CCF crisis was engineered to deprive the JVs of due compensation. That is, as the Unicom ventures approach critical mass through an expanding infrastructure and an anticipated "hockey stick" revenue growth, foreigners will hit a glass ceiling that may compromise expected rewards.

Zhu Rongji is believed to support a fast-track plan to IPO the local Unicom companies, a move that would fundamentally reshape the landscape for ownership of telecom assets. The appeal of the approach is obvious. The successful $4 billion flotation of China Telecom (HK) in 1997 made clear that share listings would become the preferred future for Chinese telecoms financing. The CTHK sale generated significant funds for investment and expansion without relinquishing management control. Importantly, CTHK is the only Chinese telecommunications venture approved by the MII for flotation on the Hong Kong or other international exchanges. Unicom ventures, therefore, will be listed in Shanghai or Shenzhen.

The ownership of the Unicom companies is more convoluted than the assets contributed to CTHK by China Telecom. Each Unicom JV has a unique contract, with different rates of capital participation, terms of profit repatriation, and varying long term liabilities, among other factors. Moreover, in the CCF arrangements, network infrastructure is typically leased to a joint venture company. Strictly speaking, the physical assets are owned by the foreign party, not by the joint venture. A formula is required to equate the book value of the lease and management contracts into equity. Some investors believe these assets need to be treated as high risk speculative investments in any pricing negotiations, equivalent to early stage venture capital. If provisions are not made for current partners to be adequately compensated in the transformation of CCF contracts, demand for new Unicom issues could suffer.

Conversion of CCF arrangements to equity prior to a flotation, should that occur, will involve haggling over time-sensitive components of existing contracts. All existing contracts stipulate that the physical network be transferred to the local party at the end of the term, typically 15 years. Premature termination or re-negotiation of the CCF agreements could potentially deprive foreigners of the opportunity to yield profits in the out years of the term. None of the Unicom CCF joint ventures are profitable to date; net rewards are expected to accrue only in the later years, after a network is fully deployed and when operating margins are expected to improve dramatically. Any fundamental changes will also have to overcome operational audits of the Unicom ventures ordered by the MII. Minister Wu has publicly indicated that some ventures will be scrutinized for having violated development laws, and that these JVs would be "cleaned up one-by-one." He specifically cited the widely adopted practice of using installation fees as a component of revenues that may be ultimately repatriated to foreign partners.

Public listings of the Unicom ventures would enable the leadership to yield significant structural adjustments and achieve "synchronization" with other macro-economic reforms. Major telecoms companies dominate stock exchanges around the world and China could inject considerable value into its domestic bourses. The entire financial services industry – brokers, investment bankers, institutional investors – would get a lift from a score of new telecom properties on the local capital markets. As State Development Planning Commission official Zheng Xinli recently quipped, "Telecoms…is a good piece of meat and everyone wants to have a bite."

Restructuring the Unicom CCF ventures could have a similarly positive impact on domestic banking. China's bank portfolios are burdened by politically directed lending to ailing state owned enterprises. Balance sheets would be improved greatly by blending quality investments to more stable (and invariably profitable) telecoms enterprises with existing non-performing loans. The government clearly sees the broader economic benefit of tying the health of the banks to properties many consider to be rising stars. The Bank of China has extended a 22 billion renminbi ($2.7 billion) line of credit to Unicom to accelerate domestic borrowing in the sector. Timing of the credit appears to be anything but coincidence. Local Unicom operating companies may be obliged to tap the debt pool to displace the quirky CCF arrangements with foreigners, or perhaps dilute existing foreign positions.

With Unicom's capital supply suddenly in turmoil, local bank branches may begin competing with one another to underwrite telecom loans – just as the Bank of China itself had to compete with other state banks to win the business with Unicom. This competition could signal greater flexibility in the domestic capital market. From a macro-economic perspective, linking the banks to core infrastructure spending makes sense. But the abrupt shift to debt financing from indirect equity flows is radical surgery for China's new operators. Even if the banks pay out the credits, which is uncertain given Unicom's tormented political history, local ventures will need to find other sources of capital. Debt funding alone would unreasonably burden the fledgling Unicom companies. Stock listings may be the only practical course to achieve healthy debt/equity ratios, and support the broader ambition to buttress the banks.

The Equity Equation

The supplemental -- and from the foreign view, desired -- approach to improving the liquidity of Unicom joint ventures is to allow direct foreign investment. Foreign equity would become blended with domestic equity and debt, providing Unicom financial planners with a range of tools to underwrite capital expansion. State Council officials are keenly aware of foreign wishes to participate directly in China's telecoms. Some also appreciate the economic rationality of turning Unicom JVs into mature corporations, in part by allowing diversified ownership.

MII Minister Wu, by contrast, reportedly opposes conversion of CCF lease arrangements to equity on the basis that the time is not "ripe" to allow foreign participation. The chief reasons for not allowing direct foreign investment and widespread competition, summarized briefly, include:

- Unicom does not have universal service obligations, and with foreign help could cream-skim lucrative urban markets while ignoring rural areas;
- aggressive support for alternative access networks would encourage network redundancy, and misallocate "scarce" investment resources;
- tariffs in China are still set by decree and not market forces;
- profits from China Telecom continue to cross-subsidize postal operations, reportedly $16.4 billion in 1997, and erosion of China Telecom's profitability would be a threat to the postal system;
- a telecom law has not yet been adopted to ensure fair competition.

And, while rarely expressed openly, there is an apparent provincialism and fear in certain circles of foreign exploitation: a fear that if the doors to ownership are opened, superior western technology and operational capability would gain the upper hand over domestic institutions. China often plays the shrinking violet in international forums, a poor developing country that needs to protect itself. With the second largest network in the world, these somewhat suspect assumptions can be more accurately described as protectionism.

Despite the conservatives' view that global capital is not required in China telecoms, the government leadership clearly wants Unicom to succeed – and some dimension of foreign funding will be required. International bankers for years warned darkly that, without privatization, China Telecom would fail to meet its ambitious development targets. They were wrong. China Unicom, by contrast, owes its existence to private funding and foreign know-how. The company will succeed only if allowed to employ a rational, market-oriented business model, with the discretion to apply capital and operating alliances as it sees fit.

The World Waits

The timing of the CCF issue and tabling of scenarios for conversion of Unicom contracts to equity appear linked to China's negotiations for accession to the World Trade Organization (WTO). The WTO telecommunications accord was signed by 68 countries in early 1997, though China did not present an accession offer at that time. Membership in the WTO confers free trading status among member countries, and is the penultimate measure of integration into the global economy. China's policy of opening to the world demands it be a full-fledged member of the multilateral agreement. Telecommunications (along with financial services) is a strategic stumbling block.

China needs to agree to a schedule of allowing transparent access to the telecoms sector in line with WTO expectations. Key elements of the proposal, agreed through informal vetting among trading partners, include: terms and operating parameters for introducing competition; the degree and timetable to which direct foreign investment is allowed; creation of and constitutional support for an independent regulator; and removal of non tariff trade barriers such as cross subsidization to hide economic inefficiencies or predatory interconnection fees by the dominant carrier.

China's preliminary offer under consideration includes allowing direct foreign ownership of up to 25% of mobile voice providers, up to 35% in value added data providers, and perhaps 100% for paging networks. Oddly, terms of the mobile offer do not include mobile data, suggesting that market opening may be restricted to current second generation network technologies, not future growth areas. Also, China may seek to limit private equity to only one mobile venture per city. While incorporating equity would be a significant step forward, the terms proposed may actually downgrade rather than boost the financial opportunity already available to foreigners in the market. Many Unicom existing CCF deals allow profit sharing at ratios far higher than the mooted maximum of 25%. The final terms China produces will ultimately be a compromise between the Ministry of Foreign Trade and Economic Cooperation (MOFTEC), which seeks to maintain positive relations with foreign governments, and the MII, famous for doggedly protecting its parochial interests. Consensus will be achieved with the State Council, State Planning Commission and others, with approval made at the very top of government. The end result will be telling. Within the offer will be clues indicating whether China is truly ready to endorse the openness and diversity of information access demanded by the information age.

The wind-up of CCF presents the first tangible opportunity to accelerate restructuring of China's telecoms services environment. All eyes are on the leadership to articulate a vision to protect China's sovereign interests while continuing to open to the world.

Return to Top View Full-screen

The General Law for Telecommunications and the Development of a Competitive Market in Brazil

Mônica Medeiros de Oliveira-Gajdys

University of Hawaii, U.S.A

ABSTRACT

This study examines the nature of the General Law for Telecommunications with regard to competitiveness created within the new market as a result of its legislation. It also identifies strengths, weaknesses, opportunities, and threats that the legislation poses for a competitive market environment.

View Full Text

The General Law for Telecommunications

and the Development of a Competitive Market in Brazil

I. INTRODUCTION

The General Law for Telecommunications was signed by President Fernando Henrique Cardoso in July of 1997. The law carried great expectations that it would improve and modernize telecommunications services through the establishment of a competitive market. The new legislation provides a national policy framework for telecommunication in Brazil, with strong emphasis on competition. This long-awaited bill contains the first set of rules for a privatized and competitive telecommunications market, following decades of state monopoly. In addition, it creates a regulatory agency, and provides for the organization of telecommunications services through its new market oriented model. It also authorizes the government to privatize the state owned company, Telebras S.A, which had been the sole telecommunications services provider for Brazil, and opens the market to foreign companies.

The Brazilian government held a monopoly on the market throughout the history of telecommunications in the country. Consumers were deprived of proper service and bore the aggravation of an obsolete and overloaded system -- retarded for lack of investments in the infrastructure -- for over a decade. The opening of the market was recognized by policy makers as a way to attract investments to improve and modernize the telecommunications system. This is a condition paramount for enabling the country to be included in the "globalized" world and in the information society. The law is an attempt to achieve these goals.

This study examines the nature of the General Law for Telecommunications with regard to competitiveness created within the new market as a result of its legislation. It also identifies strengths, weaknesses, opportunities, and threats that the legislation poses for a competitive market environment. The end of the government's telecommunications monopoly creates an extremely attractive opportunity for private corporations, but does not necessarily assure a competitive market. Privatization of telecommunication companies all over Brazil may be an indication that the government wants to remove itself from control of this market sector, but Brazil's telecommunication law does not completely support this plan as a long term policy. Brazil's historical culture of state intervention -- vivid in the new regulatory agency -- and highly regulated economy may pose obstacles to the competitive market.

This paper argues that the General Law for Telecommunications is a good introduction to a free and competitive market, but if policy makers do not remain attentive to its function it can foster a scenario of private monopoly. The legislation is interventionist and conservative. In light of this, it may hinder a free market. Initially, the institution of a controlled environment may be necessary to ensure ample and fair competition, as well as guaranteeing consumers better services at lower costs.

II. OVERVIEW OF THE GENERAL LAW FOR TELECOMMUNICATIONS

The goal of the General Law for Telecommunications, in force since July 1997, is to establish a national policy framework that ensures a competitive market in the telecommunications sector in order to improve the telecommunications services in Brazil. It is obvious, from the text of the law, that policy makers were cautious in their efforts to open this market, under state monopoly for decades. However, the result is quite encouraging for those interested in the telecommunications industry. The 1997 law is constituted of four sections:

1. Fundamental Principles
2. The Regulatory Agency and the Sectorial Policies
3. Organization of Telecommunication Services
4. Restructuring and Privatization of Federal Telecommunications Companies

1. *Fundamental Principles*

The first section of the telecommunications law establishes grounds for the development and modernization of telecommunications in Brazil; which is the ultimate goal of the legislation. The law, which sets the policy framework for the sector, reveals a strong disposition by the policy makers toward creating a free and competitive market in this area. The language of the law expresses that the government must foster competition and the diversity of services, and punish those who try to impair this freedom of initiative and competition. The government is also directed to create opportunities for investment and to stimulate development of technology.

The new law determines that it is the responsibility of the government to organize the telecommunications services in the country. This means regulating and inspecting the provision of services, the establishment and operation of telecommunications networks, and the uses of orbit resources and radio-frequency spectrums. In addition, the State must ensure that the entire population has access to telecommunications of good standards at reasonable rates.

Telecommunications services are to be regulated according to the national sovereignty interests, the principles of the social function of property, free initiative, and competition. In addition, the rights of subscribers, the government obligation to repress abuses of economic power and to reduce social and regional inequities play a significant role in the regulation process. The new law gives the government the authority to intervene in cases of "imperfect competition," and to repress transgressions of the economic order, such as the arrangement of mergers in order to dominate the market.

2. *The Regulatory Agency and the Sectorial Policies*

The second section of this legislation creates an agency to regulate and inspect telecommunications services. The law determines that the National Telecommunications Agency (Anatel) be independent from the government and be in charge of implementing national telecommunications policy. Anatel will be responsible for granting contracts and supervising services rendered under public and private systems. It is also responsible for imposing sanctions and for interventions necessary in order to implement the national telecommunications policy.

According to the law, the agency constitutes a board of directors and an advisory board. The former is appointed by the President upon approval by the Senate. The president of the board is chosen by the President of the Republic from among the members of the board of directors. The advisory board is formed by representatives appointed by the Executive, Federal Senate, House of Representatives, class entities representing telecommunications service providers, users, and society.

Anatel is in charge of managing the Telecommunications Inspection Fund (FISTEL) that gathers revenues derived from concessions, permits or authorization to exploit telecommunications services and the uses of radio-frequencies, as well as payments for the issuance of service authorization, fines, and indemnification, among others. A portion of Fistel is allotted to the universal service support fund.

3. *Organization of Telecommunication Services*

The new legislation divides telecommunications services into two categories, according to their scopes of interests. The categories can be of collective interest or restricted interest services. Restricted interest services can never hinder collective services and are to be regulated for that reason. Services are also divided between public and private. Public services are those of collective interest whose existence, universalization and continuity the federal government has an obligation to ensure (e.g. telephone and cellular phone services). Private businesses can provide this service through concession or permit, but will be responsible for universalization and continuity obligations. Universal service is to be sponsored by contributions of telecommunications service providers to a telecommunications fund.

Anatel is directed to repress actions that hinder free, ample, and fair competition. The law is very clear on this issue, that to the point of detailing behaviors considered unacceptable; such as the practice of creating subsidies to artificially reduce service costs. The agency is also directed to foster effective competition and prohibit economic concentration in the market by establishing restrictions, limits, or conditions on companies related to obtaining and transferring concessions.

Since policy makers' primary goal is to develop and advance telecommunications services in the country, the law determines that service providers investing in research and development will receive credit, tax and costums incentives. Initially, providers of public services will not be able to establish the rates for their services. Fees and tariffs will be determined by the government if services are considered of public interest. The law permits Anatel, after three years of the contract, to submit service providers to a free tariff system, if there is ample and effective competition among providers. This will enable providers to determine their service rates. However rates will have to be reported to the agency, which will monitor them to prevent arbitrary increases in profits and other damaging practices to competition.

The law directs Anatel to ensure that providers share the gains resulting from modernization, expansion or rationalization of services with users. In addition, economic gains that do not arise directly from business efficiency, such as reduction of taxes, will be transferred in full to the users. On the other hand, the agency will review tariffs in order to limit the burden of new rules for services, The legislation is not as strict on the exploitation of what are considered private services. Those interested in providing these kinds of services will be regulated based on the constitutional principals for economic activity and consumer rights. This chapter also stresses that the law will ensure free, ample, and fair competition in the exploitation of such services. "Freedom is the rule," states the law, which establishes that no authorization shall be denied, except for relevant reasons. The rates for these services are free, and there is no limit to the number of service authorizations an organization can have.

The General Law for Telecommunications also regulates services that utilize spectrum and orbit. This section is not very thorough. It determines that radio-frequency spectrum constitutes public property and will be managed by Anatel. Its use is restricted to authorization by Anatel and will be granted through bidding. The term of validity is 20 years and can be extended only once for an equivalent term.

Anatel will also manage telecommunications services via satellite, regardless of whether access occurs from the national territory or from abroad. Telecommunication services offered in Brazil via satellite will have to give preference to the use of Brazilian satellites, when providing equivalent conditions of those of foreign satellites. The right to exploit Brazilian satellites for telecommunications signals ensures the occupation of their orbits and the use of radio-frequencies destined for control and monitoring of those satellites. It also ensures the provider of telecommunications via satellite a concession of 15 years, which may be renewed only once. The authorization for the satellite use is also obtained through bidding.

4. Restructuring and Privatization of Federal Telecommunications Companies

Competition is seen by the policy makers as the key for the development of telecommunications in Brazil; an effort in this direction is readily apparent in the text of the General Law for Telecommunications. However, the legislation is quite conservative in what it allows the businesses interested in exploiting telecommunications in the country to do. It may not foster the free, ample, and fair competition that it proposes. The law is more interventionist than one would expect, considering the policy makers' intent to open the market and attract investments in order to promote advancement of telecommunications. This may be attributed to the decades of state control of public services; a cultural aspect that is not easy to abandon at first, and creates this paradox between the policy intent taxes, or other legal charges on providers.

The legislation is not as strict on the exploitation of what are considered private services. Those interested in providing these kinds of services will be regulated based on the constitutional principals for economic activity and consumer rights. This chapter also stresses that the law will ensure free, ample, and fair competition in the exploitation of such services. "Freedom is the rule," states the law, which establishes that no authorization shall be denied, except for relevant reasons. The rates for these services are free, and there is no limit to the number of service authorizations an organization can have.

The General Law for Telecommunications also regulates services that utilize spectrum and orbit. This section is not very thorough. It determines that radio-frequency spectrum constitutes public property and will be managed by Anatel. Its use is restricted to authorization by Anatel and will be granted through bidding. The term of validity is 20 years and can be extended only once for an equivalent term.

Anatel will also manage telecommunications services via satellite, regardless of whether access occurs from the national territory or from abroad. Telecommunication services offered in Brazil via satellite will have to give preference to the use of Brazilian satellites, when providing equivalent conditions of those of foreign satellites. The right to exploit Brazilian satellites for telecommunications signals ensures the occupation of their orbits and the use of radio-frequencies destined for control and monitoring of those satellites. It also ensures the provider of telecommunications via satellite a concession of 15 years, which may be renewed only once. The authorization for the satellite use is also obtained through bidding.

4. Restructuring and Privatization of Federal Telecommunications Companies

Competition is seen by the policy makers as the key for the development of telecommunications in Brazil; an effort in this direction is readily apparent in the text of the General Law for Telecommunications. However, the legislation is quite conservative in what it allows the businesses interested in exploiting telecommunications in the country to do. It may not foster the free, ample, and fair competition that it proposes. The law is more interventionist than one would expect, considering the policy makers' intent to open the market and attract investments in order to promote advancement of telecommunications. This may be attributed to the decades of state control of public services; a cultural aspect that is not easy to abandon at first, and creates this paradox between the policy intent and the actual law.

The federal government had, for decades, a monopoly on telecommunications services, from conventional telephone -- including local and long distance services -- to satellites. The government of Brazil, especially the military, had considered telecommunications of strategic importance to the nation's security. The left wing sector of society still considers telecommunication vital to Brazil's sovereignty. Thus, opening telecommunications services to a competitive market, in which foreign companies can participate, was considered a taboo.

Recession for over a decade played a big role in the deterioration of telecommunications services, which had achieved good standards in the 70's. The lack of investments enabling expansion of the network together with the growth of the population created great demand for telephones all over the country. It is estimated that 78 per cent of urban homes, 98 per cent of rural properties, and 46 per cent of businesses do not have a phone line, according to Telebras. Today, there are 10.55 phone lines per 100 people, putting Brazil in the 55th place in the world for phone line density. This presents a big market and profitable business prospects. In addition, the stagnation of telecommunications forced the prices of phone lines to increase to a point that turned this basic service into a luxury.

The advancement of telecommunications technologies globally over the past 20 years has generated a big gap between Brazil and the rest of the industrialized world, posing a substantial problem to the country's developmental ambition. Opening the market is not a matter of liberal ideology but a necessity. The country does not have the resources to invest what is necessary to catch up with the needs of a nation that aspires to be part of the globalized world. The government estimates that telecommunications services need investments of US$ 70 million through the year 2003 in order to reach the standards of industrialized nations.

The new legislation opened the telecommunications services market to competition, but did not reduce regulations. The law permits the government to privatize telephone companies all over the country, including Embratel, the long distance provider; the last definitive stroke against the state monopoly. Anyone who can present a technical-operational capacity to provide services at a minimum standard level can participate in the bidding for concessions to provide their services. Nevertheless, bidders must also comply with numerous requirements and submit to demanding regulation of services and inspections by Anatel.

The agency is directed to manage the provision of services down to the minutest details. Tariffs and fees are controlled by Anatel. The law also requires that providers submit, for agency approval, the draft of the standard agreement to be executed with users, as well as the operating agreements that are intended for administration with foreign providers. In addition, the services concessionaire requires Anatel approval in order to split, merge, transform, incorporate, reduce company capital or transfer stockholder control.

The General Law for Telecommunications institutes a controlled environment in order to ensure ample and fair competition in telecommunications as well as guaranteeing the consumer better service at little cost. However, this may pose a difficulty for the establishment of a truly free and competitive market. Strict rules and severe control may turn away enterprises that otherwise would be interested in exploiting the open market. Thus, the ultimate goal of policy makers -- to attract investments to develop and advance telecommunications in Brazil -- is jeopardized. In addition, compliance with the law may be difficult for smaller businesses and therefore prevent diversification among service providers. Regulatory obstacles to smaller enterprises will most definitely threaten policy makers' second goal; that being ample competition.

The policy on tariffs and fees is questionable considering the goal to attract investments to telecommunications. Control and rigid criteria for service prices tend to chase away businesses; fearing that they will not be able to get the return they expect for their investments. Total freedom, or at least more flexible rules, would add value to the concessions to telecommunications services. However, the system established by the General Telecommunications Law ensures a gradual transition from the total control of tariffs, which have been in effect for decades, to freedom to establish tariffs, which will benefit consumers. This will safeguard the consumer in case competition is not established as expected.

The law states that Anatel will determine how much providers can charge for their services during the first three years. After this period, if competition is successfully established among providers, the agency is allowed to submit them to a regime of tariff freedom. However, providers will still be under the strict supervision of the agency, which can take command of the prices if any danger to free, ample, and fair competition becomes evident. The control of prices is considered fundamental to avoid abuse, since it is expected that at first few enterprises will be providing services.

Once again, a paradox is apparent in this legislation that is aimed to stimulate free and ample competition. Policy makers are so confident in the extremely attractive opportunities for profit, in view of the Brazilian demand for this kind of service, that they are certain investors will be interested in doing business in Brazil, despite the lack of freedom that this legislation may impose. This was proven true during the privatization process. In a highly competitive auction last August, the state telecommunications companies were sold at an average rate of 63.74 per cent above the established minimum price. The strict regulation is seen as a way to prevent a private oligopoly by telecommunications giants. In the end, the control will serve the goal of incrementing a free market.

The General Law for Telecommunications is obviously the outcome of a compromise between the goal of modernizing telecommunications and the culture of monopoly of public services. The debate over foreign participation in the capital composition of telecommunications companies is a good example of this. The primary goal of the government was to have a body of rules attractive enough to foreign investors, while simultaneously preventing foreign businesses the ability to control telecommunications companies in Brazil. This was considered an inconsistency by the liberal sectors of Congress, who argued against any restrictions on foreign capital. Liberals considered these restrictions unnecessarily discriminatory. The result is a law with no explicit restrictions, which gives the government the power to establish limits on foreign participation in the capital composition of telecommunications service providing entities, considering Brazilian interests within the context of its relations with other countries.

The creation of an agency to regulate and inspect telecommunications services in Brazil was considered one of the crucial points of the telecommunications law. The structure and power held by the organization responsible for regulating and inspecting the telecommunications services reflects the freedom that policy makers believe should be given to enterprises interested in operating in this sector. In this case, the rules that establish and direct Anatel may discourage investors, especially the foreign ones, because of the napoleonic power that the General Law for Telecommunications granted the agency.

However, it is the Brazilian Telecommunications Agency's lack of independence from the federal government that causes concern for those considering operating in this sector. The board of directors for the agency is selected by the government and its president is appointed by the President of the Republic. The agency also has a strong corporatist representation as opposed to technical expertise in the regulation of services. Its advisory board is formed of political appointees nominated by the Senate, the House of Representatives, the Executive Branch, and by class entities representing telecommunications service providers, users, and the society. These factors create certain instability and uncertainty because the rules of operation may change as the government changes.

III. CONCLUSION

The General Law for Telecommunications does not reflect the expectations of pro-competition, de-regulatory legislation. However, it addresses the fear of policy makers that an uncontrollable oligopoly may replace the previous state monopoly. Strict regulations indeed inhibit a free market. Nevertheless, the formation of a monopoly or oligopoly, the consequence of overly liberal legislation, would also defeat the purpose of opening the country's telecommunications services to a competitive market. It is important that policy makers be attentive to the development of the competitive market to ensure that the controlling aspects of this law do not suffocate it. It seems crucial that, once established and strong, the telecommunications market is granted some liberties to prosper toward the nation's goals for economic development.

On the other hand, the strength of this legislation, in terms of the competitive market, is the mechanisms it prevents to control and prevent oligopolies. These being prohibition of tariff subsidies, control of prices in general, and rules against economic concentration in the market through mergers and acquisitions. These regulations will prevent larger and stronger companies from suffocating smaller competitors.

In the face of the strengths and weaknesses of this legislation, three likely scenarios are foreseeable: (1) continuity scenario, (2) transformation, and (3) collapse.

1. *Continuity Scenario*

The structure of Anatel shows that the government is not willing to totally give up control of telecommunications services. Also, the tradition of government intervention in the economy is an indication that telecommunications companies will not step easily into a free market. In a conservative scenario, the state dictates the market rules. An oligopoly is established due to strict rules that prevent the establishment of new businesses. The policy makers' goal of developing and modernizing telecommunications in the country is only partially achieved. Services improve but the technology used does not develop as expected. Prices are controlled and there are not many incentives for investment because of the fear that arbitrary rule changes may reduce the profitability of those investments. Investments are kept to a minimum level enabling decent service but not promoting progression toward developed countries' levels of technology in this sector. The average consumer is satisfied because there are more phone lines available and prices are accessible to the middle class.

2. *Transformation Scenario*

This scenario reflects what the President of Brazil, Fernando Henrique Cardoso, stressed in his speech during the ceremony for the new telecommunications legislation; that the power given to Anatel by the General Law for Telecommunications is for the good of all. Moved by a strong interest in a highly competitive market, Anatel represses economic power abuses and creates incentives to diversify the market. Mergers and acquisitions are not permitted so that oligopolies are prevented. Strong competition forces enterprises to improve their services in order to lower their costs for operation and consequently the prices for their services. Thus the market grows and there is diversity among the companies offering telecommunications services. The telecommunications system is made modern and up-to-date, offering the latest technologies available as a result of constant investment in research and development.

3. *Collapse Scenario*

The excessive power that Anatel holds creates a corrupted environment in which corporate interests prevail. Anatel is dominated by a lobby of large corporations that manipulate the agency into creating regulations in order to make establishment of new businesses practically impossible. A private monopoly is installed, controlling the market. Consequently, we observe high prices for poor services. There is no significant development in telecommunications, only maintenance of an obsolete system. There are no incentives for investment because profitability is guaranteed due to the lack of competition. The goal of modernization that would lead Brazil to the "globalized" world is, therefore, not achieved.

The likelihood that one of those scenarios becomes a reality depends on the behavior of Anatel. The fact that the relationship established by this law, between the government and Anatel, is symbiotic and that telecommunications expertise is not a requirement for the appointment of its members constitutes a serious threat to an ample and free market. Nevertheless, the structure of the agency does not necessarily indicate failure of the goal of a competitive model for the telecommunications industry in Brazil.

Return to Top   View Full-screen

Tele-Shastha – an Opportunity for Extension of Health Service in Bangladesh

Fazlur Rahman

South Asia MultiMedia, Bangladesh

ABSTRACT

With population density of 5000 per Doctor and per capita Government expenditure of equivalent of US$ 2.5 per year on health and family planning, the public health service in Bangladesh is in a precarious condition. There is shortage of financial resource as well as skilled medical personnel. In the third world countries, medical treatment calls for not only medication but motivation as well. The strategy needs increasing the productivity of prevailing medical infrastructure as well as existing manpower. Bangladesh has at present a basic telecommunication system up to the rural administrative centers and that could be used for Tele-Medicine and Tele-Health Services minimizing the resource gap between urban and rural areas and provide access to health service wherever needed.

View Full Text

Tele-Shastha – an Opportunity for Extension of Health Service in Bangladesh

Dateline August 1998:

Two third of Bangladesh was under water for more than eight weeks after the worst flood experienced in living memory. Rahim's family had to take shelter on the roof of his corrugated iron shed, with water all around. His little boy Karim fell sick with Diarrhoea. There was no Doctor or medical facility around. So he went with his boat to nearest public telephone call office (PCO). With luck he could get in touch with a Doctor in nearby town. The Doctor advised Rahim how to prepare oral saline and then administer it to Karim. This act of Tele-medicine saved Karim's life.

I. PRESENT STATUS IN BANGLADESH

Bangladesh, with a population of 120 millions, cramped within an area of about 144000 square km, is one of the densest populated areas of the world. It has a scanty infrastructure and is frequented by natural calamities like floods and cyclones too often. Bangladesh has only one Doctor per 5000 persons and one hospital bed for 3200 persons. The per capita annual income is equivalent of US$ 240 and the population density is about 820 per sq. km. The Government can hardly manage per capita annual expenditure of about US$ 2.5 on health and family planning. Primary health care is identified as the key to attain Health for All by the year 2000. Health Services Delivery System follows the overall strategies and directives for providing optimum medicare to its population in the form of curative, preventive and rehabilitative care. The health sector development is emphasized through adopting various programs in the national development plan with the purpose of building a network of primary health care services. The goal is to improve health status of the common masses through reducing morbidity, mortality and poverty related diseases.

In terms of infrastructure, Bangladesh has developed relatively well scattered facilities. At the grassroots union-level one service delivery within a static facility is available for a unit of 20,000 population; one Thana (Police Station) level facility services for 200,000 people; one district level facility (District Hospitals and Maternal and Child Welfare Centers) services for 1.5 million population. One medical-college hospital serves 9.3 million populations. There is a yawning gap between the actual and officially recommended services in those facilities. The efficacy with which the existing health care and manpower are utilized or not utilized becomes clear from the following dismal numbers.

A recent study reports that 39 percent of the district hospitals function as comprehensive, emergency obstetric care (EOC) facilities. 64 percent of the Maternal and Child Welfare Centers and 56 per cent of Thana Rural Health Centers render the minimum basic EOC services. The crisis of maternity related deaths is concentrated in the countryside. Roughly 7 out 10 of the below five age group are underweight, compared with 4 out of 10 in Sri Lanka. Over 90% of all children suffer some degree of under-nutrition. More than one quarter of them are measurably undersized. 70% of mothers suffer from nutritional anemia. Some 30000 children go blind due to Vitamin A deficiency and about 2 million suffer from iodine deficiency.

Although the capital city of Dhaka possesses a good number of relatively well-equipped tertiary care institutions and sophisticated hospitals, the general low income population of the city still do not have adequate provisions for general treatment. The Medical College Hospitals and tertiary care institutions are over-burdened with patients and hardly an acceptable standard of treatment can be provided due to rush of patients from different parts of the country to these hospitals. There is lack of collaboration between different authorities and agencies responsible for health care delivery and hence there is inefficiency of management.

There are hardly any qualified Doctors available in rural areas of Bangladesh where 80% of the population live. Doctors posted in rural areas do not normally want to stay there, as basic amenities like educational and recreational facilities are not available. The rural health complexes constructed with relatively high cost can hardly attract Doctors from cities, resulting in meager health service in rural areas and rush of rural patient in the over crowded hospitals in cities.

For treatment in Bangladesh, the rural poor flock in city hospitals and well to do city dwellers fly to neighboring countries. Although a number of private Medical Hospitals and Clinics are being set up in the country, the number of patient going for treatment in neighboring countries like India, Thailand and Singapore are increasing at an alarming rate. The lesser availability of specialist Doctors in Bangladesh is compelling the patients to make arduous and costly travel to foreign countries for treatment.

II. NATIONAL HEALTH POLICY

The proposed National Health Policy of Bangladesh intends 60% of budgetary allocation for health sector to be spent for primary health care services under the Essential Service Packages (ESP), the rest 40% for infrastructure development, salaries and meeting other costs. Women, children and the poor would have priority claim on public health delivery systems, particularly in the countryside and depressed urban neighborhoods. The public health shall be community managed and there shall be participatory delivery mechanism for improving the effectiveness with which the existing facilities and manpower are utilized. For every 6000 people there will be one community clinic to ensure better health care services A special focus of the policy is to provide services to maximum number of people (about 85% of the rural population).

III. TELECOMMUNICATION IN HEALTH SERVICE

With such a backdrop and limited resource, difficult choices are to be made for providing cost effective health care services. For example, arguments between building new hospitals versus strengthening primary health care. Whether to allocate resources to build a large city or urban hospital or a large number of rural community clinics. Or whether to invest disproportionately on specialized urban doctors rather than village health workers. Resources spent on expensive curative care benefit fewer and relatively richer people than if the same resources are spent on primary and preventive care services that address the health needs of the poor. The other issue is the implementation strategy. There will be shortage of fund as well as shortage of skilled medical personnel. The strategy shall call for increasing the productivity of existing medical infrastructure as well as existing manpower. The strategy so far gave a premium to concentration and centralization of medical facility. The transition to Tele-Medicine and Tele-Health are now reversing that trend. The driving forces behind this re-structuring process are the need to get closer to the patient / citizen, make better use of skills / increase flexibility, and reduce fixed costs / concentrate in core competencies.

Telecommunications can assist local physicians, health care givers, policy makers to :

- Reach out to their communities
- Acquire a bearer understanding of the basic primary health care goals
- Discuss, motivate and analyze appropriate interventions
- Increase productivity of prevailing medical infrastructure as well as of existing manpower

In order to have a realistic chance to finance the essential package and meet the health and population sector needs, the Government shall have to strategies for mitigating the inadequacy of fund as well as medical manpower. Although Telecommunication is an overwhelmingly powerful tool, its application beyond social well being is comparatively new in Bangladesh. Its awesome power is only being recently applied for bettering commercial and business activities. The introduction of Internet and e-mail services has changed the perspective to use the power of telecommunication for inter-active applications for betterment of the end results. The possibilities of its application in improving health service are still not well understood by people involved in the profession. Tele-Medicine & Tele-Health are important applications to improve the medical quality and to enable experienced experts in cities to help the doctors at rural or remote sites diagnose patients. Tele-Shastha (Tele-Medicine + Tele-Health) has the potential to improve the Health and Family Planing Service in Bangladesh cost effectively. The concept of Tele-Medicine and Tele-Health is new in Bangladesh. In a densely populated poor country like Bangladesh the application of Tele-Medicine & Tele- Health could be a way out for Tele-Shastha (Health) – an Opportunity for Extension of Public Health Service in Bangladesh.

Indicators of Health Service in Bangladesh	
Total Number of Hospitals	919
Government Hospitals	639
Persons per Hospital Bed	3288
Persons per Physicians	4725
Life Expectancy at Birth	58
Per Capita Government Expenditure on Health and Family Planning	(US $) 2.5

Source: Compiled by BBS

Most of the patients in the rural areas need simple medication and hardly need to see a Consultant Doctor. The Doctors available in the city areas can prepare list of basic medical data those are normally required to examine a patient. These basic medical data like symptom, temperature, pulse rate, general and specific condition of a patient in the rural health complex could be obtained by a local medical personnel, nurse etc. and these could be transferred to relevant Doctors in the city through telecommunication means. The Doctor can then advice the necessary medication or directs the patient for further investigation.

In the Rural Health Centers of Bangladesh there are insufficient number of or lack of physician and/or specialists necessary to serve the population. The available facilities and technologies there are very limited and there is no system for continuing education for existing health care providers. Tele-Medicine and Tele-Health are promising and appropriate cost effective applications which have the capability to revolutionize the Public Health Service in Bangladesh. These can effectively provide necessary medical consultation support to the rural medical practitioner and/or Doctors and supporting staff from City Hospitals. These can also mitigate the resource gap in medical equipment with support from City Hospitals. Tele-Medicine and Tele-Health can help to lessen the cost of medical services.

1. ***Tele-Health***

- Some of the Tele-Health applications supported by these technologies include preventive programming, education and training for health care providers, medical staff, patients and the community in the following areas:
- Prevention health problems and promotion of methods of prevention and/or control;
- Personal health care and proper nutrition;
- Promotion of environmental concerns, especially for an adequate supply of safe water and basic sanitation;
- Maternal and child health care, including family planning, pre-natal care and well child care;
- Immunization against major infectious diseases;
- Prevention and control of locally endemic diseases;
- Appropriate treatment of common diseases and injuries;
- Training in and provision of essential life saving therapies (drugs to control hypertension, insulin for diabetes).

2. **Tele-Medicine**

Some of the services those could be provided by the Government Hospitals through Tele-medicine are:

- Medical consultation
- Diagnostics
- CAT scan, electrocardiogram, x-ray, ultra sound data transmission and interpretations
- Patient transfer / referrals
- Medical records transfer
- Transmittal of prescription and doctor's orderS

- Medical database access
- General administration
- Research links
- Central data collection and organization
- Retrieval of medical literature
- Continuing education of doctors; nurses and other medical personnel and
- Training

IV. EFFECT ON GOVERNMENT HOSPITALS

- Introduction of Tele-medicine and Tele-health facilities shall enable the Government hospitals as follows:
- Doctors from different hospitals shall be able to exchange patient records, X-ray, CT or other kind of high-resolution images and other information and consult with each other through real time discussion.
- It will be possible for patients living in the remote areas to receive advance medical services promptly from medical experts living in cities.
- It will be possible to avoid duplicate investments of the like medical equipment.

V. BENEFIT TO PRIVATE CLINICS

The Private Sector initiative in Health Development is flourishing in Bangladesh in recent years and there has been Public-Private collaboration for providing quality health care. Unfortunately, lack of utilization of Tele-Medicine and Tele-Health applications are rendering these efforts utterly inefficient. Normally Private Clinics provide medical services to well to do patients. Many of such patients are now traveling abroad for treatment or medical check-up. The private clinics at the district towns can have link-ups with private clinics in the capital city (Dhaka), where the experts / consultant doctors are available. Through Tele-Medicine, the patients in the district towns can get the medical facilities available at Dhaka and the costly and laborious travel could be avoided. Similarly, the private clinics at Dhaka can establish business links with private clinics/hospitals abroad and thereby obtain Tele-Medicine service from abroad. This will reduce the necessity of traveling abroad for medical treatment.

VI. ROLE OF DONOR COUNTRIES

While it is difficult for Government of Bangladesh to increase budget for health and family planing, donor countries role in providing necessary equipment for Tele-medicine for the Public Hospitals and

Clinics can play a decisive role in improving public health service in Bangladesh. This will also call for link-up of cooperation between the concerned hospitals in Bangladesh and those of donor countries.

Problems	**Possible Relief through application of Tele-Medicine & Tele- Health**
Inadequate coordination between different care providers (Government Departments, Autonomous Bodies, City Corporations, NGOs, private organizations etc.	Government and all other stakeholders could establish coordination with a view to providing comprehensive curative, preventive and promoting health care to the population.
Large population versus small number of Health Facilities particularly for in-patient medical care.	Tele-Medicine application can support the small Sub-Health Center facilities from the Main Health Center and thus serve large number of population.
Lack of properly developed referral system that results in unbearable burden of work to the referral hospitals.	Tele-Medicine application can support Health institutions to have an equitable distribution for optimum medical care at different stages with an established referral system.
Lack of precise standard of health care at the primary level due to absence of field staff.	Tele-Medicine & Tele-Health applications can support private & public facilities, standard health care to affluent as well as disadvantaged segment of population.

Source: The Daily Star, Bangladesh

A Floating Medical Center during 1998 flood in Bangladesh

VII. ROLE OF NGOs

There are a few joint venture clinics and hospitals run by International Agencies and NGOs. The ICDDR (International Center for Diarrhoeal Disease Research) [Bangladesh] tops the list for its name and fame for treatment of diarrhoeal diseases. Some joint venture hospitals are coming up in order to help technology transfer in the specialized field of medicine, surgery, cardiology etc. Unfortunately, the application of Tele-Medicine and Tele-Heath technologies in these institutions is still minimal. There are many Non-Government Organizations (NGO) working in Bangladesh. It should be comparatively easy for the NGOs working in Bangladesh to establish relations between private clinics in the area of their work and similar private clinics in their own countries. They can set up working relations for Tele-Medicine cooperation between the local clinics/hospitals and those in their parent countries and that can effectively improve better health service for the local people.

There are a few joint venture clinics and hospitals run by International Agencies and NGOs. The ICDDR (International Center for Diarrhoeal Disease Research) [Bangladesh] tops the list for its name and fame for treatment of diarrhoeal diseases. Some joint venture hospitals are coming up in order to help technology transfer in the specialized field of medicine, surgery, cardiology etc. Unfortunately, the application of Tele-Medicine and Tele-Heath technologies in these institutions is still minimal. There are many Non-Government Organizations (NGO) working in Bangladesh. It should be comparatively

easy for the NGOs working in Bangladesh to establish relations between private clinics in the area of their work and similar private clinics in their own countries. They can set up working relations for Tele-Medicine cooperation between the local clinics/hospitals and those in their parent countries and that can effectively improve better health service for the local people.

VIII. IMPROVING PRODUCTIVITY OF CITY HOSPITALS

Generally, in cities there are hospitals, capable doctors, and nurses in the hospitals, but there are little or no means of telecommunication between wards. It takes time to gather the necessary doctors for an emergency case and offers insufficient medical treatment. Thus the available but scarce resource remains less productive, in absence of proper telecommunications. PBX telephone facility with mobile (wireless) hand-held telephone sets or at least pagers can effectively improves the situation.

1. *Tele-Shastha in Bangladesh*

One might wonder why Tele-Health and Tele-Medicine are not flourishing in Bangladesh despite the obvious benefits they can bring. The reasons are:

- Telecommunication is still scarce in Bangladesh. It has a telephone density of about 4 telephones per 1000 population. 80% of its people lives in the rural areas, where there are less than 3 telephones per 10000 population. The philosophy of application of Telecommunication (Tele-Health and Tele-Medicine) is not properly understood by the Local Health Administration and persons involved in medical profession.

- The culture of referral system is minimal and is confined within the boundary of Hospitals in Bangladesh. There is vested interest amongst the persons involved in the profession, as one thinks that referring one patient to another Doctor is merely a lost earning / business opportunity. That Tele-Medicine not only helps the patient but is beneficial to the Medical Practitioners as well, need to be brought to light to concerned people.

- "Palli Chikitsak" (village para-medical person) and "Dai" (midwife or non-qualified nurse helping child-birth) are indispensable part of medical service in Bangladesh. Very low per capita income and low rate of education resulted in meager health service. Preventive timely and appropriate medical advice could be more effective service than providing curative medical treatment itself. Motivation for taking pure drinking water, maintaining personal hygiene, proper sanitation, feeding breast milk to infants, taking iodized salt, eating fresh vegetables etc. can provide real help to those who need most. Coordination in mental and physical education is very important for rendering health service in Bangladesh. The Tele-Medicine link-up between resources available in rural areas (Rural Community Clinic, Palli-Chikitsak, Dai etc.) and those available in cities can effectively reduce the breach of accessing Health Service. Tele-Shastha can bring qualitative improvement in them and accelerate the Health Service. However, misuse of the facility could be dangerous and care must be applied through education.

- When Drug Policy was introduced in Bangladesh a few years back, it was vehemently opposed by section of Medical Personnel and well to do people. However, once introduced, the new Drug Policy made medical treatment more accessible to general people. The same is likely to happen with Tele-Shastha as well.

VIII. THE VISION

The per capita income in Bangladesh is too meager to provide any meaningful standard of public health service and there is no possibility of substantial raise in the public health service expenditure. With the latest technological developments in the Telecommunication sector and convergence of Information Technology, it is now possible to create and transfer the health service anywhere in Bangladesh by adopting Tele-Medicine and Tele-Health (Tele-Shastha) applications. Despite its benefit, ignorance and lack of initiative are causing slow spread of Tele-Health and Tele-Medicine applications in Bangladesh. It has the potential to crack any vested interest in the profession. The main impact of Tele-Shastha will apply to the vast majority of the people living in the rural and suburban areas, who generally fall into the poorer and disadvantaged section of the population. A new vision for the society, and a new spirit of cooperation between rich and poor people are required. The deployment of Tele-Shastha application could provide the platform for such a national reawakening for accessing basic health service for the people living in the Bangladesh.

IX. REFERENCES

Author	Source
Telemedicine and Telehealth in Pacific Islands Region	Steven D.Bice & others PTC'96
From Radio Relay Links to Telemedicine Proposing "The Telecom Aid Activity"	Iwato Asahara PTC'98
Telemedicine through Shernet	David Yong Chang Zhao PTC'98
Health for All	AZM Obaidullah Khan Bangladesh
The Information Infrastrcture Meeting the Need of Bangladesh	Fazlur Rahman PTC'96
GRAMTEL A Vision for Rural Bangladesh	Fazlur Rahman Asia Pacific Telecommunity Journal Jan 1998
Health Services in Dhaka City Problems and Solutions	Professor Shah Monir Hossain Director, Medical Education and Health Manpower Development

Telecommunications in India and the Challenges Toward Growth

SOWRI RAJAN KOMANDUR

Department of Telecommunication, India

ABSTRACT

In this paper a detailed analysis of the Telecommunications in India especially in the light of the new liberalisation policy and the opportunities and challenges the private sector has to face to survive has been made. Also the working of the Telecom Regulatory Authority of India and the impending decisions from the Government which help the participation of private sector and the growth of Telecom Sector was discussed.

View Full Text

TELECOMMUNICATIONS IN INDIA AND THE CHALLENGES TOWARDS GROWTH

INTRODUCTION :

Telecommunications is now universally acknowledged as one of the prime movers of the modern day economy. It is of vital importance for a developing country like India. Ever since the necessity for high quality telecommunications services was realised by the Government of India, the National Telecom policy has become a part of the programme of economic liberalisation adopted in the year 1991. This National Telecom Policy provided for private sector participation to supplement the efforts of DoT in Basic Telephone Services. After protracted struggle, the first private basic Telephone Operator came into existence in June 1998 in the state of Madhya Pradesh. With all the accelerated development taking place in the field of telecommunications, the present telephone density in the country is about 1.72 per hundred population which is even much less when compared with other developing countries. As teledensity is low, there is great potential for the growth of Telephone demand with the accelerated growth of economic activities.

TELECOM POLICY AND GROWTH :

The Government has initiated the process of privatisation after the new Telecom policy of 1994 was announced and the deregulation of the sector has been set in Everybody looked at India's privatisation process as a promising one, but due to some of the problems that developed subsequently, there was delay in the process. We all know that India's Telecommunications Industry has received tremendous attention from investors and industry players both nationally and internationally. The growth potential of India is next to China. The main objective of the Telecom policy is to ensure availability of telephone on demand, reduction in the waiting list, increase telephone penetration and upgrade the network. The National Telecom Policy is the elemental guide in the development of the sector. The NTP should address all the basic structural parameters of the telecommunications sector like ownership and licensing, private sector entry and competition, regulation, restructuring of the dominant operator and legislation.

After the announcement of the liberalised Industrial Policy in 1991, production of all types of Telecom equipment was delicensed, permitting private sector to enter. Later on Foreign companies were permitted to have majority equity share. The main emphasis of 8th Telecom plan (1991-97) of the DoT, was for rapid expansion of the Telecom network and transforming into a modern and efficient one. With the progressive achievement by the DoT in digitilizing the switching and transmission network in the country, it can be said that to a very great extent the important objectives of the 8th plan were fulfilled. Now the DoT is in the race with other private companies in achieving the objectives of the ninth Telecom plan (1997-2002) in further modernising the network, introducing better and new technologies and also making available to the customers the value added services like cellular, paging, E-mail, Internet and other high speed data services through VSAT at international standard.

The growth of telephone network during the period 1992-1997 has been phenomenal, nearly 8.73 million new telephone lines were added. A total of 267,832 villages out of about 600000 villages in the country have been provided with telephone facilities. The demand projections made on the basis of actual demand during the period 1991-97, indicate an average growth rate of 16.5%. Based on the growth rate, the demand from 1997-2007 was estimated to be 81.83 million telephones. Not only providing telephone connections, the DoT is planning to introduce ISDN, in all major cities, Internet Services, Mobile Satellite Services, Personal Communication Services, Multimedia Services. The Indian Telecom Sector witnessed a gradual and functional reform as a result of the policy of liberalisation of the Government. Major changes since 1991 have contributed for the rapid growth of the Indian Telecommunication system. The liberalisation of equipment import, lowering of import tariffs opening of Telecom services to private sector and the liberalised foreign investment policy are some of the changes.

The DoT and MTNL to-gether added 32.57 lakhs new telephone connections (Direct Exchange lines) during 1997-98. This is the highest figure ever achieved so far. The number of telephone connections in the country thus increased from 145.43 lakhs on 31st March 1997 to 178 lakhs on 31st March 1998 with a record growth of 22.4 percent during 1997-98.

The DoT's new tender norm of awarding delivery rating based on whether they are first time suppliers and the new equipment purchase norms stipulated by the DoT had raised the hackles of the industry. Two major companies RPG Telecom and Finolex - Luscent (Formerly AT & T) approached the High Court contending that the new norms will keep the new entrants out of the contention. On the other hand the DoT says that the new procurement system is aimed at getting quality products at competitive price and that there is every endeavor to provide level playing field for all the players, But the Telecom Equipment Manufacturers Association and other think that it would be better if the DoT reverts to the earlier procedure of dividing the orders to all suppliers at the lowest quoted price.

The DoT has decided to increase the all India connectivity target for 1998-99 by an ambitions 25 per cent. The DoT is planning to increase the exchange capacity by 36.5 lakh lines. The DoT will provide 31 lakh DELs and the MTNL will add remaining 5.5 lakh lines. The DoT has planned for an annual plan outlay of Rs. 10,900/- crores for 1998-99. To meet the growing demand for telephones DoT wants to install 24 million additional lines in the next five years. The demand projection made on the basis of actual demand for the post seven years between 1991 to 1997 indicate an average growth rate of 16.5 per cent according to DoT sources. To meet the growing demand, the DoT is planning to install on an average 25,000 to 35,000 Km of optical Fibre Cable annually.

NINTH PLAN STRESSES EXPANSION MODERNISATION OF TELECOM SECTOR :

A Capital outlay of at least Rs. 83,000 crore is envisaged for the Telecom sector and is to be primarily financed out of internal and extra budgetary resources generated by DoT and MTNL. However, to compensate the Government operations in unremunerative areas, adequate budgetary support may be provided by sharing of licence fees. A part of the licence fee may also be used to finance the development of Telecom infrastructure. The planning commission has recommended that the number of operators may be increased to provide greater competition. Under the present policy, only two private operators are permitted in the cellular, mobile and radio paging services. Planners have also recommended that long distant services and international connectivity sectors should be thrown open in due course of time. The DoT monopoly ends in 1999, while VSNL one ends in 2004.

PSUs are also to be permitted to provide value added services (VAS). An integrated project for creating the basic infrastructure for VAS and other Telecom services is to be taken up on pilot basis in Punjab, Orissa, Kerala and Maharashtra. Policy making including licensing is to be separated from operational wing of DoT to take the Telecom reform process to its logical conclusion. The DoT network is to be restructed with a realignment and strategic alliances with private sector companies. The commission has also recommended that the Telecom Regulatory Authority (TRAI) be made truly autonomous and self financed body supported by a team of professionals from diverse fields. The document concedes that basic services have not yet taken off and has asked for adequate steps to ensure speedy and effective operations of basic services by the private sectors. However it has stressed on ensuring adequate rate of return on the investment of the private operators.

Basic Telecom services have grown at a rate of 17 percent annually over the past decade. The commission has estimated the demand at beginning of the 9th plan to be at 174 lakh direct exchange lines (DELs). This is projected to grow to 360-380 lakh DELs by the year 2001-2. Thus an additional 186-236 lakh additional DELs would have to be provided by the Govt. and private sector during the plan period.

A target of 2.39 lakh village public telephones (VPTs) has been set for the plan. Rural connectivity has been identified as a major thrust area, as only 2.678 lakh villages out of 6 lakh villages have been provided with telephone facilities. A target of creating additional 18 lakh lines trunk capacity (TAX) is proposed in long distance connectivity. This capacity is to be created by government as it is a monopoly of the DoT. It has also set a target of 1.4 lakh route kilometers of optical fibre system during the plan period. Other major targets include one public call office (PCO) per 500 people in urban area, provision of adequate number of PCOs in public institutions like hospitals, shopping centres, educational centres along with STD PCOs after every 10 Km on the National Highways.

BASIC SERVICES :

The current status of Basic Services is detailed below.

Companies	Circle	Present Position
Bharati Telenet	Madhya Pradesh	Signed the license started commercial service from 4.6.98.
Reliance Telecom	Gujarat	Signed license
Hughes Ispat Ltd.	Maharastra, Karnataka	Signed license for Maharastra
Essar Comm vision	Punjab	Signed license
Tata Tele services	Andhra Pradesh	Signed license
Tele link Network India Ltd.	Rajasthan	Signed license

Techno Telecom Ltd.	Bihar	Licensed to be signed
HFCL Bezeq Telecom Ltd.	Delhi, Haryana UP (West) and Orissa	LOIs Issued
Basic Tele Services Ltd.	Tamilnadu	LOI accepted case pending

Bharti Telenet which is a joint venture between Bharati Telecom and Telecom Italia (70:30) already entered into service in Madhya Pradesh State. Tata Teleservices in Andhra Pradesh is also working towards entering the service. Huges Ispat and Reliance Industries are expecting to start their projects in Maharastra and Gujarat respectively next year. Thus the DoT's monopoly in local access, intra-state long distance calling, data and Internet services has now been broken. Six basic Telecom operators signed licence agreements to roll out services in some of circles. The DoT has to face competition in the circles, and the imminet deregulation of domestic and international long distance markets. It is ultimately the business customers who constitute the main chunk of the DoT's revenue. About 15 to 20 per cent of the customers account for revenue ranging from 65 to 80 per cent. Also the DoT gets huge segment of business, about 40 per cent of its revenue accrue from the domestic long distance services. About one third of this revenue is from intracircle calls. The total market thus put to-gether comes to about US$ 533 million and the local call market is worth about US$ 1.4 Billion. The private Telecom operators are expected to use their own transmission back bones in cities with high intra circle long distance potential. The Internet service providers are being allowed to set up their own transmission links for Internet traffic. The DoT is spending much on manpower costs. Nearly 60 per cent of its operating costs are towards salaries etc.

The Department of Telecommunications (DoT), Videsh Sanchar Nigam Limited (VSNL) and Mahanagar Telephone Limited (MTNL) are expected to fund the requirement of funds amounting to Indian rupees 262 million (US $ 6.2 million) for the financial year 1998-99. The new levy of 0.5 per cent on the revenues of all Telecom service providers would go to TRAI. Also the TRAI is proposing a processing charge for each petition at Rs. 5000 (US $ 192) The TRAI is funded by the disbursements from the central budget.

The basic wire line telephony is being built. The private basic services in the country became operational on 4 June 1998 in the State of Madhya Pradesh by the private basic telephone operator Bharti Telenet. Except for Bharti Tele net, all the remaining five licensees who have paid the first instalment of license fees are yet to start the services in their respective circles. However all the service providers are in the process of understanding the continuous change in the market needs which are directly influencing financial viability of the projects. At present most of the operators have the objective of implementing a network in the shortest time and launching commercial services at the earliest. In the initial years, they will deploy fixed-wire less technologies in the network on a high scale. The initial phase of finalisation of the network plan, roll out/ demand pattern took a long time. There are four major elements which have a direct impact on the operators' strategy of network deployment and its growth plans. The coverage and capacity requirements drive the technological and investment plans. The net work quality and performance keeps varying as the network grows and it is thus a continuos process.

TECHNOLOGICAL DEVELOPMENTS :

There are new, more innovative and cost effective technological developments to attract and meet the demand for services in India. The Indian Telecom Industry is being revolutionised with the introduction of host of new products. For instance first time in India code Division Multiple Access (CDMA) based wireless in local loop (WLL) network will be introduced commercially. Other technologies like Alcatel 1000 S 12 switching system armoured Fibre Optic cabling and Intelligent Network introduced commercially in Madhya Pradesh, first time. The DoT has planned to integrate the wireless in local loop (WLL) technology with C-DoT . One of the unique features of the technology that would emerge is that it does not require a power source at the subscribers' premises. Basic private service operators are interested in wireless, but to use this technology, they require higher band-width, the major part of which is being held by the defence services.

BPL Mobile has come out with three tailor made packages such as value Eco, value business and value premium to cater to the various categories of the subscribers. Each of these plans has been made extra attractive by way of a certain amount of free air time and reduced air time charges as low as Rs. 2.50 per minute under all value plans the access fee for value Eco would be Rs. 820, value Business Rs. 1,340 and value premium Rs. 1,960. These packages also came with the free hand set or free SIM and activation charges. For a specified period each month, certain amount would be deducted from the subscribers' bill to the value of the hand set chosen or SIM and activation charges.

Siemens Public Communication Networks Ltd. (PSCNL) is introducing and making available in the Indian Market future technologies like synchronous digital hierarchy (SDH), EWSD innovations, dectlink radio access, broadband-CDMA (B-CDMA) link radio access, Internet solutions and ATM networks.

The company's equity is divided between the German parent, Siemens AG which has 70 percent and Siemens India which has 30 percent.

The company's focus is the public market including the Department of Telecommunications, Videsh Sanchar Nigam Ltd. Mahanagar Telephone Nigam Ltd., the mobile phone market and the basic services market. The B-CDMA launched now is basically the right product for this market. The new product offers new operators a wide range of facilities with 64 KB and copper line quality. It also provides three times faster fax services."

RADIO BASED SERVICE :

The B-CDMA technology can be used to provide radio based telecommunication service in a point to multi-point network, It is a spread spectrum multiple access technology which provides subscribers access to the public switch telephone network, on demand, using special radio signals which transport voice, data and fax services. It is an optimal solution for WLL and PCS.

B-CDMA offers an umbrella coverage and all the hotspots - crowded area - are addressed by Dectlink. This is for cordless systems and also for radio in the local loop applications. It is easily installed and can cater to 3,000 subscribers per square kilometer while the B-CDMA can handle 1,000 subscribers per square kilometer.

Private operators will have to operate in a competitive market. They would have to compete not only with the established DoT network but also with established mobile operators.

Dectlink is designed to handle dense areas. As subscribers grow and density grows, wire lines can be installed and one can put fibre optic cable and go with SDH. The DoT has an advantage of having its cabling already in place which new operators do not.

One of the main products of SPCNL is the intelligent network (IN) of the cellular market which provides operators with features like prepaid cards, virtual private networks and many other features under the IN platform giving operators a competitive revenue earning situation.

BASIC SERVICES SEGMENT :

In the basic sector, an interesting marketing situation prevails. The DoT is now confronted with competition from the fast emerging private sector market which has a new set of requirements. They too want add-ons like IN, ISDN and they also want to add on data communications. The Private Operators are therefore providing them equipment such as ATMs and IN and other features so that they can quickly compete with the private market. The B-CDMA which is two years ahead of its time will be offered to the DoT as it has plans to go in for WLL to cover the market. This will enable it to offer services like data, voice and video conferencing. SPNCL can offer highly differentiated price, better service and connectivity which the others cannot - that is the strength of Siemens, as claimed by the company.

CELLULAR MARKET's PROBLEM :

The cellular phone market is growing at around 20 per cent per annum. Today, operators are confronted with a situation where numbers have ceased to matter. The name of the game is increased usage per customer. The market is changing and the cellular market, having passed through its startup phase, is going through its development phase. It constitutes about 75,000 users but 25 per cent of the subscribers are non-users. It has ceased to be technology driven and has become a consumer electronics market. The price of the terminal will keep falling, operators are offering packaged services and penetration is going to increase.

SPCNL plans to introduce pre-paid cards and has already submitted its proposal to operators in Mumbai and is hopeful about its introduction in the next two months.

SPCNL has a 100 per cent export oriented unit for software development in Bangalore where there are about 450 engineers. Its Gurgaon office handles planning and projects, SPNCL employs about 150 people at its Telecom switch manufacturing unit at Salt Lake, Calcutta, where it has also started manufacturing telephone handsets. Switching devices contribute about 40 per cent of SPCNL's sales and the Calcutta unit can double capacity without additional investment. Over the last four years, the company has invested Rs. 80 crores in its units.

The new products will be totally imported. The gap between completely imported equipment and CKDcomponent level-including the customs duty is too small to justify its manufacture here. Unless there is reduction in component duty and the gap exceeds 30 per cent, it is unviable. The landed cost of the imported equipment against an indigenously manufactured item is sometimes lower considering duties, levies and octroi.

The company also cites the high cost of capital as one of the major deterrents. The interest costs here are too high. This cost factor is very important.

There was an addition of 500000 subscribers to the cell phone user base in 1997. At the end of 1997, there were 772,000 cellular subscribers on 34 networks in the country. From scratch in the beginning of 1997, the market share of the companies in the circles grew progressively.

TATA CELLULAR's NEW PACKAGE :

Tata Cellular is offering an innovative package called TCD Plus, which provides long distance calling to places within and outside the Andhra Pradesh State, at rates cheaper than the STD.

Earlier (in November last) it had introduced a facility called TCD that provided subscribers access to long distance calls between Hyderabad, Vizag, Vijayawada and Guntur only. The TCD Plus offers subscribers the facility of long distance calling to 60 destinations from Hyderabad, and over 100 places from Vizag, Viajayawada and Guntur.

Calcutta, Chennai, Cuttack, Bhuvaneshwar, Jamshedpur, Kharagpur, Dhanbad, Patna and Varanasi are some of the cities outside the State which can be accessed from Hyderabad. The rates work out to be five per cent to 29 per cent cheaper than the STD rates, depending upon the time and destinations.

Tata Communications Ltd. (TCL), said it was the first cellular operator in the country to offer such a facility.

To avail of the TCD Plus facility, one has to be a regular subscriber and also pay a refundable deposit of Rs. 3,000.

PAGING :

The paging market in India is showing mixed signals. Though some paging companies are planning to under their net works. Max page, the paging service arm of Hutchison Max Telecom which has got a license for the city of Bangalore is planning to undertake restructuring operations. Mobilink has joined with Beltron paging, a Bihar state Government undertaking to widen its network. Thus Mobil link will be able to reach Patna, Varanasi, Ludhiana, Amritsar and Nagpur. Hutchison Max. Telcom will transfer all its radio paging subscribers in the Punjab Telecom circle to Punwire but will continue to operate the services in other cities. The decision to transfer customers follows Max. Telecom's inability to pay the license fees for Punjab circle and the decision by the DoT to cancel the license. Max will however continue to provide services in Chandigarh, Ludhiana, Bangalore, Ahmadabad, Hyderabad, Pune and Vadodora. In the first phase tenders were called for 26 cities and in the second all Telecom circles minus the 26 cities were offered to the private sector. It is expressed by the private operators that 60 to

70 per cent of revenues in Telecom services businesses are going to the Government in one form or the other, a major component being the license fees. Company officials feel that their financial woes would have eased had the government granted an extension in license period and allowed connectivity through VSAT. Though proposal have been made to various forums, the DoT has been unable to respond to these proposals in a decisive and positive manner. The DoT has decided to cancel the Punjab license of Max. page.

ANNUAL TELECOM GROWTH RATES

Year	Percentage annual growth	Tele density
1986	9.4	0.41
1987	10.1	0.45
1988	9.0	0.48
1989	9.6	0.51
1990	9.9	0.56
1991	10.6	0.60
1992	14.5	0.67
1993	17.5	0.77
1994	18.1	0.90
1995	22.1	1.08
1996	22.3	1.28
1997	22.8	1.72

DOT TELEPHONE DEMAND PROJECTIONS

Year	All India demand Projections (In million numbers)
1999	24.11
2000	28.09
2001	32.73
2002	38.13
2003	44.43
2004	51.75
2005	60.29
2006	70.74
2007	81.83

India operates one of the longest Telecom networks in Asia and the 12th largest in the World comprising of over 22, 212 Telephone exchanges with a total equipped capacity of more than 17.74 million lines. The long distance transmission Network has about 1,50,000 route Kilometers of terrestrial Microwave radio and co-axial cables and about 52,500 route kilometers of optical fiber cables. Full automatic International Subscriber dialing (ISD) service is available to almost all countries. Other services like Intelligent Network, Frame Relay and Asynchronous Transfer Mode for wide Band multimedia applications are being introduced. The total investment required by the DoT and MTNL during the next ten years would be of the order of US $ 65 Billion and private sector will require to invest about US $ 24 billion. Private initiative would be used to supplement the departmental efforts to raise additional resources both through internal generation and adopting innovative means like leasing, deferred payments, Build operate and Transfer (DoT), Build lease and Transfer (BLT) etc.

The then Government chose to adopt the system of auctioning licenses. But in most countries where liberalisation in the Telecom sector has taken place, licenses are not granted on the basis of any auction but on some form of revenue sharing which results indirect investment being made by the private operator in building up the infrastructure. In view of this a section of the DoT as well as private operators are in favour of abandoning the concept of license fees and resorting to revenue sharing arrangement.

It is felt by the Telecom Equipment Manufacturers that restrictions are inhibiting the demand for

Telecom equipment like provision of additional frequency spectrum to licensed Telecom service providers, the tendering procedures of DoT/MTNL which limit the capability to instal not more than 2 to 3 million new lines every year and the imposition of unviable tariffs on private service providers.

The service providers of private sector expect the DoT to be restructured into a separate operating organisation, and also strengthen the TRAI, reformulate the license fees, license agreements and tariffs in consultation with TRAI.

RADIO FREQUENCY SPECTRUM:

DoT and the Defence Ministry have reached an understanding on making adequate radio spectrum available for cellular and wireless local loop (WLL) services. At present over 70 percent of the available radio spectrum in the country is controlled by the defence sector. In 1981 National Frequency Action Plan gave large spectrum range to defence sector since not many users existed at that time.

The draft Global Mobile Personal Communications Systems (GMPCS) policy prepared by the DoT proposes a combination of license fees and revenue sharing agreement. This draft policy is awaiting the sanction of the Government: GMPCS services promise a seamless global mobile connectivity through a constellation of satellites. The ICO system architecture already provides for rerouting calls through VSNL since the later has won the bid to locate one of system 12 satellite access Nodes (SAN) in India. Since iridium has located a gateway at Pune to be operated and maintained by VSNL, it may have to operate the system within regulatory environment and route call through the ground segment i.e through VSNL. DoT has already issued the letters of intent (LOI) to three companies Indium, ASC and ICO to provide services in India.

REGULATION :

The Telecom Sector is administered centrally through the DoT in the Ministry of Communications. The Indian Telegraph Act, 1885, The Indian wireless Telegraph Act, 1933 and the Telecom Regulatory Authority of India Act, 1997 govern this sector. For the purpose of service provision, the country is divided into 'circles' corresponding to the boundaries of the states of the country. Long distance transmission is grouped into four regions.

It is more than a year, the Telecom Regulatory Authority of India (TRAI) came into being as a result of marketization of the Indian economy and the entry of foreign operators. The TRAI is responsible for facilitating the introduction of private operators, supervising the growth of Telecom sector, fixing tariffs and arbitrating between contending parties. This was the first regulatory body to be set up under liberalisation programme.

Regulators can promote universal service and timely application of innovative technologies and services. There is a need to establish a legal frame work. The principles embodying these objectives should be laid and administrative structure be defined to achieve, these objectives. The DoT is a victim of rigid governmental rules and regulations, influence of heirachial structures and distance between different levels of hierarchy. The regulatory authority is needed to establish balanced development of and better use of resources with universal service objective. End to end monitoring of services, since user is provided with facilities operated by different entities, should be a part of licensing agreements

Regulation depends upon country's political, judicial competence and commercial customs. The fundamental purpose of Telecom sector regulation is to optimise sector performance as per the objectives laid down by the government. This can be achieved by making conditions conductive to long-term investment and enforcing through steps in order that abuse of monopoly power does not take place. In this connection the credibility and the stability of legal frame work is of utmost importance. The establishment of TRAI is a factor that increased the optimism of private operators in India. Another factor in favour of private operators is the increasing pressure on the DoT by the government and subscribers to get private basic services providers under way. The Ministry of Finance also has been placing pressure on the DoT to set the basic services licensees' operations under way. The basic service Operators' first year license fees has been included in the budget for the year 1997-98. Foreign Investors are permitted to a minimum of 10 percent and maximum of 49 per cent investment in India's ventures. The foreign ownership is allowed to exceed the limit through a holding company or through issuing of American Depository Receipts (ADRs). The funds also can be raised through additional external commercial borrowing and rupee debt. The private Telecom service operators have considerable challenge in searching for massive investments required to finance their network build out plans. Because of this great need for investment funds, there are numerous opportunities arising for potential investors.

The DoT has prohibited the private operators from charging higher tariffs, which has foiled the strategy of some operators to offer premium services at premium prices. However the private operators can concentrate on heavy telephone users such as corporate houses and high revenue residential neighborhoods to generate profits. They can focus on high revenue pockets of service and intra circle long distance traffic between these pockets of service. However the universal service obligation required by the private operators can be met with minimum of network deployment in these low-revenue areas.

The impact of privatisation has brought about certain facts to light. The operators want fair return for their investment and that the terms extended to the private operators should not be worse than the government operators. The operators compared the access charges, license fees, spectrum charges port charges and the capital costs with those of MTNL and there is a great difference in these charges and hence the private operators are placed in disadvantagous position in the level playing field. The operators made some suggestions to bring about a revision of Telecom tariffs and other charges. They want direct connectivity to VSNL instead of going through TAX of DoT and revenue sharing to replace license fees.

The TRAI is stung by the uncooperative attitude of the DoT and wants the Government to define its role and jurisdiction in policy decisions. The latest in the series of disputes was the grant of license to the Mahanagar Telephone Nigam limited for providing cellular mobile telephone services in Delhi and Mumbai early this year without any recommendation made by the TRAI with regard to the need and timing for the introduction of a new service provider. After the panel deemed the license invalid for violation of the TRAI act, the Government and MTNL appealed to the High Court and the Delhi High Court set aside the TRAI order and cleared decks for the entry of MTNL into cellular Telephone service. The judge observed that the recommendations which TRAI was entitled to make can not be called a condition precedent to grant of license.

The Government does not propose to dilute the powers of the Telecom Regulatory authority of India.

The Govt. expects that any dispute relating to license conditions should be settled by arbitration which is provided for in the license agreement. The TRAI has jurisdiction over DoT only when it acts as a service provider. It is not acting as a service provider when it issues a license. The TRAI in turns though not disputing the Governments right to issue license, expects TRAI to be consulted before licensing MTNL.

In a bid to regulate Telecom tariffs, the TRAI in its report entitled consultation paper on Frame work and proposals has suggested drastic changes in tariffs for local domestic and long distance, international and mobile telephone calls. This is given in the annexure enclosed. For international calls the revenue sharing would be in the ratio of 45.55 between the private operator and VSNL. The tariff suggestions, if implemented are expected to boost the fortunes of cellular and paging operators and the emerging ISPs. DoT, MTNL and VSNL may say that recommendations are not revenue neutral.

A study was conducted by the ICICI on the Cellular phone services in India. At the heart of the problem is the average airtime revenue per subscriber per month. Unless something is done to encourage increased usage of mobile phones, it may be difficult for the operators to survive. When two private sector or joint venture service providers were chosen for each of the four metropolitan centres nearly three years ago, they were expected to invest heavily in creating the infrastructure and service centres for the purpose. At that time a 20 percent growth rate was envisaged over a five year period, given the fact that the teledensity of 1.5 per line per 100 people was among the lowest in the world, comparing poorly with the global average of 11 per 100 people. China has a teledensity of 2.3 and the Philippines 1.7 per 100 people. After three years, the four metros have over 5.5 lakh subscribers for cellular phones. The service providers could achieve one per cent penetration in Delhi and Mumbai. Among the eight operators, Hutchison Max Telecom private LTD in Mumbai tops the list with over 1.3 lakh subscribers, with Bharti in Delhi taking the second slot. The bottom two slots go to the operators in Chennai with a little over 21,500 and 19,500 subscribers.

Mumbai is having the highest usage with an average of 216 minutes per month per subscriber and the Calcutta the lowest with 106 minutes. The problem is 71 per cent of the subscribers account for less than 100 minutes per month and this is making the service unprofitable. On a detailed calculation the license fee will work out to Rs. 502 per subscriber whereas 54 per cent of them generate revenues that are below the cut-off level. Though there has been a substantial increase in the subscriber base in three years, their air time usage has dipped alarmingly. As a result the debt service coverage ratio has fallen below one, making the project non-viable for lenders. Ofcourse some suggestions have been made not to dampen the privatisation process in such a key infrastructure area as cellular - reduction in the DoT's interconnect changes, reduction in license fees, direct interconnection between private operators and VSNL.

It is being discussed at high level the issues and to bring about an action plan to encourage private phone firms. The launching of a fourth round of tenders to ensure a competitor to the DoT is selected for all the Telecom circles. Other issues are like reducing the obligation on the private sector for providing phones in villages, abolishing the compulsory requirement of 10 per cent Foreign equity in all phone ventures and the merger of two circles where no bidder has shown interest despite three rounds of tenders. The companies have complained that the obligation of wiring villages in their licensed areas is too expensive because they will be setting up networks in cities right from the scratch. They say it would be less expensive for the DoT because its network is more widely spread.

The ground for most of the concessions was prepared long ago, the DoT might prefer to implement them at appropriate time to make them fool proof against failure. The Telecom commission may have to consider whether private companies can be exempted from the obligation of wiring villages in their licensed areas and also the merger of two circles for the purpose of bidding because no company is coming forward to bid during the first three rounds of bidding. There is consensus on merging the North east circle with Assam and merging of Jammu and Kashmir with adjacent circle is yet to be considered.

Regarding extension of license fees for the private operators, the industry expressed the Finance Ministry which is competent to grant, is expecting recommendations from the DoT, the main competitor in the Telecom service sector.

CONCLUSION :

When the philosophy of liberalisation unfolded in 1991, privatisation was a completely new phenomenon in the Telecom sector. The most important heads which have to be immediately tackled are licensing procedure to the private sector for running communications services such as basic services, cellular, radio paging, powers rested with the Telecom Regulatory Authority of India (TRAI), restructuring the DoT to enable it to become flexible in tariff structure and customer service and quick selection of new technologies and services for the future. Thus there are tremendous challenges to be faced by the Government in resolving the issues relating to the achievement of growth in the Telecom sector with effective participation by the private parties both domestic and Foreign, the DoT to realise the importance of competitive spirit, and the level playing field to cater for the needs and satisfactions of the customers. There are no real technological blocks to the provision of services to meet the undeserved in India. Only expectation is the conducive political and commercial climate which is likely to come up shortly as market forces and political forces interact in the days to come.

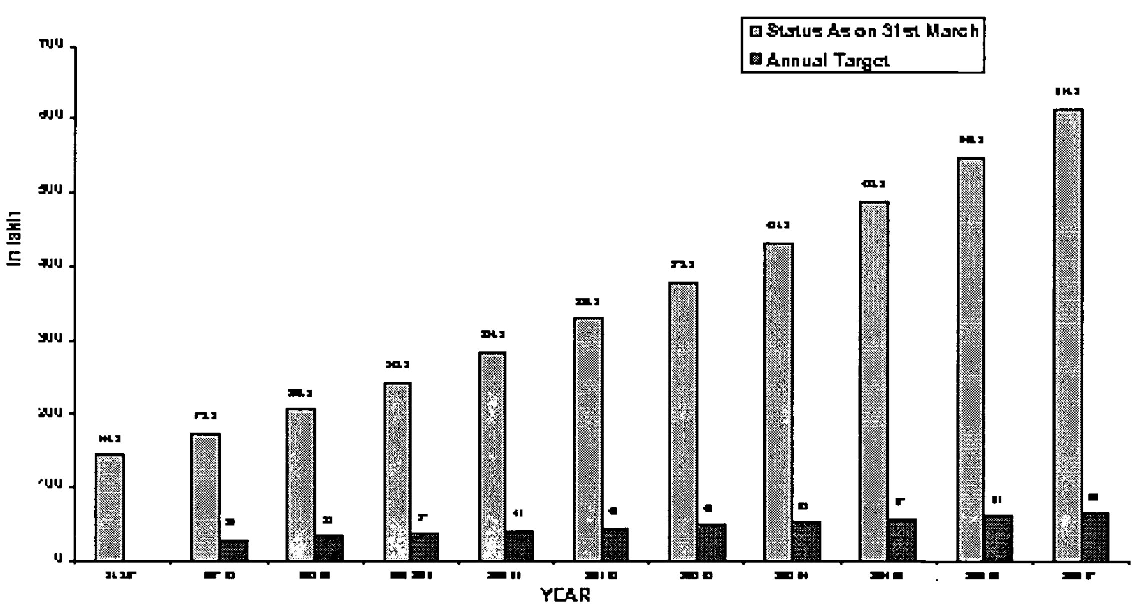
TRAI's Number Game

TRAI's act to balance the telecom scenario

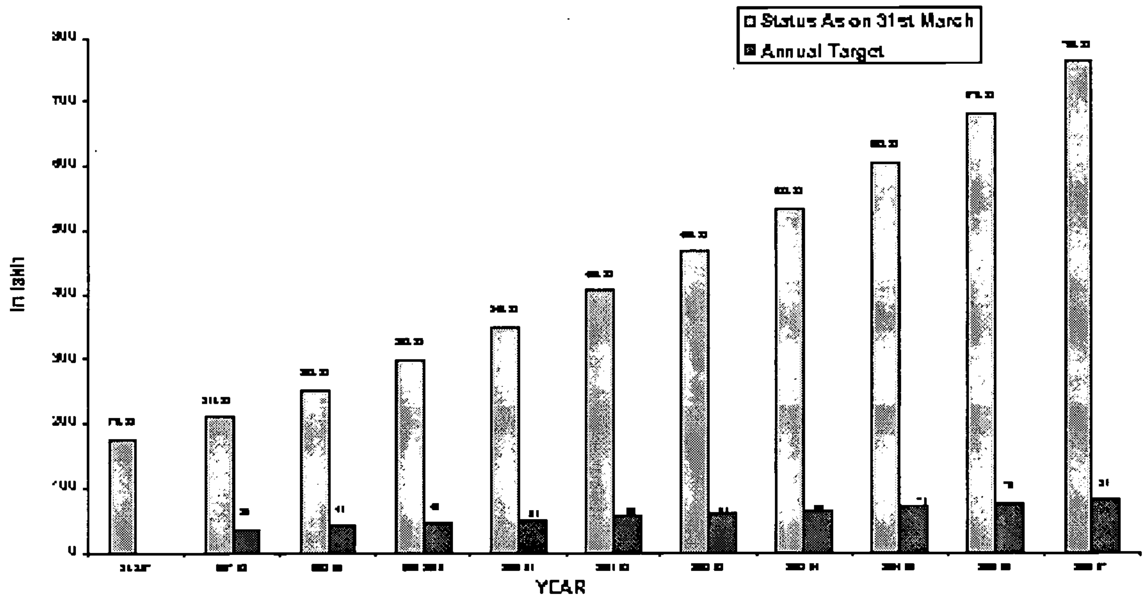
Particulars	Present	Proposed
Basic Telephony	Rural/Urban	Rural/Urban
Basic rental (bimonthly)	150/380	320/620
Local call (for 3 minutes)	0.60/1.40	1.30
STD call (per minute)	0.20/42.00	0.43/19.50
ISD call (per minute)	18.00/84.00	19.50/39.00
Mobile rental (monthly	156	600
Peak cell charges (per minute)	16.80	6.00

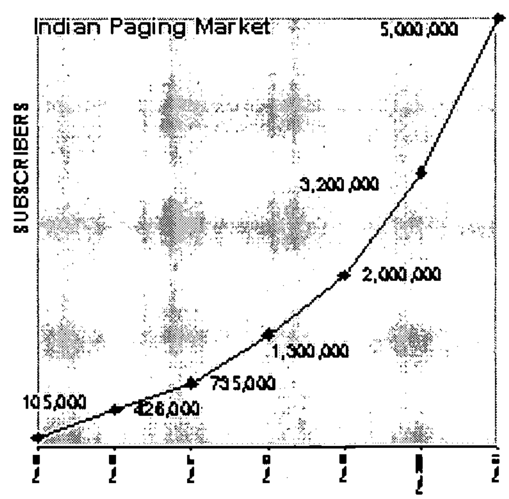
Landline to mobile (per minute)	normal charges	3.80
Pager rental (monthly)		
Alphanumeric	250	300
Numeric	75	200
Call to Pager (per minute)	normal charges	Rs. 1.50 flat rate
Leased line rental (over 1000 km)		
64 kbps	11,25,000	92,500
2 Mbps	53,70,000	21,00,000
14.19/100*15,000 = 2,128.50*3 = 6,385.50+15,000 = 21,385.50		
14.19/100*18,000 = 2,554.20*3 = 7,662.60+18,000 = 25,662.60		
14.19/100*20,000 = 2,838.00*3 = 8,514.00+20,000 = 28,514.00		

DIRECT EXCHANGE LINES



SWITCHING CAPACITY





Paging Service Provider

Subscribers
(as on March 31, 1998)

Microwave Communications Ltd.	**80,901**
Hutchinson Max Telecom	67,555
DSS Mobile Communications	221,264
Modi Korea Telecom	70,776
RPG Paging Services	94,478

Page Point Services (I) Pvt. Ltd.	73,543
Usha Martin Telekom	12,877
BPL Wireless Telecom Ltd.	10,939
Easy Call Communications Ltd.	20,743
ABC Communications Ltd.	23,082
Matrix Paging (I) Pvt. Ltd.	44,294
Telesistem (I) Pvt. Ltd.	20,268
Punwire Paging Services Ltd.	231
NICE	508
BELTRON TELECOM ITD.	441
Total for City Paging	**741,900**
Total of Circle Paging	**29,379**

Return to Top   View Full Text

Pacific Islands Resolutions

Steward, David

ABSTRACT

Not Available

View Full Text

Pacific Islands Resolutions

I would like to put the position of the small Pacific Islands to you. We would like to think that our case is based on being fair. Surely this is something that we should be able to expect.

While the position on accounting rates tends to be polarised into two camps, the developed countries versus the underdeveloped countries, many larger telecommunication operators from developed countries are sympathetic to the small Pacific Islands situation.

I will use the word subsidy through out my presentation. This is not a word that I would normally use, but it is a word that has been used by the FCC, in particular, and other developed countries to describer their payments to us, the small Pacific Island countries.

I. RESOLUTION 1

The ITU, using US based consultants, did an independent cost study of four small Pacific Island countries in 1998. The cost study was conducted using the globally recognised TAS model. The results showed that the cost to terminate a call by the small Pacific Island countries was in the range of US$0.50 to US$1.00 per minute. The higher cost to what is normally quoted is easily explained by lack of economies of scale and high transmission costs due to the exclusive use (by necessity) of satellites. The consultant to the Cook Islands made the statement that Telecom Cook Islands Limited was as efficient as any comparable sized US company. The small Pacific Island countries, as defined in the overhead, request treatment as a special category and that the settlement rates be based on independent cost studies. **Should these small island countries be asked to subsidise the US consumers by providing connections below costs?**

The FCC has stated in the Benchmark Order (paragraph 74, 86) that if a carrier can demonstrate that it costs to terminate a call is higher than the FCC bench mark, then the FCC will consider revising the benchmark for that carrier. The small Pacific Island carriers request the FCC do just that for the small Pacific Island countries.

II. RESOLUTION 2

The American carriers are also against asymmetrical rates. Its apparently fair enough for small Pacific Islands carriers to be required to bring down settlement rates down to costs or below costs, but the American carriers have no such requirement or pressure. When we discuss settlement rates, the FCC "demand," that we move down to our costs. Interestingly, that the FCC benchmarks apply to every country in the world except for the USA. Under the FCC benchmarks, the US carriers settlement rates should be 8 cents by 1 January 1999. . The small Pacific Island countries request the immediate implementation of asymmetric arrangements, which should be based on cost using a fully distributed historic cost model. **Should the small island countries to be expected to continue to subsidise the US customers by paying over cost for services.**

III. RESOLUTION 3

Many of the small island countries such as the Cook Islands only have one direct bearer circuit. So we are heavily dependent on transit fees. We are not in a competitive market, as has been suggested, because we only one direct circuit. Also our volumes are so small that no one really cares. Has anyone here looked at the ratio of transit fees to the settlement rates? Most transit fees are higher than the charge for originating or terminating a call. What are the costs to transit a call at an international gateway compared with the cost to originate or terminate a call? The developed countries are totally against sending benchmarks for transit rates citing confidential rates exist anyway. However what is certain is that these confidential rates do not usually apply to small volume Pacific Island countries. The small Pacific Island countries support the implementation of the proposals in paragraphs E.4.1. And E.4.2 of Annex E of ITU Recommendation D140.

Should the small Pacific Islands countries be asked to continue to subsidise the networks of the developed countries.

IV. RESOLUTION 4

Universal Service is another issue. Some countries have invested heavily in telecommunications infrastructure spending millions. This development also helps the developed countries as without telephones, who are their customers going to ring. In the Cook Islands, this development was funded by loans and has to be paid back. This is a true cost of providing the network. The repayment of these loans is funded partly from revenue from international settlement rates. For this revenue to be taken away will bankrupt the Telecommunications operator. The FCC has stated in the Benchmark Order (paragraph 174) that it will consider extending the transition period for foreign carriers in countries for which the proportional annual reductions in settlement rates would entail a loss of greater than 20% of the countries annual telecommunications revenue. The small Pacific Island carriers request the FCC extend the period for the small Pacific Island countries.

Return to Top View Full-screen

Current Status of Telecommunications Development in Pacific Islands Countries

PETER LOKO

Director, International, Telikom PNG, Papua New Guinea

ABSTRACT

none

View Full Text

Current Status of Telecommunications Development in Pacific Islands Countries

PETER LOKO, Director, International, Telikom PNG, Papua New Guinea

PITA

Melanesian Paper

1 INTRODUCTION

It is an honour to represent the views of the Melanesian countries at this PITA conference

The countries in the Melanesian Region include Fiji, Solomon Islands, Vanuatu, Papua New Guinea, New Caledonia and West Irian (Part of Indonesia). With the exception of New Caledonia all are members of PITA. The population of Melanesia is about 90% of the total population of the Pacific Island nations largely due to the masses in PNG and Fiji and the land mass is about 98.8% of the total land area of the Pacific Islands. (Please see Table 1).

Table 1: Population, Total Land, and Telecommunication Coverage

Country/Territory	Population	Land (Sq. Km's)	No. of Populated Islands	Populated Islands with no access to telecom
1. Fiji	778,450	18,333	99	20
2. Papua New Guinea	3,951,500	462,840	60	50
3. Solomon Islands	367,400	30,303	N/A	N/A
4. Vanuatu	164,100	12,000	80	8
Totals	5,261,450	523,476	4239	78

The terrain and geography of the Islands in Melanesia range from densely populated areas to scatted areas and the economy depends largely on minerals, marine and forestry products and tourism.

Because of the scatted population, the rugged terrain and many islands with populations per village ranging from 20 to about 15,000 the cost of providing telecommunications is high Land issues in Melanesia are quite unique and at times a contentious issue.

Telecommunications is mainly by terrestrial, satellite and cable means. Mobile Satellite services are becoming increasingly popular with Inmarsat and the Optus Mobilesat countries in the region mainly use INTELSAT, PALAPA, INMARSAT and the AUSSAT satellite system.

The operational cost of networks in the Melanesia is quite high and coupled with the drop in the value of the various currencies against the major foreign currency capital and maintenance costs have increased dramatically largely due to the Asian Economic crisis.

Telephone penetration varies from 1% to 6% whilst the bulk of the population is as high as 85% in rural areas.

Up to 1996 the telecommunications sector was largely in the hands of the Government. The trend is changing as all Countries in the region are undergoing changes to prepare for deregulation. They are all members of the World Trade Organization (WTO) APT & CTO with PNG being the only member of APEC.

2 CURRENT STATUS OF TELECOMMUNICATIONS DEVELOPMENT IN MELANESIA (SOURCE: PITA SUBMISSION WTDC 1998 MALTA)

2.1 FIJI

Telecommunication services in Fiji is provided by Telecom Fiji Limited the National Service Provider and Fiji International Telecommunications Limited (FINTEL) the international carrier.

Telecom Fiji operates as a private liability company formed in 1989. The Postal services were separated from Telecommunications leading to the formation of the two new companies, Telecom Fiji Ltd and Post Fiji Ltd in 1996.

Telecom Fiji is licensed to provide and operate telecommunication services throughout Fiji. The license gives the company monopoly on the provision of network services for 25 years.

The international carrier FINTEL, is a joint venture company between the Fiji Government (51%) and Cable & Wireless, plc (49%) and has an exclusive 25 year operating license. FINTEL pays Telecom Fiji Limited 50% of net revenue accruing from international services.

The network in Fiji is 99% digital with an overall teledensity of 9.4%. Urban areas are well serviced with approximately 20% penetration while rural is 0.6%.

2.1.1 Telecommunications Services

International access is via FINTEL's Standard A Earth Station and Submarine Cable Terminal in Suva. The satellite earth station provides direct links to Japan, Hong Kong, Singapore, Australia, New Zealand, Canada, USA, Tonga, Solomon Islands, Vanuatu and Western Samoa.

The alternate international routing via the ANZCAN Submarine cable system is to Australia, New Zealand, USA and Hawaii and Canada.

Telecom Fiji Limited now provides a total exchange line capacity of 89,405.

The core trunk network is made up of optic fibre interlinking the major urban centres, copper plant between local trunk networks, and digital trunk microwave radio interlinking the centres across the main islands. Small rural locations utilise VHF single or multiple channel radio systems. Fiji's northernmost island is linked to the national network via satellite on the DAMANET Network, which is the first digital DAMA link on the Telstra DAMA Network.

Digital Mobile Communications is provided by Vodafone (Fiji) Ltd. Vodafone uses an Ericsson GSM switch (MSC) with 21 base stations operating through a single Base Station Controller (BSC).

The Company shareholding is TFL 51% and Vodafone (UK) 49%.

2.1.2 Telecommunications Development

Telecom has now replaced all analogue exchanges in urban centres to have a 98% digital switching network.

The introduction of DRMASS radio systems to rural communities outside urban centres has greatly improved access to areas previously with poor communications. Links. Major radio trunks utilise 140MB Digital Radio Systems (DRS), and 140MB Fibre Optic Digital Radio systems to interlink the main switching centres.

To remote and outer island communities, Trunk Radio Systems are used. Other rural communities are linked to main exchanges using line concentrator systems.

New services introduced by Telecom Fiji include Toll Free Service (0800), Voice Mail Service, Calling Card Service, Paging Service, and is also the Internet Service Provider.

2.1.3 Future Developments

As part of its 5-year development plan, TFL will digitalise the switching and transmission network by the year 2000 in support of the company's business plan.

New technologies to be introduced include wireless local loop systems, which will supplement services in areas where capacity is exceeded or in areas lacking infrastructure.

To keep abreast of technological advancement both service providers are wary of the requirements for change and the need for resource management and training.

The network in Fiji is 99% digital with an overall teledensity of 9.4%. Urban areas are well services approximately 20% penetration while the rural is 0.6%. Total connected lines are 72,600 connected lines.

2.2 PAPUA NEW GUINEA

Telikom PNG a 100% government owned enterprise was formed in January 1997 to replace the former Post & Telecommunications Corporation (PTC). Telikom is licensed to provide all telecommunications services throughout PNG on a monopoly basis till the year 2002.

2.2.1 Telecommunication Services

There are 4000 customers connected to the AMPS mobile Telecom service. GSM is planned for the year 1999. The Internet service has already proven successful with PNG having 5 ISPs.

The 57,000 exchange lines in PNG represents 1% of the telephone penetration. 85% of the population in PNG live in rural communities and have access to 4% of the total telephone lines available in PNG. GSM is planned for 1999 and the Internet Services has provide successful with PNG have 5 ISPs.

The PNG telecommunications system is 100% automatic, with international links to 143 countries, and domestic services to most urban centres.

PNG's Domestic and International Communications Centre located at Gerehu in Port Moresby includes an 18 metre Intelsat Standard A Earth Station and a 7 metre Optus Antenna providing global and direct links to Australia. A second Optus antenna commissioned in September 1996 links Lae to Optus in Sydney Australia. The Optus links are fully digital links utilising CCS7 signalling. An 18-meter Domsat antenna serves as a Hub for the domestic satellite system. PNG has access to INTELSAT, INMARSAT, AUSSAT,PALAPA and ASIASAT.

The Domsat network interconnects 13 centers throughout PNG using a leased transponder on an Intelsat satellite. The domestic network in addition to telephony services also provides a TV distribution service, and replaces a troposcatter system to two remote locations, and also provides a telephony restoration service. It also has a number of transportable earth stations for emergency purposes.

From 1992, Telikom commenced a five-year modernisation programme to replace all analogue telephony switches to digital.

PNG has begun introducing from 1991, fibre optic in its core network to interconnect its switching centres in the urban centres.

Mobile communications services are provided by Pacific Mobile Communications, a100% wholly owned subsidiary of Telikom. The service using AMPS technology covers the Port Moresby, Lae and Mount Hagen regions.

Communication links to remote rural out stations remains on HF Radio. There are 1200 HF stations throughout PNG that are licensed to operate on the Outstation Network.

2.2.2 Telecommunication Development Plans

The government has embarked on an extensive rural Telecommunication program. The target it has set for the service provider is that by the year 2000 the telephone penetration must be 3%. The government has allowed Telikom to retain dividends payable to Government to implement the Rural Telecom Program. Five (5) provinces have recently benefited from this exercise. Telikom has joined Iridium to provide Mobile Satellite services this year.

2.3 SOLOMON ISLANDS

The Solomon Telekom Company Limited (Telekom) provides telecommunications services. Telekom is a joint venture between the Solomon Islands Government (58.1%) and Cable & Wireless plc (41.9%). Telecom was formed in 1989 when the international service provider SOLTEL (Solomon Govt/C&W - JV) took over the government run national service.

2.3.1 Telecommunications Services

The National switching network in the Solomon comprises an Alcatel E10B and an NEC NEAX 61K trunk exchange forming the core switch in Honiara. Four NEC NEAX 61S and four GPT UXD5 local switches are on outer locations.

The core trunk transmission comprises of DAMA satellite network and digital microwave links interconnecting the main islands to Honiara to form the National Telephone Network.

Telekom operates a Domestic satellite system (VISTA) which uses six 6.5 metre dishes on the outer islands working to the 7.6 metre hub in Honiara. The Honiara International Gateway earth station is a Standard B working to eight destinations Australia, New Zealand, Fiji, PNG, Hong Kong and Singapore via IDR bearers.

To provide communications to the outmost islands Telecom utilises OPTUS Mobilesat service through the OPTUS B1 satellite. Registered customers are billed by Telekom through data received from Optus. Telekom is also introducing Inmarsats mini M service.

Telekom will continually introduce new products when they are feasible.

2.3.2 Telecommunications Development

Telecom is currently embarking on a major Rural Telecommunications Infrastructure development in an endeavour to increase penetration throughout the island group.

The project targets second line rural locations beyond the provincial centres; to provide basic telecommunications services.

Other technologies under consideration to provide access where terrestrial access is difficult are satellite (VSAT) or other low capacity domestic systems.

2.4 VANUATU

Telecommunications Services in Vanuatu is provided by Telecom Vanuatu Limited. The Company share holdings is 33% Government, 33% Cable & Wireless and 33% France CR.

It is a twenty year financhise agreement from 1982 with the Government of Vanuatu and Telecom Vanuatu.

Telecommunications:

The Public Switch is an Alcatel E10B Digital Switch and serves 5,179 customers. It is a local, trunk and International Gateway.

TVL has an ambitious plan to provides reliable and quality rural telecom services.

Vanuatu has an AMPs mobile service implemented in 1994 and is limited to the Port Vila Metropolitan area.

The Introduction of Internet has seen 541 customers connected.

The network is 100% digital - both for the Switching and transmission elements.

INTERNATIONAL services are supported by a standard 'A' 13 metre Earth Station in Port Vila with direct circuits to Australia, New Caledonia, New Zealand, Hong Kong and Fiji.

Plans

Plans are in place to;

- increase rural penetration

- expend cellular services

- introduce ISDN

- increase internet services

- introduce LEO via Iridium

- Reforms

3 TELECOMMUNICATIONS DEVELOPMENT IN THE MELANESIAN REGION

Telecommunications in Melanesian is developing at a gradual pace. Mobile and Internet services are gaining popularity and reforms to the monopoly are expected.

The Melanesian Countries have just started considering a "Melanesian Telecommunications Concept: an idea proposed by Vanuatu during the Heads of Government meeting for the Melanesian countries. It is a Government initiative and the machinery to get it started are still in a conceptual stage.

4 TRENDS

The countries in the region are capable of developing their networks. Need for regional and global support is necessary as the Industry undergoes changes. The role of PITA and its connections to global institutes will assist these countries in one form or another. Policies and Government control in the sector are changing and need to be reformulated.

5 REQUIREMENTS

Some areas of priorities for the Melanesian countries includes;

a) increase penetration of rural services

b) assistance to overcome the "millenium bug"

c) the accounting rate problem

d) appreciation of the impact of changes in the Telecommunication Industry particularly

policies and legislation

e) appreciation of the impact of the local currencies against major ones in relation to delivery of Telecommunications Services.

6 CONCLUSION

There is a need for collaboration amongst PITA members through the organisation PITA and bilaterally amongst member nations. There is a need for a stronger collective presence at regional and international foras.

The areas of priority identify need to be addressed so that Telecommunications Services are continuously provided.

Bigger players and countries should appreciate the issues of the smaller ones.

IP Telephony & Advanced Services White Paper

Scott Wharton
Director of Marketing
VocalTec Communication

ABSTRACT

Not available

View Full Text

VocalTec™ COMMUNICATIONS

IP Telephony & Advanced Services

White Paper

Release 1.0

Author: Scott Wharton, Director of Marketing

January 1999

IP Telephony & Advanced Services 1st Edition – January 1999

VocalTec Communications Ltd.

1 Maskit Street
Herzliya, Israel 46733
Tel: +972-9-970-7777
Fax: +972-9-956-1867

VocalTec Communications Inc.

35 Industrial Parkway
Northvale, NJ 07647
Tel: +1-201-768-9400
Fax: +1-201-768-8893

VocalTec Communications UK Ltd.

The Forge, Grange Court,
Grange Road
Tongham, Surrey

UK GU10 1DW
Tel: +44-1252-783-500
Fax: +44- 1252-783-511

VocalTec Communications Japan KK.

Hanzomon KD Building 3F
1-8-9 Hirakawacho,

Chiyoda-ku,
Tokyo 102-0093 Japan
Tel: +81-3-5215-1572
Fax: +81-3-5215-15 73

email: info@vocaltec.com

http://www.vocaltec.com

Executive Summary

The recent buzz in the communications industry is about IP Telephony. The initial focus was on PC-to-PC communication, but quickly switched to phone-to-phone communication using the Internet as a backbone. Much of that focus is on the short-term arbitrage opportunity that exists today. However, IP Telephony is more than about simple phone-to-phone applications and arbitrage but a whole host of advanced services. This paper attempts to discuss some of the possible advanced services that are possible with IP telephony and will be behind this emerging communications revolution.

The market drivers for IP Telephony include cost advantages, network developments, and advanced services. IP Telephony provides lower cost communication by using compression and pooling effects to lower transmission costs. Equipment costs are also lower based on open standards and the power of Moore's Law that brings a PC-like industry evolution to the telecommunications industry.

The Network development is also driving IP Telephony into the marketplace. The IP data network is expected to eclipse and dwarf the PSTN size in bandwidth capacity over the next 5 years. As such, the challenge is to put a small amount of voice traffic over the data network instead of the current question of how to put a small amount of data over the voice network. Broadband Internet access will also drive the demand for IP Communications as a highly valued revenue source for broadband services providers looking to generate reasons to upgrade to the faster connection.

Advanced Services beyond traditional phone-to-phone combined with the cost advantages and network developments will send IP Telephony into high gear growth and adoption. Some of the areas of advanced communication services that will expand include PC-to-phone, Web-to-phone, Multi-point conferencing, PC-to-PC, and Messaging.

The advantage of PC-to-phone communication include the opportunity for arbitrage, ability to service a global market from one location, convenience of saving rational phone line access, and friendly user interface to provide the customer information. Applications include: cheap or free calling, virtual second lines, "never busy" services, enhanced billing options, and easier conference calling.

coming years.

IP Telephony Market Drivers

The drivers of the IP Telephony market beyond arbitrage that will help it take root include cost advantages, network development, and advanced services.

Cost Advantages

The original appeal of IP Telephony hinged on the cost issue. Even today, cost is one of the main drivers of market acceptance. Arbitrage, especially internationally, represents a significant part of the IP Telephony market today. For example, a call from an Asian country might cost $US 1.00/minute, but cost only pennies with IP Telephony to the US. Because IP Telephony calls tend to be regulated as data and not as voice, they can receive advantages with respect to regulatory treatment and cost to the customer.

Beyond possible regulatory and arbitrage advantages, IP Telephony has inherent cost advantages over conventional circuit-switch telephony. According to James Crowe, CEO of Level 3— a $15 billion startup founded to focus on IP Telephony— it was recently estimated that his company would be able to provide voice services at 1/27th the cost of conventional telephony using IP Telephony.

Cost drivers are easy to understand, but they only explain part of the move to IP Telephony. The reasoning behind this cost differential is based on many things including lower bandwidth requirements and open standards based equipment.

Transmission Cost

IP Telephony can transmit voice over an IP network less expensively because it is packet-based instead of circuit-based. According to Qwest Communications, the 4th largest phone company in the United States, it is estimated that IP Telephony would cost 1.98 per 650MB payload of voice calls whereas the PSTN would cost $27

Packet-based networks save on bandwidth by using compression techniques and also by sharing a network bandwidth resource more efficiently than circuit–switched networks. Packet-based networks, unlike their circuit-based cousins, do not need to have a fixed, reserved amount of bandwidth for each call. This helps them create "pooling effects". The pooling effect is a capacity management concept, which basically means that packet networks can carry more calls with the same amount of bandwidth, whereas circuit-switched networks using fixed amounts of bandwidth only increase geometrically in capacity when network bandwidth increases.

Equipment Cost

IP Telephony equipment is largely not proprietary, but based on common industry standards as well as standard hardware and software components including PCs and DSP chips. As such, the cost of communications equipment in the IP Telephony space is expected to fit the profile of the PC industry where performance doubles every 18 months (according to Moore's law) while prices drop. This is compared to the current telecom environment where progress is measured in single digit growth and multi-year product life cycles are the norm.

Network Maintenance Cost

Currently, there are 2 major networks — one for voice and one for data (and more for cellular, paging, video etc.). As the networks converge and voice and data will be allowed to flow on the same network, there will be maintenance costs in maintaining one network vs. two. These maintenance cost savings from concentrating on one network are expected to create further ongoing cost savings beyond the lower transmission and equipment costs

Network Development

Network Size: Voice vs. Data

According to leading experts in the communications industry the total size of the data network throughput is expected to equal the size of the voice network in 1998. Further, many of the leading communications players are predicting that voice will be such a small part of the future network, it will be free in the near future. In a recent financial analysts' meeting, Cisco management predicted that voice communications would be free in the near future.

This concept can be illustrated by assuming current growth rates continue for the next 5 years (approximately 10% for the Conventional PSTN Network

	1998	1999	2000	2001	2002	2003
[redacted]	1.0	3.0	9.0	27.0	81.0	243.0
[redacted]	1.0	1.1	1.2	1.3	1.5	1.6
[redacted]	**1.0**	**2.7**	**7.4**	**20.3**	**55.3**	**150.9**

and 100-500% for the IP Network), and the IP Network traffic will be many times greater than the PSTN. For example, in 2003, assuming a growth rate of 10% for the PSTN and 300% for the IP Network, the IP Network will be over 150 times greater than the PSTN. At that point, it makes more sense to send the relatively small amount of voice over an integrated data network, than to send data over a limited voice network

Broadband

The emergence of broadband service for the business and home is also driving IP Telephony. As broadband access companies look for ways to recoup their costs of network development, they are finding that IP Telephony is one of the top value-add services that customers are expressing a willingness to pay for faster Internet access.

Additionally, broadband access is having a similar effect to the one that faster PC processors have on software: The more bandwidth available to the customer, the more software and application developers will work to take advantage of the new resource. This will lead to a self-reinforcing cycle of increased bandwidth and new and improved applications to use with that bandwidth.

Advanced Services

IP Telephony is about more than just voice. IP Telephony can enable not only voice, but also any type of service that data can transmit over an IP network including video, data, fax, messaging and more. As such, IP Telephony will drive new services that take advantage of the flexibility of the Internet Protocol (IP) standard and create services based on a mix of multimedia instead of singular mediums such as voice.

An analogy that fits here relates to the evolution of the radio and television for broadcasting. When TV first came onto the market, people used it like a glorified radio substitute, literally reading from a script as if it were a radio show. As people began to harness the multimedia capabilities of TV, it did not replace the radio (voice only) but became the far richer and dominant medium through which broadcasting was done (multimedia).

Similarly, IP Telephony is first being used a way to transmit voice as it is done today on the PSTN but in a less expensive manner. However, as applications and infrastructure become available, IP Telephony will supercede (but not replace) the voice-only applications of today with richer applications and services of tomorrow.

Summary

In summary, while IP Telephony is being driven primarily by arbitrage today, it is the combination of the lower cost, expected dominance of IP and data on the network level, and the advanced communication services that are driving the market and making IP Telephony a viable technology for communication.

Examples of Advanced Services

The following are some advanced IP Telephony services with descriptions and the drivers behind market acceptance:

PC-to-phone Communication

PC-to-phone communication is possible when a user on a PC makes a call over an IP network to a regular phone through a telephony gateway. PC-to-phone communication allows a service provider to offer voice service to anyone around the world with a multimedia desktop computer and access to the Internet. For the end-user, the process is simple: just connect your computer to the Internet, dial the person's number and the call goes through a telephony gateway to the destination phone number and the conversation can start.

Market Drivers

The market drivers for PC-to-phone service include arbitrage, global coverage, and convenience.

Arbitrage

A service provider can take advantage of significant arbitrage with PC-to-phone service by bypassing the International accounting rates for phone to phone service. Since the public Internet or an Intranet can be used for one side of the call instead of initiating on the PSTN, the call can in most cases fall into a gray regulatory area. For example, a call from Asia that might be priced at US$1-2.00/minute can be completed for as little as US$.05-10/minute. Despite the low US pricing, the service provider can still make a significant profit by terminating the call for a cost of as little as US$.03/minute to anywhere in the US.

Global Coverage

PC-phone service can be offered with one end point connected from anywhere in the world on an IP network through one telephony gateway. In light of this, the service provider technically can offer global service from anywhere in the world to anywhere in the world. The end-user call make a call from a PC using the public Internet and connect to a service provider (say in the US) which can either terminate the call in the US or "refile" (i.e., redirecting calls through a low-cost country) the call over the PSTN from the US to another country. Hence, a service provider can complete a call from a PC to any phone in the world from only one location instead of constructing a worldwide network. A company building a phone to phone network would have to have a worldwide network since a phone to phone call requires two gateways in both locations.

Convenience

PC-to-phone service offers convenience to those with only one phone line to make outgoing calls without disconnecting their Internet connection and to not miss incoming calls when online. This need is also complementary to the service provider's desire to complete as many calls as possible, leading to higher revenue and profits.

User Interface

By using the PC as the voice communication device, a service provider can offer visual features to the user such as billing information, promotions, or advertising to offset calling costs.

Applications

Cheap/Free Calling

Service providers can offer very inexpensive or even free calling. Inexpensive calling can segment the market and reach people internationally who pay a very high tariff. Free calling can be offered as a new service, possibly even subsidized by PC banner ads during calls to pay for the service and enhance profitability for the service provider.

Virtual Second Line

For the caller with only one phone line at home, the person can use a PC client to make a phone call, thereby using the Internet connection as both a data line and a voice line. This alleviates the need to invest in a second phone line for the occasions in which both uses are needed (or to allow chatty teenagers to make their important phone calls while on the Internet).

Similarly, in a small office, the PC client can be used in lieu of adding a new PBX expansion card and installing new phone lines until they are really needed. Additionally, a PC client can be used for calling from a hotel, saving large sums over heavily surcharged hotel rates.

Never Busy

One of the major problems local phone companies and PTTs around the world face is the busy signal received when the receiving party is surfing the Internet. When a caller gets a busy signal because a customer is on the Internet, this results not only in a missed call by the consumer but a missed call completed by the phone company and lost revenue. By providing a PC client to the Internet user, this customer can receive notification through the computer that someone is attempting to make a phone call that can either be taken through the computer or sent to voice mail.

Enhanced Billing

Using the Internet-connected PC as the telephone allows a service provider flexibility to adjust pricing according to capacity utilization. Just as the airlines and hotels use yield management techniques to set pricing for plane tickets and hotel rooms, service providers can drop or raise prices in real-time and show this information to customers to smooth out demand and maximize capacity utilization.

Conference Calling

The PC client can be used for conference calling by initiating a call from the Internet, for example, to one person online and one on the PSTN. This links together those "online" and offline (for the international caller saving potentially large sums of money) while making conference calling easier and less expensive to set up using the friendly user interface of a Windows program.

Web to Phone Communication

The World Wide Web has become almost synonymous with the Internet itself. The Web is more than just a place to look at static information, but also a place to conduct transactions and communicate. Web-to-phone communication can come in many forms -- as simple as clicking on a web page to speak to someone behind the Web to sophisticated communication in multiple media formats.

Market Drivers

The market drivers for Web-to-phone communication include ecommerce, single line restriction, and customer service.

Ecommerce

Ecommerce is driving the need for increased levels of service on the Internet and voice is a logical extension to address that need. Allowing the user to speak to a live operator while surfing the Internet can increase the sales yield and allay security fears by allowing the customer to provide credit card information with voice instead of data.

Single Line

Many users on the Internet only have a single line for voice and data. Web-to-phone communication allows the user to speak and interact with a customer service agent without disconnecting from the Internet connection.

Customer Service Demands

As the consumer becomes more demanding for ever-higher levels of customer service, the web is a powerful tool to serve the customer for longer hours and with more sophisticated interactions. Web-enabled call centers can not only allow the agent to speak to the customer, but send them forms, show them merchandise, and even see the agent via video conferencing.

Applications

Ecommerce Facilitation

One of the most talked-about applications of the Web is the simple integration of clicking on a website button and placing a voice call over the Internet to a call center. Adding voice capability to a website is seen as a key enabler for ecommerce. This is especially true for those people who want to complete a transaction with a live person for either security reasons or to ask a question requesting information not found on a website.

Global 1-800 Service

As the Web is a global medium and standard, Web-to-phone calling can be used to provide 1-800 service worldwide overnight. For example, a European call center can set up one gateway in their office, link it to their website, and have anyone from around the world call them for free with a click of a button on their webpage. This expands voice access to their call center dramatically, and reduces costs using the Internet for the 800 calls, making it cost-effective for customer and company.

Customer Service

As an extension of the 1-800 service, companies can voice-enable the Web to offer expanded customer service, allowing the web surfer to speak to a call center agent and complement the data on the website. In addition, the website owner can go beyond traditional customer service by offering simultaneous voice and data, which includes joint web surfing, form pushing (to and from the customer) and video conferencing, all while on the same Internet connection.

Remote Voice Mail

Companies can offer remote voice mail to their workers travelling out of the office by placing a button on the web to click on and check/leave messages. Similarly, service providers (e.g., web hosting companies, ISPs, CLECs) can set up a service by hosting voice-enabled web pages for consumers or businesses from their home pages.

Directory Services

Website can add voice buttons to a web directory that now includes email addresses and other contact information so that web surfers can immediately connect to the person they want to reach by clicking on a web page. This can be used for companies (for internal and external use), universities, and public directories like white pages and yellow pages (e.g., Four11 and GTE SuperPages).

Web IVR

Voice on a website can simply extend the traditional IVR model of calling a company for automated information, but from the web. For example, a movie information phone service (e.g., "Movie Phone") can offer the same voice menu services via the web that they currently offer on their phone IVR menu, but at much lower cost to themselves and the user.

Multi-point Conferencing

One area where IP Telephony offers great promise is multi-point conferencing. Multi-point conferencing is a relatively large and established market in the corporate environment and a significant revenue producer for phone companies. The market today, though, is limited in its potential by the cost of conferencing, the limitation to voice only, the user interface of the traditional phone, and set-up expenses. IP Telephony offers cost advantages, multimedia calling beyond voice-only, a more flexible user interface, and lower set-up expenses which will drive conferencing to new levels of usage and new services.

Market Drivers

Cost

Conducting conferencing calls on the PSTN today is very expensive and an inhibiting factor for conference calling— especially in the residential market. Conference calls over an IP network can be provided for a much lower cost than over the conventional PSTN, thus opening up a whole new avenue of services for families, home offices, and groups. This is especially true with the emergence of broadband IP access in which provision of conferencing combined with a broadband connection will drive the costs down and make conferencing grow given an elasticity of demand with lower prices.

Multimedia

Traditional conference calling is limited to voice only because of the PSTN. IP multimedia conferences can not only deliver voice but video, data sharing, text chat and more, enhancing the quality and usefulness of the conference for all involved.

User Interface

The user interface of the regular telephone is extremely simple and easy to use for conventional calling to a single party. Ask the user to do more than this simple calling and the reliable 12-button user interface gets a bit unwieldy. Since a computer with a graphical user interface can start IP conferences, it can be much easier to provide such services as conferencing from a Microsoft Windows application or a web browser.

Set-up Expenses

The set-up expenses of an operator-assisted conference call can be quite high for the service provider due to the often-required human assistance. With IP Conferencing, the call can be more easily set-up, billed and controlled online using PCs and web browsers, thereby reducing setup costs that can be passed on to the user as savings, fueling the demand for such services. Additionally, because the billing can be done online through an automated account, costs can be reduced further.

Applications

IP Conferencing can be either a traditional private conference between known parties or a public conference among interest groups.

Private Conferencing

Private conferencing services could be offered to those who already know each other and would like to set up either a lower-cost voice conference or a richer multimedia conference using the service provider services. The conferencing service can be provisioned by a company itself or by a service provider. A service provider can charge for the conferencing in a number of ways: A flat monthly fee for use of the service per user or group, per conference call, via the quality of service (e.g., Internet vs. Private IP service).

Public Conferencing

Public conferencing is a service that can be offered to Internet users who would like to conference based on a common interest or a special event. For example, a service provider can set up a conferencing server and have users meet on a website to discuss a sporting event. This could be either a "free-form" discussion among the participants or a moderated discussion by a host. The business model for these conferences could be either a free conference capability for the end users supported by advertising and commerce or similar to a "web-hosting" of the conference for a group.

PC to PC Communication

PC to PC communication is seen as the "Holy Grail" of IP communications whereby the flexibility of the PC makes possible all sorts of new types of communication. As the PC has a very flexible interface, information can be presented in more complex ways than with traditional single-purpose communication devices like the phone, pager, fax, etc.

Furthermore, because the PC is a multimedia device with a direct IP connection, communication can easily blend media types (voice, data, and video) with both synchronous and asynchronous communication types. A PC in this case does not have to be limited to a traditional multi-purpose PC as we know it today but can also include new computer-based devices like personal digital assistants, smart cell phones, smart televisions and more. As Microsoft and Intel adapt the PC platform to become more suitable to IP communication, this trend is expected to accelerate.

PC to PC communication is already complementing and in some cases replacing the phone and fax and other traditional communication devices in the modern workplace. To test this assumption, ask the average person how much time he or she spent communicating using a PC 5 years ago compared to today. In many cases, people will realize upon reflection that they spend at least 50% of their time or more at work in front of a PC communicating and a smaller percentage of their time using other means (fax, phone) than they may have thought. This communication is primarily asynchronous today, but synchronous communication, through IP communications will rapidly expand the percentage using PC communication.

Market Drivers

Multimedia Capabilities

PCs can offer multimedia capabilities such as voice, video and data allowing for a combining of these data types for communication. Much as the TV provides superior broadcast functionality vs. the radio, the PC will provide richer and more interesting communication possibilities vs. the traditional analog phone, fax, etc.

Minimal Cannibalization

Using the PC for its multimedia capabilities offers the promise for service providers of new services with little cannibalization of existing services such as voice since the PC services can be multimedia-based. Currently the revenue generated from multimedia services is very small relative to the overall market. Multimedia communication services offers a new host of service opportunities which could generate more demand for existing services through compatibility with the current infrastructure (e.g., phones, faxes, and pagers) while expanding these new services based on emphasizing video and data communication in addition to voice.

Flexible User Interface

The PC, mainly through the Windows environment, offers a much more flexible user interface than the current crop of communications devices. For example, much more sophisticated service and features can be offered through the PC vs. using the traditional 12-button interface of the telephone. The flexibility offers the promise of a richer array of services while providing for ease of use requirements necessary for mainstream adoption.

Dumb Network, Smart Endpoints

By using the "dumb" IP network which focuses on transmission and not applications and "smart" endpoints such as PCs, new services can more easily diffuse in the marketplace by a mere software update via the Internet. The current infrastructure of an "intelligent" network with dumb endpoints such as phones makes adding new services and capabilities much more difficult and expensive.

Broadband IP Access

The emergence of broadband IP access to the business and home will drive demand for high-bandwidth intensive applications. IP communication capabilities will allow service providers to offer bandwidth-intensive services and premium pricing beyond the relatively low bandwidth-consuming voice.

Cheap/Free PCs

As PCs component prices continue to fall and the primary usage demand shifts from desktop stand-alone applications to network usage, PCs will become universally available to consumers and business and in some cases free, using the cellular phone pricing model of free hardware in return for service contracts. One likely scenario is a service provider leasing a PC with Internet and communication services for a single contract and/or monthly pricing arrangement.

Applications

Multimedia Communication

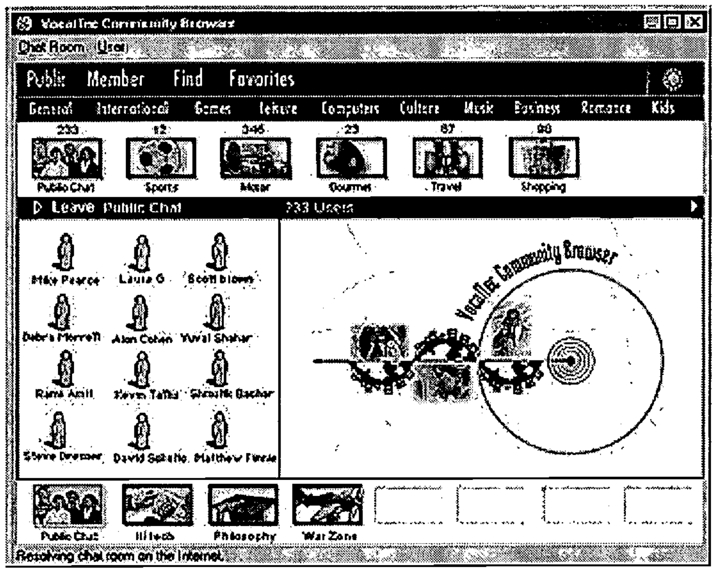
People will be able to conduct multimedia conversations from their PC including voice, video, and data. With the combination of multimedia PCs, Internet access, and broadband speeds, this type of communication has advantages over POTS and expensive proprietary solutions that currently exist.

Enterprise Workgroup Collaboration

Teamwork and group collaboration is increasingly important to competitive companies around the world. Remote communication tools such as the phone, fax, and email are spreading people further outside the headquarters making quick decision making even more difficult. Organizations can use client-server IP Telephony solutions to complement other remote meeting tools such as the phone, fax machine, and email to solve everyday problems making work quicker and more efficient.

Virtual Communities

Worldwide communications and IP Telephony are converging to create "virtual communities" not bound by distance but the interests they hold in common. Today we see the beginnings of these virtual communities on the Web and the use of instant messaging programs to share information, primarily with text. IP Communications will facilitate multimedia virtual communities beyond text chat and postings, allowing a richer environment for ecommerce, professional organizations, and internal discussion groups within corporations.



This VocalTec Community Browser (part of VocalTec Internet Phone) is an example of how people can meet from around the world, based on their common interests, with voice, video, and data.

Churn Reduction

PC-to-PC communication can help service providers reduce churn, keeping customers from switching to the competition. Service providers (such ISPs and regional phone companies) can offer higher quality service within network (getting around current lack of QoS) creating incentives for users to stay with a service provider on the same network to get higher quality of service. For example, a regional phone company can offer ISP services to the customers with higher quality on their network for people communicating on-network with a slightly lower quality for those customers communicating with those of another company. Thus, the phone company provides an incentive for customers to stay with the company and give the incentive for others to join so as to gain the same quality of service. Further, service providers can create "sticky" applications (applications that create switching costs to other service providers) beyond simple voice to keep members from switching to competitors. This tactic is used widely by the portals such as Yahoo!, AOL, and Excite (e.g., customized programming, communities).

Messaging

Messaging is defined as asynchronous communication units in different media such as voice mail, fax, pages, email, etc. Messaging is somewhat of an overlap of the other categories previously mentioned but nonetheless a significant category of communication in its own right.

Market Drivers

Quality of Service

Messaging can more easily provide for quality of service since messages are mostly asynchronous in nature and as such are not as time-sensitive as real-time communication.

Device-independent Communication

Despite the increasing number of communication devices and options available to businesses and consumers today, most phone calls end up in voice mail and faxes go to where a person is not. In most cases, the phone call or fax is actually going to a fixed device (phone, fax, pager) and not directly to a person, unless the person has the device with them. The products and services that gain in popularity will be device-independent. Device-independent services mean that an individual can dictate where, when, and how their messages are received, regardless of the origin of the communication. IP Communication makes this much easier to do with intelligent routing to where the person is and rather than to where the devices are.

Unification of Devices

With this proliferation of communication devices comes an increase in the number of messages each person must receive, prioritize, categorize, and answer daily. There is a great need for the ability to get all messages handled from one device (unified inbox) or to send messages from one device to many device mediums (unified broadcasting).

Applications

Follow Me

"Follow me" services allow the user to set up a personalized communication profile that directs communication to follow the user instead of the devices. A user can filter messages based on the caller and not just the device. For example, a user can set the profile so that if a call comes from the boss, the call can be taken right away, but if it is a sales call after 5pm, route the call to voice mail.

Using a standard IP Telephony Gatekeeper, it is possible to combine the devices in the PSTN world with the IP world to make this possible. Moreover, a simple web-browser interface can be used to set this profile and change it on the fly for more efficient message management.

Never Busy

Using an Internet connection, a person could find out through the PC all the messages being sent to that user, even if it is a fax, email, voice mail or page. People will be able to review, filter, and even route calls to a device of their choosing based on the person calling and message/urgency.

Unified Messaging

Service Providers will be able to offer an array of new services to allow customers to managing their messaging communication more efficiently including unified broadcast, unified inbox, and a whole host of management capabilities for their messaging services to help them work more efficiently from anywhere at anytime.

Conclusion

In conclusion, IP Telephony is generating a lot of attention today based on a short-term arbitrage phenomenon. However, the long-term market drivers are true cost advantages, network convergence and development, and the advanced services that an IP-based communication system can offer. Advanced services will allow service providers to go way beyond the current offerings of services and create a clear path to expanding revenue and profit.

These communication services include PC-to-phone, Web to Phone, Multi-point Conferencing, PC to PC communication, Messaging and many more services beyond our imagination today. When creating plans about designing and deploying future network infrastructure and services, look beyond the fractured networks and relatively simple services of today to envision the opportunities coming upon us made possible by IP Telephony and the advanced services that will drive the Communications industry into the 21st Century.

Return to Top View Full-text

Switched Voice Moving to Packetized (IP) Voice:
A Trickle or an Avalanche?

JOHN E. KRZYWICKI

Chairman, Cambridge Strategic Management Group, USA

Abstract:

Not available

View Full-text

Switched Voice Moving to Packetized (IP) Voice:

A Trickle or an Avalanche?

Click here to start

Table of Contents

CSMG Cambridge Strategic Management Group

Switched Voice Moving to Packetized (IP) Voice: A Trickle or an Avalanche?

Or, the Death of the Class 5 Switch??

Prepared for:

PTC '99

Prepared by:

John E. Krzywicki, Chairman, Cambridge Strategic Management Group

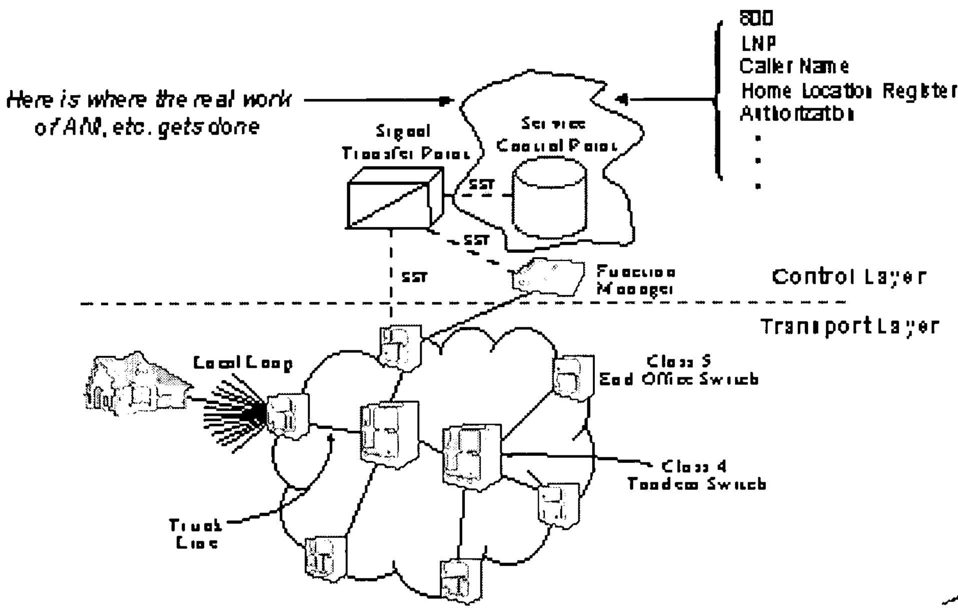
18 January 1999

Today's discussion

- Everyone's Historical Vision, vs. Reality
- "Moore's Law of Switching"
- The Early Tips of the Iceberg
- The Collateral Mass Market Force That Sets the Stage
  - xDSL, especially VDSL
- The Pros and Cons of Switched vs. Packetized Voice
- Some Predictions for the Future

CSMG

For many years, the vision has been to off-load features and new services to AIN devices outside the Class 5 switch, but preserving that switch's basic functionality

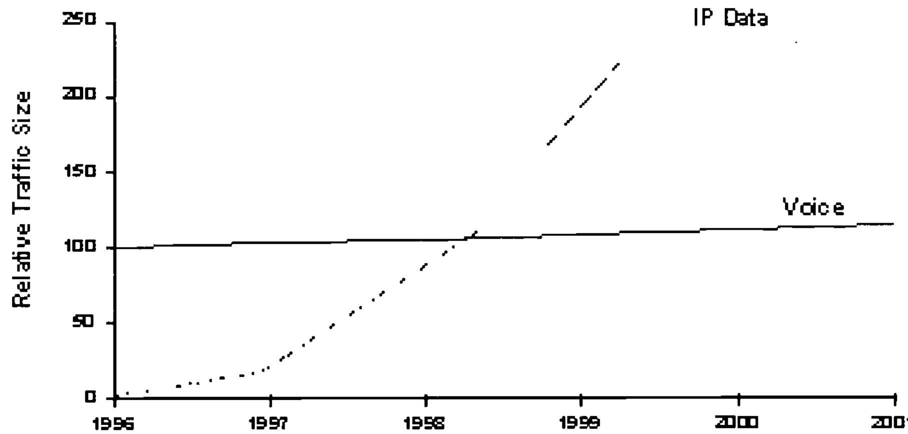


CSMG

Slide 3 of 11

Everyone's Historical Vision, vs. Reality 4

While the above generally works well, a new reality has changed things so dramatically that many people are being forced to rethink architectures generally. That reality is switched data, especially the Internet



Source: JP Morgan, The Yankee Group, Telstra

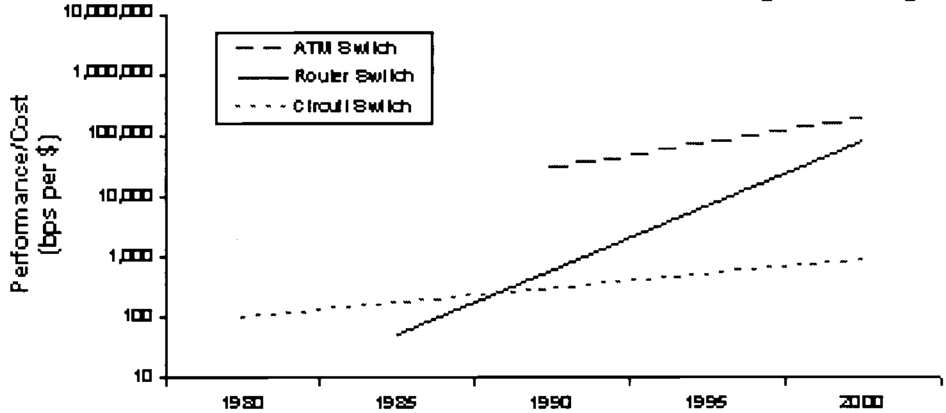
For example, CSMG forecasts Asia-Pacific Internet bits up by a factor of 108 from 1997-2002

CSMG

Slide 4 of 11

The stress that the explosion of data will put on Class 5 networks as time goes on follows not only the explosion in IP bits, but also a set of trends that can be predicted confidently regarding switching costs

Performance Economics of Various Switching Technologies



Source: Business Communications Review

As networks go 80% + data, circuit switches will fall further behind in price-performance

CSMG

Slide 5 of 11

Overall, packet already offers significant cost advantages, and these will increase rapidly

	Circuit Switch	Packet Switch	Packet/Circuit Ratio
At 64-kbps Voice Coding: (Cents per Minute)			
Switching	.62	.04	6.6%
Transmission	1.88	.94	50.0%
Interworking	N/A	.49	High
Estimated Operating Cost	2.50	1.47	58.8%
Year 2003 at 64-kbps Voice Coding:			
Switching	.44	.01	2.3%
Transmission	.75	.12	16.0%
Interworking	N/A	.01	High
Estimated Operating Cost	1.19	.14	11.8%

Source: Business Communications Review

Short-term, however, is often one's focus

- Videotron and Sprint have run the numbers, and picked NGN

CSMG

Slide 6 of 11

Voice over IP ("VOIP") has been with us for almost three years. A 1996 CSMG study concluded:

- Double dial VOIP technically viable
- Near zero US domestic market for it
- Significant international demand, based on rate arbitrage
  - Probably not sustainable for developed countries — this has turned out to be clearly the case
  - Probably sustainable for developing countries, especially with restrictive telecom environments — and this is still mostly true

Double dial VOIP will have almost no impact on established PTOs using Class 5 switched network architecture

CSMG

Slide 7 of 11

Now, however, carrier grade VOIP (single dial, minimal call set up time, PSTN voice quality) is nearly here

- Level 3
- Sprint ION
- Videotron in Canada

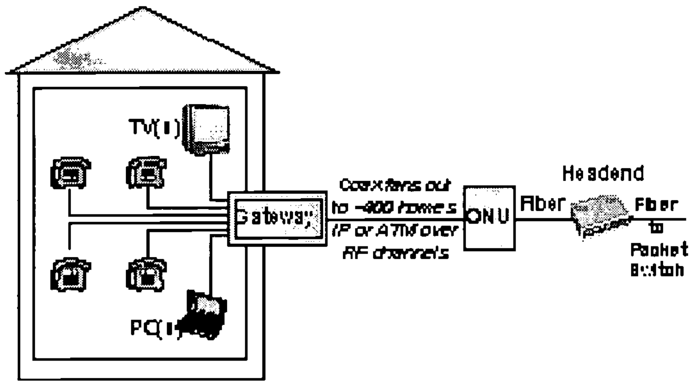
All 2 H 1999 market entry

- At least one major Asia-Pacific PTO philosophically committed to Class 5 cap and eliminate over time
  - When is still very much an issue
- Essentially all major PTOs and top competitors entering serious study phase, if not RFI/RFP phase

CSMG

xDSL, especially VDSL, sets the stage

Architectural Flexibility



Service Concept Flexibility

- All native IP packetized
- Integrated services
- Customer ordering flexibility
- New services written purely in outboard software
- New billing paradigms

The box that can digitize/packetize everything is down to $600! Voice is less than 15% of the non-video bits!

CSMG

Slide 9 of 11

The pros and cons of switched vs. packetized voice can be set forth fairly simply

Switched Voice	Packetized Voice
• Class 5 switches are reliable and thoroughly tested	• VOIP is new and must be tested at scale
• Class 5 switch features are very robust	• Limited features for early releases; more later
• Class 5 switches are not designed for data	• Routers are designed for data
• Most Class 5 switches are already installed and paid for	• New entrants to local voice services (using unbundled local loop) find VOIP especially attractive
• Deriving multiple voice circuits on one copper loop over ADSL/VDSL can be done, but needs significant new gear	• Deriving multiple voice circuits on one copper loop over ADSL/VDSL can be done more efficiently
• Voice and data circuits travelling different paths are harder to synchronize	• Voice and data circuits travel the same path — easy to synchronize
• Voice still has to use some form of Class 4 backbone network	• Can easily put VOIP into native IP backbone network
• Many more	• Many more

CSMG

Slide 10 of 11

While any "crystal ball" exercise is risky, to provoke lively discussion we take some strong stands

- Carrier grade VOIP is a question of when, not if
- If Level 3, Sprint and/or Videotron are even roughly on time and prove in carrier grade VOIP at scale, the rush for new entrants will be on
  - Switch costs are beatable now, let alone 2001+
  - New entrants in Asia-Pacific and globally
    - Often are more Internet oriented than established PTOs
    - Need to conserve loop and CO plant
  - Features will catch up
  - On the other hand, each 6 month delay changes the dynamic
- Established PTOs will move later, but still move, to such architectures
  - To relieve switch, loop plant exhaust
  - To respond to competition
  - To be sure, it will take a decade plus to significantly reduce — not eliminate — the installed base of Class 5 switches

On the whole, however, we see Class 5 → VOIP as with microwave → fiber options — a huge, maybe not 100%, but huge changeout is just beginning

CSMG

Slide 11 of 11

Study on the Characterization of Music

and a Melody Retrieval Method Using Hummed Melody

Masayoshi Umeda, Kazhuhiko Kushima, Masashi Yamamuro, Yuichi Nishihara, Noburoy Taniguchi and Seiichi Konya

NTT Information and Communication Systems Laboratories, Japan

ABSTRACT

This paper proposes a melody retrieval method based on hummed queries. The method proceeds by (1)extracting feature vector of melodic information from musical data, and storing it in a database, (2)extracting same feature vector from a hummed musical segment (input data), and then comparing the input feature vector with the stored feature vectors to find the most similar matches, (3)returning the result music data in order of similarity.

View Full Text

Study On The Characterization Of Music And A Melody Retrieval Method Using Hummed Melody

I. INTRODUCTION

Due to rapid progress in network services, there are more people who want to access to different types of digital media such as pictures, animations, and sounds. Music information is very popular but retrieving it is not easy with the current keyboard-based interfaces. This paper describes a music data retrieval scheme based on query by humming. A query method based on humming is convenient because no special knowledge or skill is needed by the user.

II. MUSICAL DATA RETRIEVAL

Talking about music data retrieval systems, there are several input methods such as entering title of the music or using melody played by a music keyboard or using data after scanning music scores. But when we can't remember the title or the artist's name when using a music on demand system or Karaoke, humming would be an useful input method. When we feel like listening to a certain music, there is a high possibility that we come up with the melody of the music in the first place. If music retrieval using hummed melody was possible, it must be useful since we can use the melody right out from our mind. It might be useful to use music keyboard or to write music score for those who can, but that is not true for most of the people who does not have musical knowledge. However, in case we could remember the name of the artist, we would rather use that as a key. So, if we think about the practical situation when humming music retrieval is effective, it is when the database is large enough that there are many music whose title and artists couldn't be remembered.

There are several melody retrieval methods that use hummed query [Ghias 95],[Kageyama 94]. One typical approach to musical data retrieval is approximate pattern matching (ex. DP matching) using MIDI data. Our approach, on the other hand, a database-centric approach, includes a data preprocessing phase similar to the case of keyword retrieval. Musical segments extraction and the calculation of associated feature vectors are carried out in advance and the information obtained is stored in the database. This information is later used in query processing.

This paper proposes an expression vector space model for melodic information. The only data needed to do the matching is the feature vector, so the method reduces data storage demands compared to using the complete music data (ex. Using MIDI data for DP matching). The result of the search is sorted in order of similarity and there is a high possibility that the music desired by the user would be retrieved even if the input data was slightly incorrect (i.e. musical interval, rhythm). Also, using database (including index) makes the performance of retrieval higher than using DP matching.

III. DESCRIPTION OF OUR RETRIEVAL METHOD

As mentioned above, our approach is a database-centric approach. A database management system(DBMS) creates partial music data (child data) from the whole source music data (parent data), and extracts feature vectors from child data. The DBMS stores sets of parent data ID, child ID, and feature vectors. The vector space DB is a retrieval engine that rapidly performs vector matching. DBMS stores the relations of parent data - child data. A data search extracts the same feature vector from input hummed data, and then compares the input feature vector to the stored feature vector. DBMS returns the most similar matches in order of similarity. We detail the feature vector in the next section. DBMS returns a set of results ranked by overall similarity which is the simple sum of the similarity between the feature vectors of the input and stored data. Figure 1 shows the retrieval process in our database-centric approach. This approach is similar to the approach of ExSight[Curtis 97][Yamamuro 98], an image retrieval system.

IV. THE FEATURE VECTORS

Parent data (whole source music data) is sampled at a low rate, split into short segments of a few seconds (child data), and then stored in the server. This method makes it possible for the user to search from any portion of a music. This means that there is no restriction in the search point of music data. This data is pretreated using a Haning window and Fast Fourier Transformation (FFT); 512 data points are used in each FFT. Figure 2 shows how to split the parent data into short segments (how to make the child data). Figure 3 shows how the data is treated by FFT. After FFT is performed, the below features are extracted from the data.

Frequency components summed at log intervals

(vector dimension: 18)

The frequency of the highest frequency component

(vector dimension: 24)

The normalized frequency

(vector dimension: 28)

The difference frequency from next normalized frequency (vector dimension: 28).

(1)'s data is summarizing number of data every frequency, and making histogram. This histogram data is multidimensional vector. Figure 4 shows how to making multidimensional data. (2)'s data is counting highest frequency component, and making histogram. (3)'s data is summarize number of highest frequency component at a fix frequent part (normalized), and making histogram. (4)'s data is summarize (3)'s difference frequency from next normalized frequency, and making histogram. Figure 5 shows difference frequency from next normalized frequency. Using (1), we can retrieve complete melodic information which is related to information about the tune of a melody. So we can retrieve by melody. The feature vector data scale is a log scale. The reason for this is that human hearing is log scale based. The other feature vectors are also log scale. Using (2), we can retrieve main melody line data because the main melody line's sound pressure is high in general. Using (3), we can retrieve any octave variation because (3) summarizes the octave variation of each section by normalization. (4) allows us to retrieve using musical scale, i.e. not just octave variation data because if the music scale is similar, the melody is discerned as the same piece of music.

V. AN OUTLINE OF APPLICATION

This subsection outlines a typical application. The user only needs to connect to the server and hum into his mike. Also, he can play the keyboard, or use any other music data he can get. He can hum any portion of a melody. A way to connect the server is tcp/ip socket (use tcp port). The server extract the feature vector from hummed data automatically. And then the server retrieves music from the database and shows them in order of similarity to the key. The user interface allows the user to fine-tune retrieval by changing the weight between the feature vectors and emphasizing certain musical feature. The server can store the music data in any popular sound format(such as AU, WAV, AIFF, MIDI). Figure 6 shows a System image. The user's GUI is implemented in JAVA and appears as a web browser that searches for musical data. Figure 7 shows a GUI image for music retrieval.

VI. EVALUATION

To evaluate our approach, we stored 50 pieces of parent data in a database. These music data are popular songs, screen musics, animation songs, and Christmas songs. The average playing time per music is about 4 minutes. The child data extraction found about 150 musical segments from each piece of data in average. Table 1 shows the results of a preliminary experiment.

Table 1: Result of Experiment

Trial	1	2
Size of result set	10	10
#of correct music segments in the set	5	5
Recall(%)	83	56
Precision(%)	50	50

The relation between the number of nearest neighbors searched, recall rate (percentage of correct child data in the returned set out of the total correct child data in the database), and precision rate (percentage of correct child data out of the returned set) are shown. Since our approach extracts many redundant child data, the precision values are not particularly high, whereas recall values are fairly high if we request a large number of result musical data.

VII. CONCLUSIONS AND POSSIBLE APPLICATION AREAS

This paper shows how to combine multi-dimensional features and similarity retrieval to allow the accurate retrieval of child data where the retrieval key is simply hummed by the user. Simple evaluation results are presented. The features are very simple but catch the distinctive features of musical data well. The use of multi-dimensional vector retrieval resulted in high retrieval accuracy. And such a system would be useful in any multimedia database containing musical data by providing an alternative and natural way of querying. Recent advances in cable data network technology have made many new applications possible such as KARAOKE on demand. Also we can use such a system in commercial music industry, music store, music radio and TV stations and even for one's personal use. This research will stimulate new services and interest in networking.

VIII. REFERENCES

1. [Ghias 95] A. Ghias, J. Logan, D. Chamberlin, B. C. Smith, "Query By Humming", ACM Multimedia '95, pp.231-236,USA(1995)

2. [Kageyama 94] T. Kageyama, Y. Takashima, "A Melody Retrieval Method with Hummed Melody", Journal of The Institute of Electronics Information and Communication Engineers, pp.1543-1551,(1994)

3. [Curtis 97] K. Curtis, N. Taniguchi, J. Nakagawa, M. Yamamuro, "A Comprehensive Image Similarity Retrieval System that utilizes Multiple Feature Vectore in High Dimensional Space", International Conference on Information, Communications and Signal Processing, ICIS'97,

pp.180-184,(1997)

4. [Yamamuro 98] M. Yamamuro, K. Kushima, H. Kimoto, H. Akama, S. Konya, J. Nakagawa, K. Mii, N. Taniguchi, K. Curtis, "ExSight - Multimedia Information Retrieval System", Proc. of PTC'98,USA(1998)

Return to Top View Full-screen

Integrating FM Broadcast Stations in VSAT Networks for Distance Education in the Pacific Islands

Best Bruce and John Woodard

University of Guam, U.S.A

ABSTRACT

This paper presents both a brief economical background of the region and a technical framework for delivering educational and telemedicine services into remote island areas of Micronesia. The paper describes how the design and use of different types and levels of telecommunications technologies, including the Peacesat network, Intranet, Internet, FM radio and SSB can be used as the basis for establishing an integrated system for program delivery.

Suggestions are included regarding some of the key principles and operational guidelines that should be considered in designing distance education and telemedicine programs and the infrastructure needed for delivering those programs.

This paper will provide the reader with insights about how to design and manage a telecommunications system that is uniquely suited for delivering distance education course content as well as providing telemedicine resources into remote island areas in ways that are technically reliable and financially sustainable.

View Full Text

Integrating FM Broadcast Stations in VSAT Networks for Distance Education in the Pacific Islands

I. INTRODUCTION

The University of Guam, through its mission statement, has a mandate to support development, through education, in the U.S. affiliated Pacific Islands. These islands, which are commonly called the freely associated states of Micronesia include the Commonwealth of the Northern Mariana Islands (CNMI), the Republic of the Marshall Islands (RMI), the Federated States of Micronesia (FSM), and the Republic of Palau. This paper presents a brief overview about the University of Guam's recent efforts to use different types and levels of telecommunications technology appropriate to these developing nations as the basis for establishing an integrated distance education delivery system. Many references to Peacesat and the University of Guam's distance education programs can be found in prior PTC proceedings.

The goal of this integrated teleeducation project is to provide people living in the more remote parts of the region with a cost-effective pathway to higher education opportunities. By so doing, it will be possible to enhance people's sense of self-reliance. In turn, people will be better prepared to live more satisfying and productive lives. In meeting this challenge, we have devised solutions based on the use of different distance education technologies and extension outreach methods. Efforts have been made to apply these solutions in ways that allow for both the cost-effective and technically reliable delivery of distance education courses throughout this vast 3,000,000 square mile area of the tropical north western Pacific.

II. BACKGROUND

Although Guam is the most developed island in the Northwestern Pacific region, the entire region reflects conditions often found in the newly industrialized countries (NICs) of Southeast Asia. The social and economic fabric of Guam and the other islands within the region is much different than any place in the continental United States. The cultures are diverse, and the kind of social and economic changes occurring in the region are much different. The government structures are a mix of Western and traditional, so the dynamics of political decision-making are skewed from the U.S. norm.

From an economic perspective, needed capital, infrastructure and other resources that are so essential for business to flourish in the region are sorely lacking. Outside of Guam and the CNMI, economic conditions in the outlying parts of the region can best be characterized as only slightly better than subsistence levels.

Regional demographics: The 1990 US Census, as well as more recent World Bank and International Monetary Fund (IMF) studies all suggest deteriorating social, economic and environmental conditions in many of the recently established island nations in the Western Pacific, including over 300 islands in the former US Trust Territories. With the exception of the situation on Guam, the figures for all the former trust territories show lower GNP, larger per household populations, and a general lack of employment opportunities. These demographic indicators reflect the trend towards increased dependency on outside resources in the form of foreign aid.

Since the end of World War II, Pacific islanders and their governments have become more and more dependent on external donor assistance. As the termination date for U.S. compact aid nears, the consequences of this fifty-year dependency on outside resources will become more acute. Efforts need to be made to rekindle a spirit of self-reliance in the hearts and minds of many Pacific Islanders. Self-motivation alone will not solve the problem. Pacific Islanders also need assistance in acquiring knowledge, skills, and the infrastructure needed for effective action.

The economic base: While the reasons are different from one island nation to the next, each of the jurisdictions within the region are experiencing economic hardship. Throughout the region, poor public infrastructure and the high cost of imported goods and services have forced local people to become highly and increasingly dependent on the U.S.-supported governments to meet their day-to-day needs. During the past five years, the lack of economic opportunities in the FSM and dependence upon just a few industries have caused more than 20,000 people to migrate to Guam, Hawaii and the U.S. mainland in search of a better life. This massive migration from the region into these areas has placed additional burdens on these jurisdictions. It is becoming increasingly difficult to provide needed social and educational services and economic opportunity for people in need.

Within the islands, it is often those with education who leave, leading to a vicious cycle that binds together emigration, lack of economic development and poverty. A small percentage of those in the labor force are able to find work in few support industries linked to the international fishing fleets that operate in the region. A few are able to find low paying service jobs in the small tourism industries. However, the vast majority of people in the region either work for the government in some type of patronage job or they simply try to survive through subsistence-level agriculture or small scale fishing. Neither the agriculture nor the fishing creates sufficient cash income to escape poverty or pay taxes needed to support critical public services such as telecommunications.

Lack of telecommunications: Lacking in the pacific islands region outside of Guam and the CNMI is access to resources and infrastructure that underpins important development efforts being undertaken in the region. The availability of telecommunications infrastructure is a central factor in providing educational and medical services to people who live in the more remote areas of Micronesia. Unfortunately, existing telecommunications infrastructure in the remote areas of the FSM and Marshall Islands is grossly inadequate.

While there are high quality telecommunications links between the outside world and jurisdictional centers of the four states in the FSM and the Marshall Islands, establishing such links to the more remote island areas remains an unmet need. As budget resources continue to shrink, the likelihood that reliable, cost effective communications will be extended in the foreseeable future is very unlikely. A cost effective telecommunications solution, capable of facilitating the delivery of educational and medical information and service referrals needs to be devised and implemented if meaningful economic progress in the region is to continue.

III. ELEMENTS OF THE SOLUTION

1. *FM radio programming*

With vast distances between islands the most cost-effective way to deliver distance education programming into the outlying jurisdictions is through small VSAT systems such as the regional PEACESAT network. Our proposed project will couple low-power FM radio transmitters to the PEACESAT network in order to reach a larger audience. These educational FM broadcast systems have proven to be culturally acceptable and reliable in Africa, Australia and parts of the Caribbean; they allow DE to be received on inexpensive FM radios.

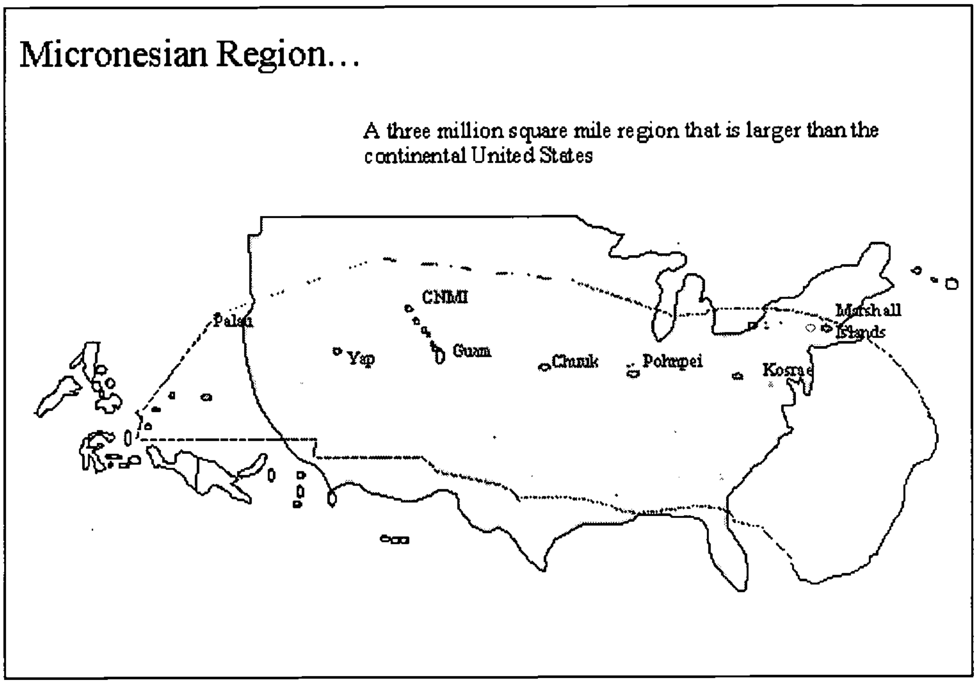
A robust marine grade stereo package with mixer and microphone that transmits in 50 KHZ steps across the broadcast band (87 to 108 MHZ) with no tuning adjustments is the most appropriate technology. Power output is typically 25 watts with good frequency stability in temperatures up to 45°C to cope with the tropical environment. Simple modulation metering with high voltage, reverse polarity and antenna fault protection provides ease of operation by local island workers. The system runs on 12 to 14 volts DC, and the battery banks can be charged by photovoltaic modules.

As designed, the FM transmitting stations will be established through this project. With transmitters connected to existing PEACESAT stations in Yap, Pohnpei, Kosrae and Chuuk in the FSM as well as Majuro and Palau, distance education programming, originating from University of Guam, will be transmitted over the PEACESAT network and then rebroadcast to the outlying island areas using the FM transmitters. Learners on the surrounding lagoonal islets within a ten mile radius will benefit. Interactivity will be accomplished via phone patch, established VHF/FM repeaters, SSB/HF radios or PEACESAT supported e-mail services.

Curricular support materials will be distributed via CD-ROM in text, html and pdf formats to each of the PEACESAT reception stations on a monthly basis. These materials will be designed as enhancements to over-the-air distance education activities being delivered via the PEACESAT-FM radio links. Subject matter materials will be downloaded onto existing Linux and Unix Intranet servers that have already been installed in each jurisdictional level PEACESAT station. Once downloaded, local students and others involved in supporting project activities as advisors and mentors will be able to access relevant subject matter materials in a timely and convenient manner. Once downloaded, local counterparts and collaborators will be able to edit and modify downloaded materials using local languages and examples. These materials can then be reproduced and used with clients in different settings.

As envisioned, when not broadcasting distance education programs, the FM station will be used for locally produced culturally enhancing programming for medical alerts, search and rescue operations, and general governmental civic programming. An additional benefit to the local population is the emergence of enthusiastic wireless technologists for the future of the region.

Figure 1

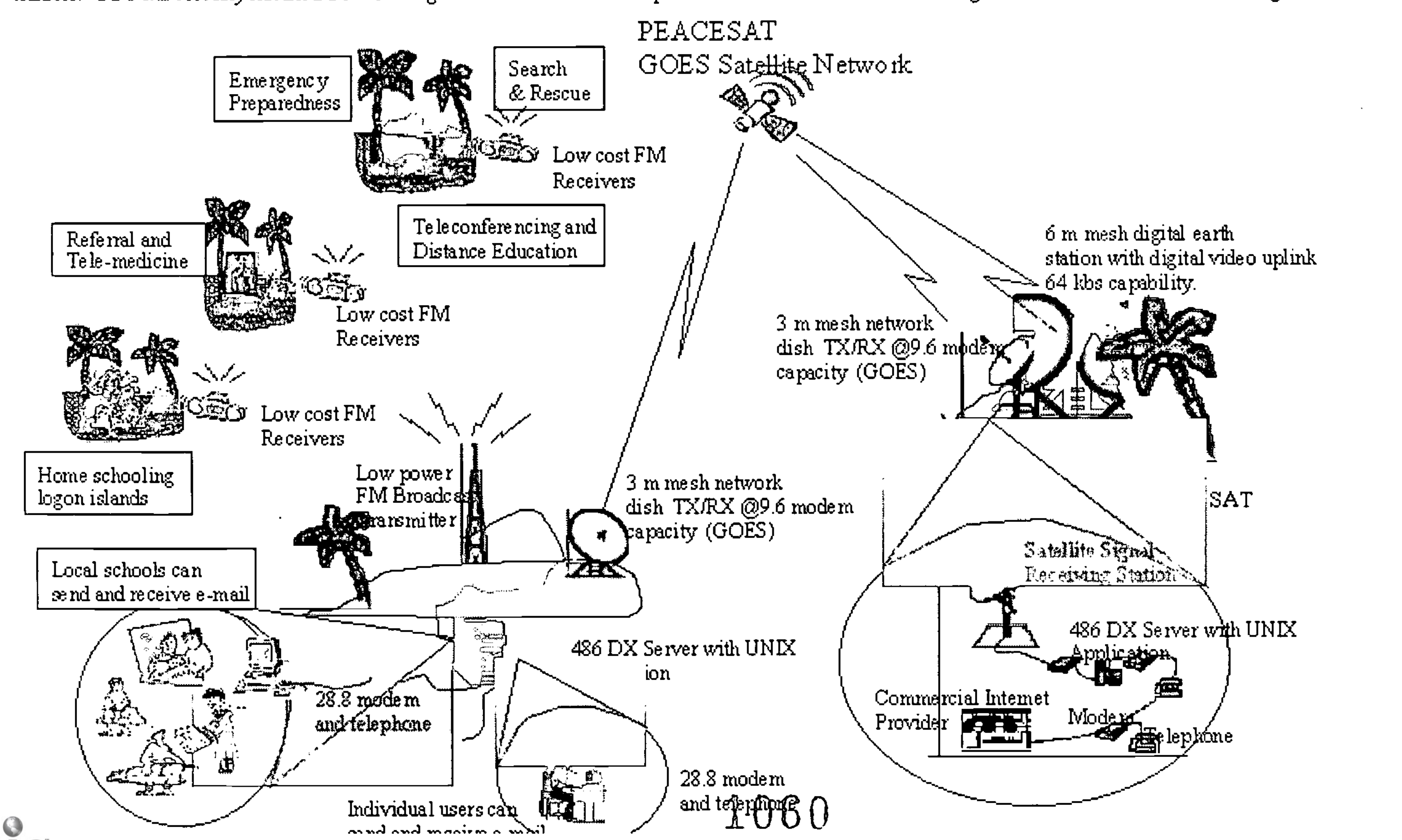


Integrating FM Broadcast Stations in V SAT Networks for Distance Education in the Pacific Island Areas

Figure 2:

Micronesian Distance Education Telecommunications Network

The following illustration describes our topology for the dissemination of information and conducting distance education courses throughout the region over the PEACESAT Micronet System. Micronet is based on the integrated use of PEACESAT GOES Network, SSB/HF, FM Broadcast systems and e-mail. The 22 Micronet PEACESAT terminals on 9 islands across 3 million square miles have simplex and duplex channels that provide SCPC voice, data, and limited video transfer. UOG has recently installed a 6-meter digital earth station that will provide enhanced basic service and higher modem rates for full motion digital video links.



Return to Top View Full-screen

Data Transmission Methods on the Japanese

Inter-University Satellite Network

Kikuo Asai, Kimio Kondo, Kiyohiro Yuki, Yuji Sugimoto, Zenji Hayashi,

and Noritak Ohsawa

National Institute of Multimedia Education, Japan

ABSTRACT

The "Space Collaboration System" (SCS) is the inter-university satellite network in Japan, which has been operated since October in 1996. The present SCS consists of 100 VSAT (very small aperture terminal) stations at the universities and plays an important part for the Japanese distance education. It can be used for sharing classes, debates, symposiums at distant places, exchanging 1.5 Mbps compressed images among the VSAT stations. The interactive communications are available as well as broadcasting on the SCS session.

The data transmission service is necessary for efficient uses of the SCS. This service can make (1) transmission of teaching material during the session, (2) transmission of large capacity data over midnight, and (3) interactive data communications among VSAT stations. The feature of the SCS is to make a broadcast or multicast, switching the transmitting stations in three transponder channels with 1.5 Mbps. We can use one channel for broadcasting or multicasting the data. The notices of the broken data or unreached packets and the interactive data communications require a link accessible to the chair station from the others. The link structure dominates transport protocol type and quality of service. We discuss about the data transmission methods using the SCS, its applications, and file transfer experiment between two VSAT stations.

View Full Text

Data Transmission On the Japanese Inter-University Satellite Network

INTRODUCTION

The inter-university satellite network was built in Japan, and has been operating since October, 1996. This network is called the Space Collaboration System (SCS) [1] which plays an important part for the Japanese distance education (see Figure 1). The present SCS consists of 100 VSATs (very small aperture terminals) at universities and a HUB station placed at the National Institute of Multimedia Education (NIME). It is used in higher education for joint classes, debates, and symposiums with audio and video among the VSAT stations. The research advice and special seminars are available between students and their supervisors because interactive communications are available as well as broadcasting on the SCS session. There are around 500 uses (roughly 1000 hours) within half year (see Table 1).

In the first six months, the SCS was used for study meetings (45 %), course sharing (24 %), and conference (13 %). The sessions were organized between two stations (57 %), among three stations (18 %), and among four stations (13 %). The sessions were held for less than one hour (25 %), two hours (59 %), and three hours (6 %).

The satellite system has been mainly used for the broadcasting of courses in the field of higher education in Japan. The two-way education network has been studied by NIME in the satellite workshop experiments [2] using the ETS-V satellite with 10 earth stations including the Communications Research Laboratory, the National Space Development Agency of Japan, the King Mongkut's Institute of Technology Ladkrabang in Thailand, and the Institute Technology Bandung in Indonesia. We have recognized the usefulness of a multi-site educational collaboration network and requirements for the satellite system in the university through more than 30 workshops. We also made investigations about effects on education, and on the configuration and technical problems for the system using digital compressed images in cooperation with several domestic universities. These investigations enabled us to propose the inter-university VSAT network in 1994 [3]. It was then financed as the Space Collaboration System by the Ministry of Education.

The SCS is now limited to exchange of the audio and video among VSAT stations. To use the SCS efficiently, we have a plan to provide a data transmission service. There are several problems about data transmission on the satellite link such as transport protocol type, link structure, quality of service, error correction, and so on. The link structure actually dominates the transport protocol type and quality of service. Section 2 presents the feature and configuration of the SCS. Section 3 presents methods of the data transmission using the SCS. Section 4 presents preliminary experiment results of data transmission between two VSAT stations.

FEATURE AND CONFIGURATION OF THE SCS

The SCS has an advantage as the satellite communication method that links many users over very large areas simultaneously [4]. In addition to this, it is possible to do interactive communications with easy operation.

Interactive: Two transponder channels are at least necessary for the interactive communication. In the present SCS, three channels are shared with plural VSAT stations in the same session group. The transmitting stations can be changed by the chair station. The other stations can watch the discussion, and send a transmission request to the chair station. One session group can include any number of VSATs keeping a transponder cost constant.

Operation-easy: Satellites have been used mostly by technical staffs or professional operators because only licensed operators are legally allowed to operate the radio station and set up the channel and power of the radio equipment. The VSAT is controlled by a HUB station to allow easy operation without the licensed operators in each university. The technical operation is automated by the control from the HUB station where the licensed operators watch the network. The users can easily switch stations and audio-visual equipment by touching control-panels in a classroom.

Cost-effective: The compressed pictures are exchanged in the SCS to suppress the transponder cost. 1.5 Mbps at ITU-T H.261 was selected as the optimum bit rate as of today because of the followings; (1) enough picture quality for discussions, (2) small delays in the coding and decoding, (3) better compatibility among different-vendor CODECs, (4) and small 2.4 m antenna.

We briefly introduce the configuration of the SCS to demonstrate the above features. Figure 2 (see Figure 2) shows the VSAT system placed at each university. The uplink and downlink frequencies are Ku band, and transmission power is 30 W with an offset-parabola antenna with a diameter of 2.4 m. There are three kinds of MODEMs which are used for communication (1536 kbps) of the audio and video signals, link-control (Out-bound: 64 kbps, In-bound: 32 kbps) from the HUB station, and order-wire (16 kbps) as a connecting line. These baseband signals are modulated onto a microwave carrier with quadrature phase-shift keying.

Each VSAT station has various audio-visual equipment so that the users can make effective communications for education. The users operate the audio-visual equipment with AV touch panel monitor, and can select the transmitting and monitoring images and control voice level in the room with easy operation. The AV control system automatically control the audio-visual equipment sharing link control information with the link control system, such as function that the voice from own station is canceled.

METHODS OF DATA TRANSMISSIONS AND APPLICATIONS

The feature of the SCS is to switch the transmitting stations for three transponder channels with 1.5 Mbps. Any station in a session group can transmit whenever the chair station assigns the channel to the station through the HUB station. We can use one channel for broadcasting or multicasting data. The efficient application is (1) simultaneous transmission of teaching materials with video conference during the session. The lecturer can immediately send clear materials to students at each station. The second application is (2) data transmissions using the night channels. This is available for multicasting large capacity data of teaching materials to a large number of stations. Besides the teaching materials, the users can obtain up-to-date software and Web data. Another application is (3) interactive data communications that each station makes a response to the chair station. This applications can be used for confirmation of attendance, acquisition of students' answers for teacher's questions, and questionnaires.

We are planning to provide two kinds of quality for data transmission as a service: One is the service with low quality to broadcast data using UDP (User Datagram Protocol) without connection handshake and verification, while the other is the high-quality service with reliable multicast protocol using the tunneling technique[5] on the ground-based network. Figure 3 shows system configuration for the data transmission in the SCS. To make two transmission modes of the audio-video and data, the connection must be switched between MODEM-to-CODEC and MODEM-to-Router. The control line is necessary for switching the connection with a command from the transmitting station. We use a data port of the CODEC as the control line.

In the case of the low quality, the UDP is used for the data transmission. The transmitting station with a server does not receive any response from the client stations. The data transmission rate is expected to approach to 1.5 Mbps which is the full rate-bandwidth. But there is possibility that packet loss occurs in the data transmission. In order to recover the packet loss, the same data are transmitted several times. If there is an error in the data, the frame is replaced to the new one. This method is useful for transmission of large capacity data over midnight.

On the other hand, the high quality service requires reception of some responses from the client stations at the transmitting station with the server. TCP (Transmission Control Protocol) is suitable for this kind of data transmission in the point-to-point connection, since it has functions to notice the broken data or unreached packets and to request the re-transfer. But only one satellite channel can be assigned for the data transmission in the SCS and only one server station distribute the date to the clients. Even if another channel is assigned for the forward link, the transmission rate will be very low because of satellite delay. So we use a ground route, for example, the Internet, as a forward link accessible to the server from the clients. The reliable multicast protocol is necessary for reliable data distribution to a large number of clients from a server. The server-triggered distribution may reduce server load and network traffic, compared to downloading from the server on demand. In the Internet, the routes from the server station to the client stations are established with the tunneling technique that does not affect the other network. The maximum window size should be set in a way that does not limit the throughput for the link bandwidth. This method is useful for the distribution of teaching materials and up-to-date software.

TRANSMISSION EXPERIMENT BETWEEN TWO VSAT STATIONS

As the first step, we made an experiment of file transfer between two VSAT stations (Center 1 and 2). The MODEMs of these stations were cross-connected through the satellite link (JCSAT-3) with a bandwidth of 1.5 Mbps. The file transfer with FTP (File Transfer Protocol) obtained a transfer rate of roughly 120 kbps. The saturation of the transfer rate occurred at this rate because of satellite delay. Then the file transfer without feedback was tried using the UDP with easy FEC (Forward Error Correction) technique. This broadcasting program transfers the same file three times in order to recover some errors, and excludes packets with errors or losses in the receiving site. Table 2 (see Table 2) shows results of the file transfer at the file size of 5,640, 27,2496, and 90,7208 bits. It is found that the transfer rate is roughly 1.3 Mbps at the maximum. The file transfer without feedback can efficiently use the link bandwidth of 1.5 Mbps. The output speed of the data must be arranged properly because the buffer expects to saturate at the router.

SUMMARY

The SCS increases the VSAT stations every year, expanding the network. It has been recognized that the SCS is an important network for distance education in Japan. The number of simultaneous session will also go up, and this causes a budget problem. There are several requirements to improve the SCS in technical and operational matters, though the quality of images and the operation of instruments have been evaluated as reasonable. We hope that the data transmission service will continue to support the SCS users strongly.

ACKNOWLEDGMENTS

This research was partially supported by the Ministry of Education, Science, Sports, and Culture, Grant-in-Aid for 10680248. We are grateful to Dr. Marie Thorsten for careful readings of this paper.

REFERENCES

http://www.nime.ac.jp/SCS/index_e.html

K. Kondo, R. Suzuki, N. Hamamoto, H. Wakana, Narong H., Utro S., Satellite Workshop Experiments using ETS-V, 44th IAF Oct. 1993.

K. Kondo, K. Tanaka, H. Ohnishi, T. Kondo, Study of Inter-University VSAT Network, Online EDUCA Berlin, Nov. 1995.

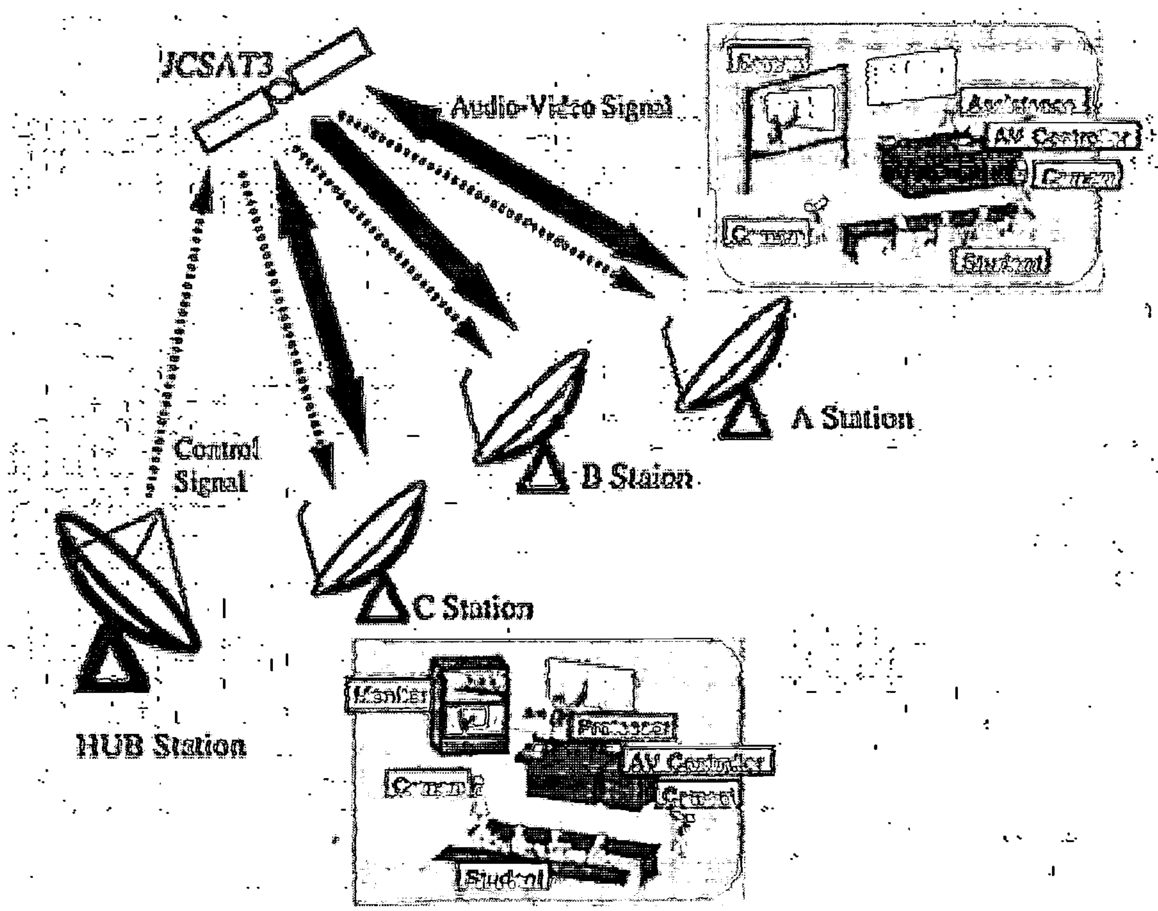
D. Roddy, Satellite Communications 2nd ed., McGraw-Hill, 1989.

S. S. Miller, IPv6 The Next Generation Internet Protocol, Digital Press, 1998.

Figure 3: Data Transmission Architecture

Return to Top View Full-screen

Figure 1 Concept of the Space Collaboration System


JCSAT3
Audio-Video Signal
Control Signal
A Station
B Staion
C Station
HUB Station
AV Controller
Student
Professor

Go Back

Table 1 Uses of the SCS

Month	Number	Time
1996 Oct.	96	182hr 15min
Nov.	111	205hr 45min
Dec.	92	166hr 05min
1997 Jan.	70	143hr 10min
Feb.	59	112hr 35min
Mar.	79	170hr 15min
Total	507	980hr 05min
1997 Apr.	55	120hr 45min
May	76	157hr 00min
Jun.	92	180hr 50min
Jul.	86	222hr 40min
Aug.	24	79hr 00min
Sep.	134	181hr 15min
Total	467	941hr 30min
1997 Oct.	116	260hr 25min
Nov.	96	194hr 55min
Dec.	75	153hr 10min
1998 Jan.	70	184hr 50min
Feb.	49	108hr 35min
Mar.	86	175hr 05min
Total	492	1077hr 00min

Total	492	1077hr 00min

Go Back

Table 2 Average Transfer Rate

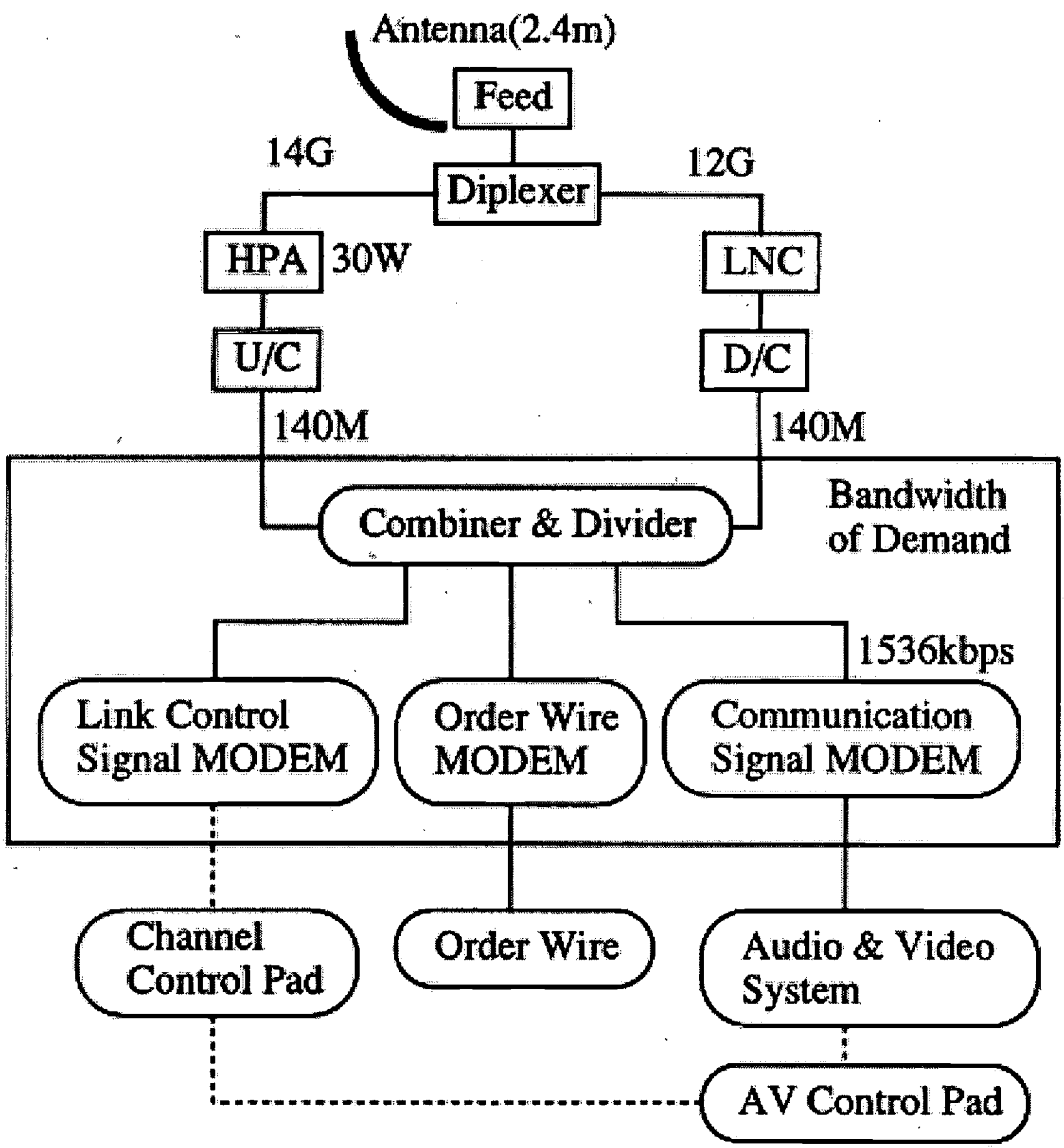
5640 bits	[bits/s]
Center 1 > 2	Center 2 > 1
561641	535562
2.6806×10^6	515681
538065	507468
537450	507788
536275	-

272496 bits	[bits/s]
Center 1 > 2	Center 2 > 1
1.22987×10^6	1.2323×10^6
1.32472×10^6	1.33521×10^6
1.21422×10^6	1.25187×10^6
1.27007×10^6	1.31582×10^6
1.21513×10^6	1.23927×10^6
-	1.23319×10^6

907208 bits	[bits/s]
Center 1 > 2	Center 2 > 1
1.3217×10^6	1.30797×10^6
1.33884×10^6	1.31975×10^6
1.30693×10^6	1.31686×10^6
1.58111×10^6	1.65967×10^6
1.51287×10^6	1.42631×10^6

Go Back

Figure 2 Configuration of the VSAT system



Go Back

Broadening Access: Developmental Opportunites for Universities in the Asia-Pacific Region

John M. Renner

Edith Cowan University, Western Australia

ABSTRACT

This paper examines three current initiatives by universities in the Asia-Pacific Region to share telecommunication ideas, skills and course materials. Two collaborative projects involving Edith Cowan University(Australia), Suranaree University (Thailand) and University Terbuka (Indonesia) have been reported at previous Pacific Telecommunications Conferences (PTC'97 and PTC'98). More recently, an international consortium of eleven universities in the Asia-Pacific Region has been established under the umbrella of the Association of Universities of Asia and the Pacific (AUAP) to promote the sharing of communication technologies internationally. A task force chaired jointly by the authors is responsible for activities associated with "Multimedia Education: Courseware Production". Other sub-groups focus on delivery systems, legal issues, policies, standards, training and international linkages.

The paper demonstrates, through these initiatives, how new convergent communication systems and electronically formatted courseware are broadening opportunities for universities to collaborate and compete. It also shows how rural and remote students as ell as on-campus students stand to benefit from the "communication revolution".

View Full Text

THE SUT/ECU PROJECT IN THAILAND

The focus of the project between Suranaree University of Technology in Thailand and Edith Cowan University in Australia is the development of interactive multimedia courseware. Both SUT and ECU had already demonstrated a commitment to advanced electronic delivery and were well placed to share expertise in this field. Industry support in Australia and Thailand further cemented the relationship.

The project was segmented into three phases:

Phase 1 Implementing and developing Virtual Campus technology.

Phase 2 Collaborating to develop prototype multimedia modules.

Phase 3 Expanding the multimedia production phase to enable marketing of IMM materials in Thailand, ASEAN and Australasia.

Our objectives may be summarised in the following form:

Phase 1

- Investigate opportunities to implement the technology locally in Thailand and identify social, technical and educational issues associated with the introduction of the Virtual Campus from a student and staff user perspective.
- Document policies and practices within and between universities associated with the implementation of the Virtual Campus and recommend policy directions.
- Establish an evaluation programme and an associated quality assurance mechanism for Virtual Campus research and development.

Phase 2

- Facilitate development of the interactive multimedia engineering industry by SUT and ECU in Thailand and Australia.
- Maximise the multimedia engineering developments in SUT and ECU.
- Produce marketable multimedia engineering products.

Phase 3

To develop a multimedia export industry focusing on skill development, innovation and training serving the needs of industry and higher education in Australasia and SE Asia.

Details covering the progress and outcomes for each of these phases of the project have been reported in the AUAP-Bunkyo University Conference Proceedings (Renner and Pairsuwan, 1997). Suffice to say that we are now entering Phase 3 which requires product enhancement, market research and commercialisation. Built in to Phase 3 is recognition of the need for rigorous assessment of IMM materials, skill development, workshops and production sessions in Australia and Thailand, trials of IMM units in bilingual format and further negotiation with commercial counterparts.

In addition, Suranaree University of Technology is currently building a Digital Production Centre on campus within its technology park ("Technopolis"), confirming SUT's confidence in the future of "borderless education" and multimedia delivery in particular. The Centre will also support the development of new methodologies for teaching and learning arising from the new communication technologies. A common format will be used for all IMM modules (as at ECU). SUT will offer accelerated promotion and other incentives for participating staff. The technical team will be enlarged to ensure effective translation of courseware to various digital formats. At this early stage in the development of a new set of educational delivery systems, student feedback and quality assurance are specially important. In response ECU and SUT are exploring various methods of evaluating the effectiveness of IMM courseware and the range of services provided by the Virtual Campus.

THE ASIA-PACIFIC DISTANCE AND MULTIMEDIA EDUCATION NETWORK

The third project will promote inter-university collaboration across all countries of the Asia-Pacific Region. Under the sponsorship of the Association of Universities of Asia and the Pacific (AUAP) and its membership of over 180 universities, the Asia-Pacific Distance and Multimedia Education Network (APDMEN) will facilitate the transfer of communication technologies and associated multimedia courseware across national and international boundaries. More specifically APDMEN will encourage collaboration between its members, with governments, with international organisations and with industry covering ten areas of interest (Figure 2).

APDMEN maintains a secretariat in Thailand and through five committees will work to achieve these objectives (Figure 3). It recognises that through university co-operation advances can be made in the quality and the methods used for delivery of courses to students. More particularly, "disadvantaged or marginalised societies can be helped in attaining equal opportunities for use of such technologies" (APDMEN, 1998, p2).

FIGURE 2: THE OBJECTIVES OF APDMEN

APDMEN will facilitate the development and transfer of emerging

distance and multimedia education technologies by:

- producing appropriate multimedia courseware in various prioritized disciplines and areas of mutual interest and concern;
- developing comprehensive training programs on multimedia courseware production and their utlization in both face-to-face and distance education

programs;

- promoting transfer and adaptation of Virtual Campus technology through the Network;
- providing a mechanism for sharing, exchanging and marketing teaching-learning modules;
- establishing a forum to discuss relevant legal issues and policies on intellectual property rights and marketing;
- providing services needed for the implementation of distance and multimedia education programs;
- undertaking high quality multimedia research and development including providing an experimental test bed for multimedia and electronic delivery projects;
- identifying key centers of multimedia research in universities in the region;
- facilitating the sharing and exchange of R and D findings; and
- supporting the building of electronic libraries and the formation of a data base on university resources.

FIGURE 3: FIVE APDMEN COMMITTEES ("TASK FORCES")

- Committee on Distance Education Delivery Systems
- Committee on Legal Issues, Policies, Standards and International Linkages
- Committee on Technical and Professional Training in Multimedia Courseware Production
- Committee on Multimedia Education: Courseware Production
- Committee on Digitalisation of Libraries

The membership of APDMEN comprises four categories:

full members (from AUAP membership)

associate members (interested non-AUAP members)

supporting members (governments, corporations)

affiliate members (non-government organisations)

The APDMEN Board comprises representatives from ten "core member" countries: Australia, China, India, Indonesia, Japan, Korea, Malaysia, Philippines, Thailand and Vietnam. Co-chairing the Board are Prof. Dr. Wichit Srisa-an (Suranaree University of Technology) and Prof. Dr. Toshio Nakamura (Bunkyo University). Additional ex-officio members have also been appointed.

Activities and achievements of APDMEN will rest largely with the five "task force" committees. Core members on these committees will be establishing links with governments and industry and identifying priorities in their respective areas of interest. Already, the Committee on Multimedia Courseware Production has suggested some points for consideration when choosing authoring tools and production of courseware. For example:

- Quality of vendor's customer support

  - experience in the development and delivery of multimedia courseware application development,

  - the plan for product upgrade,

  - support provided, e.g. web-online support, etc

  - competitive pricing.

- Courseware application development technology used

  - course design e.g. logical navigation among lessons, topics, learning resources and student's assessments, real-time interaction, etc

  - course administration e.g. on-line user regulation and tracking, monitoring and documentation of a student's progress and achievement,

  - ease of use,

  - platform support.

- Finished courseware must provide an effective learning experience designed for Internet or intranet delivery

  - the finished product must present competencies, performance standards, learning objectives, learning activities and assessment activities to students in an easy-to-use, intuitive interface;

  - the finished product must present syllabus information such as grading/credentials policy, expectations for participation, calendar of due dates for assessments, protocols for interacting with the instructor and other students, etc.

- Preferred language

  The language to be used in the courseware must be the language of instruction used in the school. The instructions for authoring the courseware may however be in English. Trials will be conducted in the use of bi-lingual courseware.

CONCLUDING COMMENTS

In this paper, we have reported progress in three international projects driven largely by the application of convergent communication technologies. We also foreshadowed the likelihood of substantial restructuring within universities in response to the new and expanding capabilities of telecommunication. Moreover, as illustrated in this paper, universities are now actively seeking partnerships with each other and with industry in order to improve communication with and between on-campus and more distant students. The three projects described here are, like many partnerships, international, sharing of experiences and expertise, and aiming at higher quality and less costly communication with students.

But Universities' concerns about implementation of advanced telecommunication systems appear to be rising in proportion to their use of electronic access for students. Indeed, not all universities and their senior executives are convinced or committed to the implementation of more advanced communication systems. Some for example are still committed to a combination of one-way radio and TV supporting postal and telephone services. Even those universities favouring computer networking and convergent communication still rely on postal services. In short, if the process of pedagogical restructuring has begun, it is far from over. The challenge will be to assess and implement advanced technologies and to produce quality courseware for student use on the network. For some, an even greater challenge will be to allocate sufficient funds to make these substantial changes possible.

Meanwhile, in the wake of these changes, students find that they can become more selective since more university opportunities are on offer. They are becoming more autonomous, more able to design and tailor-make their courses from various sources to meet personal needs. Is it possible then, that in the 21st century students will be able to wrestle pedagogic authority from universities?

Predictably, in the face of pedagogical change, universities and teachers in them are evidencing caution and nervousness. For example, a report taken from the PTC homepage dated June 18 last shows that teachers are concerned about the changing technological environment:

> "850 professors at the University of Washington have signed an open letter to Gov Gary Locke expressing their fear about his enthusiasm for instruction via CD-ROMs and the Internet .... "

In response, a government policy and adviser claimed for adult learning that:

> "Technology is likely to be the much more common method of

delivering the learning they need" (P.T.C. Homepage 1998).

Peters (1998) sums up the current situation: "on the whole, the pedagogical restructuring required ... is deep and extensive" and "we could in fact start to speak of the beginning of a new era in which distance education will develop into an extraordinarily open, flexible and variable form of teaching and learning which can be adapted to the learning requirements of all students." The university of the future will "look much more like the emerging distance teaching university than a traditional one." (Peters, 1998, p15).

We are left with a question raised by Annelise Berendt (1998, p32) who asked: "When will the virtual enterprise get real?" Answers will vary, opinions conflict, but we can be sure that the advantages of communication technology will ensure that universities will increasingly commit themselves to communication systems designed to enhance interactivity within and beyond the classroom.

Already, universities are experiencing pain as they endeavour to provide adequate multimedia courseware, reliable delivery systems, committed academic staff, capable technical support, low-cost hardware and software. Some claim that we are trying to achieve too much too quickly. Yet failure to respond to the fundamentals of APDMEN and the other two projects discussed in this paper could threaten survival and success of universities in the twenty-first century.

REFERENCES

Association of Universities of Asia and the Pacific (AUAP) 1998. Draft Strategic Plan for the Asia-Pacific Distance and Multimedia Education Network (APDMEN), AUAP Secretariat, Suranaree University of Technology, Thailand.

Berendt, A. 1998. The Virtual Enterprise Gets Real, Telecommunications, 32, 4, 32-38.

P.T.C. Homepage. 1998. New release, 13 July.

Peters, O. 1998. New Possibilities and Opportunities of Digital Learning Environments for Distance and Open Learning, Proceedings, SIODES, Shanghai, April, 1998.

Renner, J.M. 1995. Convergence of Communication Technologies to Achieve Educational Excellence: a case for the Virtual Campus, Proceedings, 17th Annual Pacific Telecommunications Conference, Honolulu, Hawaii.

Renner, J.M. Pairsuwan, W., and Idris, N. 1998. Implementing Advanced Communication Technologies to Achieve Educational Excellence: a University Perspective, Southeast Asian Higher Education Review (in press).

Renner, J., and Pairsuwan, W. 1997. Thailand/Australia University Links Program, Conference Report, AUAP – Bunkyo University, Tokyo, 10 – 12 April.

SIODES (Shanghai International Open and Distance Education Symposium), 1998. Proceedings (CD Rom), Shanghai TV University, April.

Creating Transnational Distance Education Alliances

Ted Christensen, Arlene Krebs, John Hinchcliff

George Washington University Television, U.S.A

New Orbit Communications, U.S.A

Auckland Institute of Technology, New Zealand

ABSTRACT

Not available

View Full Text

Creating Transnational Distance Education Alliances

Creating strategic alliances and joint ventures for distance education offers many opportunities as well as barriers. The opportunities for transnational knowledge networks include the sharing of resources, expertise and transcultural learning experiences. Among the barriers are accreditation, time differences, financial investment and funding resources, as well as cultural, political, legal and copyright issues.

The process of partnering and collaboration has been undergoing extensive change. Identifying and understanding this process within a single country and within a single culture is not a simple matter. However, by adding the complication of establishing a partnership that spans countries, continents, cultures, time zones and languages, you often are faced with many totally new and sometimes insurmountable obstacles. An analysis of ten steps to follow in creating transnational alliances can help to eliminate many of the barriers as well as foster a well conceived plan for project implementation.

These 10 areas to consider include:

* Cultural Understanding*fostering understanding of cultural differences and similarities; assisting students and faculty to develop sensitivities to cultural nuances; building upon cross-cultural similarities; and creating a dynamic framework for the exchange of information as well as for individual projects and team work.

* Language Differences*fostering bilingualism and multilingualism so that students and faculty develop an understanding of how language and culture are inextricably woven; determining the primary language for the distance learning program; and assisting students and teachers with their writing and speaking skills in foreign languages.

* Time Zones*determining a common time frame for synchronous learning experiences as well as adjusting to time differences for asynchronous learning opportunities.

* Education Policies established by Ministries of Education and by Educational Institutions*Education Policies reflect both institutional and national policies. These include accreditation; competency-based outcomes; learning performance; evaluation and assessment; faculty development and compensation.

* Curriculum Development and Adaptation*fostering alliances among partnering faculty who develop and teach the courses; creating opportunities for mediated or in-person face-to-face meetings; adapting curricula to meet the language, cultural and policy issues of partnering institutions; pre-testing curricula with a pilot group; marketing curriculum to adult learners.

* Legal Issues*these include copyright and intellectual property rights; contracts or letters of agreements among partnering institutions and nations; contracts with industry equipment and telecommunications vendors; and letters of agreement or understanding between faculty concerning rights and responsibilities.

* Technology*analyzing the capability of each institution and creating appropriate technology plans; selecting the technology for the transnational project; researching costs and equipment availability and accessibility.

* Telecommunications Infrastructure*analyzing the infrastructure of each institution and creating appropriate plans; selecting the telecommunications carrier for the transnational project and requesting consideration for pricing based on non-profit status; researching costs and accessibility.

* Costs*creating a detailed budget that analyzes institutional and faculty compensation; tuition fees; technology and telecommunications costs; curriculum costs; leveraging in-kind contributions; and securing institutional and national commitment to help with costs.

* Funding*researching private and governmental external funding agencies; researching institutional internal funding availability and commitment; grant proposal planning, preparation and submission. There are many successful projects in operation or positioned to emerge. These include higher education alliances, K-12 global learning projects, health and telemedicine projects as well as corporate training applications.

Case studies of some transnational projects using a variety of delivery methods: two-way interactive videoconferencing, satellite and direct broadcast satellite distribution and the Internet offer models for cooperation. Case studies include those from the National Technological University, the International University, the International CyberUniversity (presented by Dr. Hinchcliff), corporate training networks, and K-12 collaborative projects.

Some of these projects are similar in their structure and organization as well as different in terms of how each project assembled its resources, created partnerships among education institutions, industry and government agencies, trained faculty for collaborative learning, and initiated student-centered instructional materials for degree and continuing education programs. The audience will participants will be encouraged to respond to these issues, in order to build upon the experience of distance education practitioners and create new opportunities for strategic alliances and collaboration.

Securing Funding

Transnational funding opportunities have increased dramatically within the last few years by private philanthropies, government agencies, regional consortia, and multinational companies, especially those from Japan, the U.S., Germany, the U.K and France. Companies that maintain offices abroad generally contribute to local nonprofits to support projects where the company has a significant presence. Some companies have established private, nonprofit foundations within other countries, such as Hitachi, Mitsubishi and Honda have in the U.S.

U.S. companies, such as AT&T, Microsoft, Intel, Exxon, and IBM and other high-tech industries give internationally. As well some U.S. private foundations have established international headquarters, such as the Ford Foundation, the Soros Foundation and the Freedom Forum.

U.S. private foundations and corporate giving programs support a range of initiatives which generally follow the parent company*s giving programs, such as education, health and human services, public policy, the environment, arts and culture, and technology and telecommunications. The grantseeker should be aware that each program area has specified interests, so be sure to follow carefully the targeted priorities and application guidelines in your grant request.

You should also be aware that some U.S. philanthropies adjust their international focus to help countries make a transition to democratic practices based on free-market principles. For example, the Mott Foundation focuses on Eastern and Central Europe as does the Soros Foundation. The Rockefeller Brothers Foundation concentrates its giving in Indonesia, Cambodia and Vietnam, while the Ford, Kellogg and MacArthur foundations focus on South Africa, Latin American and the Caribbean.

In Europe and the Asia Pacific region, many companies operate national giving programs as well as contributing to cooperatively funded regional programs. These companies also endorse, through their sponsorships, conferences, reports, research centers, media festivals, websites and special event distance education projects such as electronic field trips and international videoconferences.

Increasingly, distance and open learning are considered solutions by ministries of education to help meet the needs of its citizens. Education is the primary concern but other equally significant areas include literacy, health and human services, environmental issues, agriculture and food systems management, and world peace and global interdependency. European philanthropies maintain an approach to giving that reflects the country's culture and norms. Additionally, each adheres to the country's legal requirements and regulations which structure the organization's operations.

For those seeking to fund higher education courses, the major content areas for funding include nursing, business and management, engineering, science, math, computing and information technology. The use of media*from film and television to Internet resources to disseminate educational materials and to foster public understanding and education are also supported. The grant seeker wishing to initiate transnational distance education should therefore form a strategic alliance or cooperative venture among institutions and then approach a diversity of funding sources in the national, regional and international arenas.

A particularly notable international contribution was made by U.S. media mogul Ted Turner, vice-chairman of Time Warner, Inc. who in fall 1997 pledged Time-Warner stock valued at up to $1 billion to endow the United Nations Foundation (UNF). The Foundation expects to award about $100 million a year for the next ten years. In June 1998, Turner committed an estimated $22.2 million to the Foundation*s first round of 22 grants.

Grants are awarded to U.N. agencies, programs, or the Foundation's sister organization, Better World Fund. The 1998 funding was directed toward projects in three broad categories: children's health, $6.5 million; environment/climate change, $1.4 million; women and population, $9.3 million; activities related to land mines, $2.6 million; food security, $1.2 million.

Drug control and poverty alleviation were other areas of support. Volunteerism is another major aspect of international philanthropy. According to a report issued by Lions Club International, the United States has the highest number of adults who participate in volunteer activities. Half of all adult Americans donate 5-10 hours of their time a month performing duties such as feeding the homeless and preventing child abuse.

Internationally, this trend also exists in Brazil where 26% of the adults spend time engaged in volunteer work. In India, this figure is slightly higher, about 32% of all adults. In France, Germany, and Hong Kong an estimated 15% of all adults are volunteers.

Securing funding for a transnational distance education project can be a creative, dynamic experience among partnering institutions. Teamwork and carefully planning are critical elements. Institutions should be prepared to provide in-kind contributions in order to leverage these for a grant application.

There are many successfully funded projects in the works. Some of these have also secured private venture capital which represents another source for private investment. The grantseeker should explore various funding sources as well as various kinds of funding opportunities.

Return to Top   View Full-screen

An Experiment of Virtual Space Distance Learning System

Nobuyoshi Terashima, Nobuo Tsuda, and John Tiffin

Waseda University, Japan

GVU-Global Virtual University, U.S.A

ABSTRACT

Recently distance learning systems have evolved by using the Internet, satellite and ISDN networks. It is desirable to develop more human friendly distance education platforms. As one of these platforms, a virtual space distance learning platform called HyperClass has been conceptualized. In this platform, a teacher and students who are at different locations, in reality their images, are brought together through the communication links and have lectures as well as do cooperative work as if they were attending in the same classroom. Then the prototype system for HyperClass has been implemented. Using the system, an experiment has been carried out by interconnecting between Waseda University and Victoria University of Wellington through the Internet. In this paper, HyperClass concept, the prototype system specifications, technologies used for HyperClass and experimental results are described.

View Full Text

An Experiment of Virtual Space Distance Learning System

I. INTRODUCTION

Recent progress in the multimedia communication technology puts distance learning systems into practical use. To make these systems more useful, the platform which provides not only a user friendly education environment but cooperative work in a virtual space, is desired. We have developed a prototype system of HyperClass for this purpose. With this system, a teacher and students who are at different locations, in reality their avatars, are brought together through the Internet and have lectures as well as do cooperative work as if they were attending in the same classroom. Using the system, an experiment has been done by interconnecting between Waseda University and Victoria University of Wellington through the Internet. This paper describes HyperClass concept in Sec. 2, the prototype system specifications in Sec. 3, the technologies for the system in Sec. 4 and the experimental results in Sec. 5.

II. HYPERCLASS CONCEPT

Fig.1 shows the system image of HyperClass. In HyperClass, a 3D virtual space is created and then participants can enter there and can handle a virtual object jointly by hand gesture, spoken language, writing, picture, mouse or key board. The participants thus can do a cooperative work while they are at different locations.Any multimedia materials for education can be introduced into HyperClass. The goal of our project is to develop HyperClass that provides a more human friendly distance learning environment. To achieve this, new concepts such as HyperReality (HR), Hyperworld and coaction fields, and new technologies such as an intelligent coding have been developed.

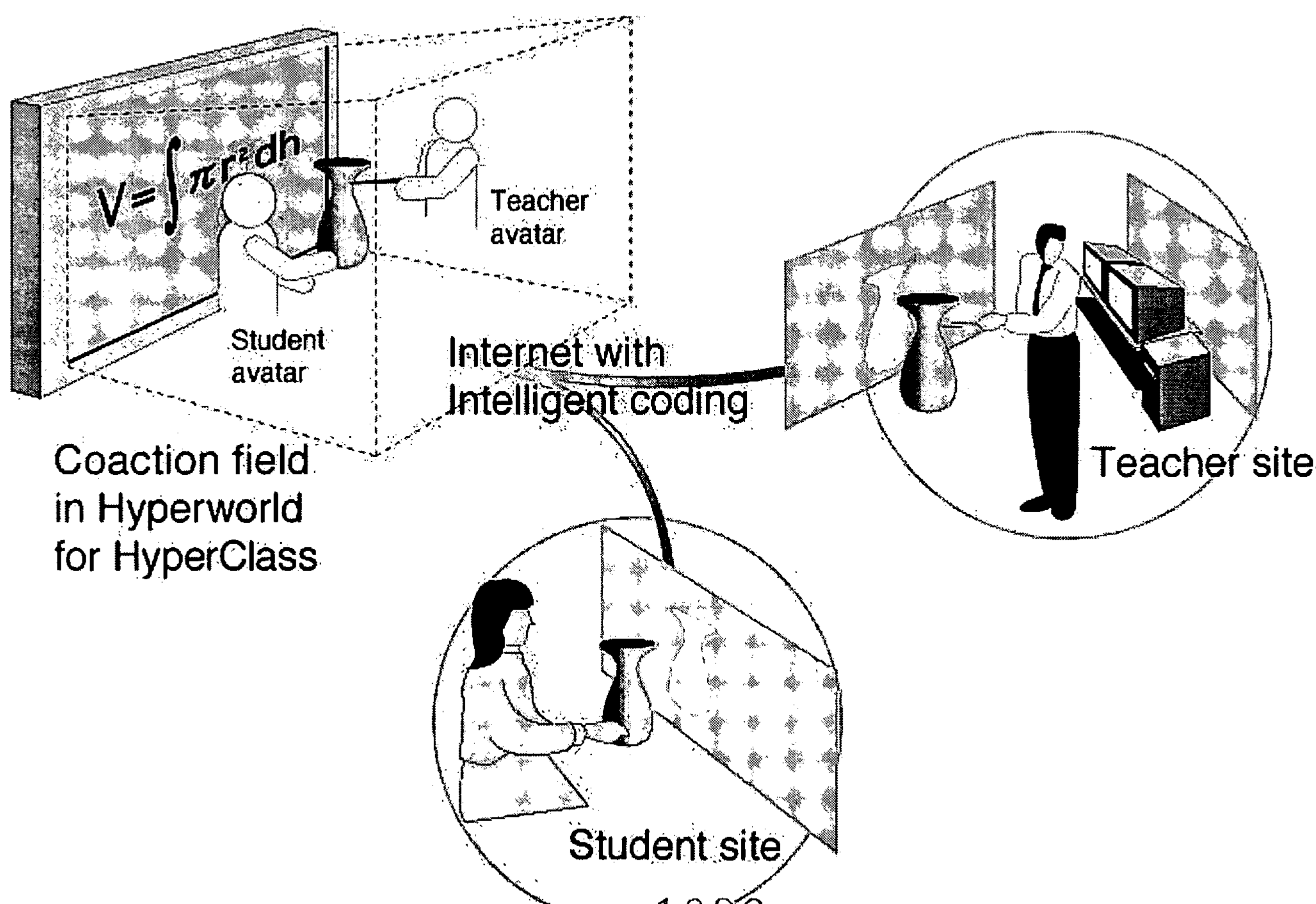


Fig. 1. System Image of HyperClass

HyperClass is based on HR. HR is the concept of combination of virtual reality and real reality. HyperWorld and coaction fields are introduced in HR. A HyperWorld is a seamless world of real and virtual. A virtual world is created by the video images of real worlds, computer generated images and/or the images sent over networks using virtual reality (VR). One or more coaction fields can be defined in the HyperWorld.

The coaction field is the place where inhabitants such as human beings or animals, real or unreal, work together and play with. To achieve this, means for communication such as hand gesture, spoken language, writing and pictures, are provided. Knowledge is shared among participants. Physical laws or biological laws are applied. When they throw out a ball, the ball falls on the ground according to the law of gravity. Non gravity field is also accomplished. Flowers grow or wilt with sunlight. Fig.2 shows a HyperWorld.

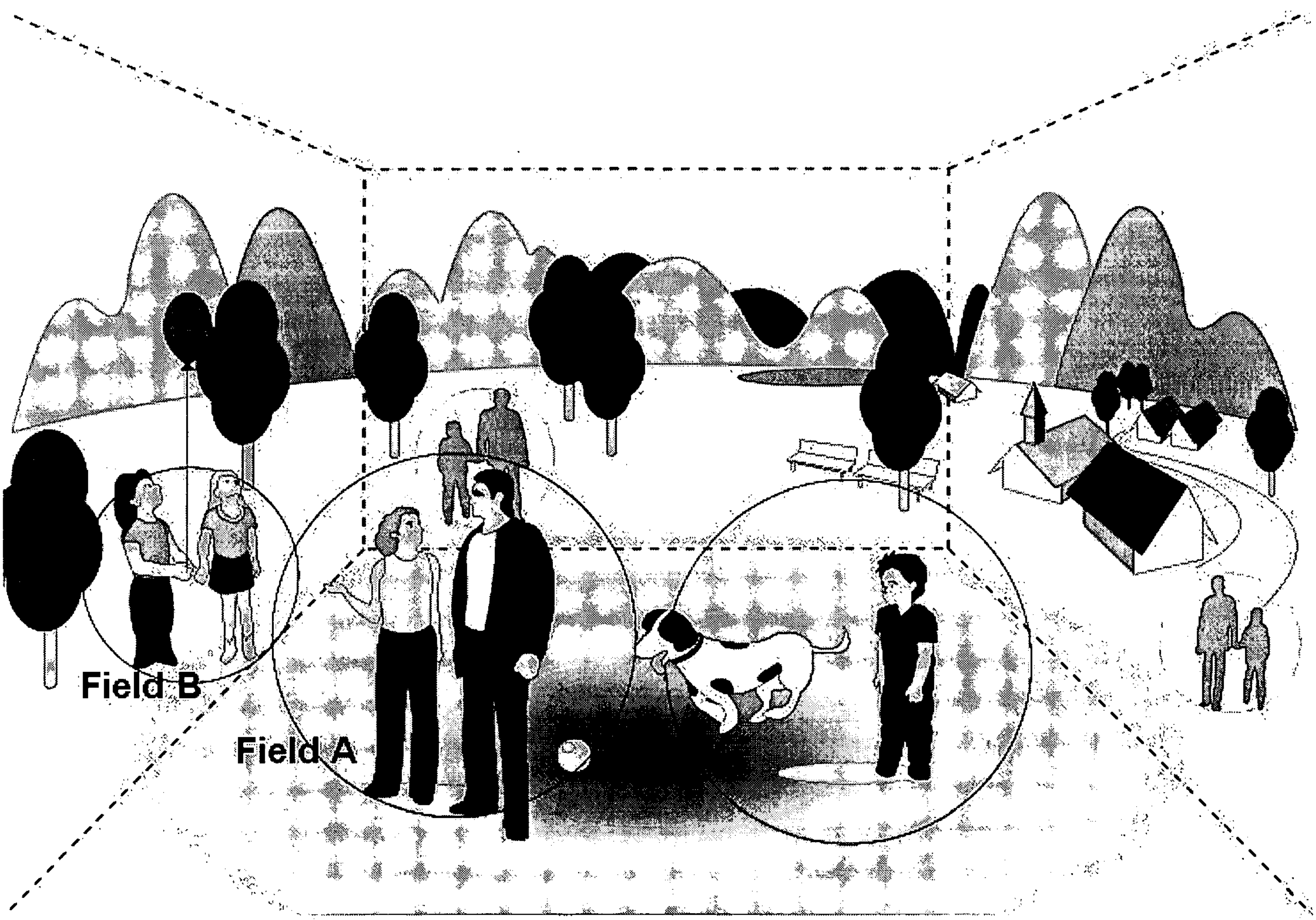


Fig. 2. HyperWorld and Coaction Field

There is a real space in front of the screens. On the screens a virtual space is created. The scene of a park is taken by camera, transmitted and displayed stereoscopically using VR technology. Therefore the space shown in Fig.2 is the combination of the real space and the virtual space. It is a HyperWorld. In Fig.2, circles show the coaction fields. In the coaction field A, two people are talking about something, for example, travelling. They share the knowledge of travelling. In the field B, two girls are playing a balloon. They know how to play it. The balloon is under the law of gravity. In HyperClass a teacher and students who are at different locations can enter into a coaction field by using the avatars (3D human objects) which represent them, and can have lectures as well as do cooperative work while observing the postures and motions of the avatars each other with a stereoscope view. In this system, the coaction fields corresponding to classrooms are defined by using the room metaphor, where the avatars can work in a room jointly and can move from one room to another according to the curriculum in the similar manner to the real world. In the coaction field, a cooperative work can be achieved by manipulating a 3D object by hand gesture using the avatar's hand. The object can also be manipulated by mouse, keyboard or other means.

III. A PROTOTYPE SYSTEM OF HYPERCLASS

HyperClass project started at Waseda University in 1996. We have developed the prototype system of HyperClass which works on a server-client environment using SGI work stations. This system provides the basic functions to achieve a single coaction field in the HyperWorld. The specifications of the prototype system are as follows:

(1) Basic structure of the room: A virtual space corresponding to a single room of a round or square floor which is a HyperWorld is created and a coaction field is defined in the HyperWorld. Two avatars corresponding to the teacher and the student are introduced into the room. One or more 3D objects can be introduced in the room for the exhibition or cooperative work. The objects can also be removed from the room. One or more 2D pictures taken by camera can be mapped on the walls of the room as the background images. These can give the room realistic sensations.

(2) Platform: The prototype system works on a server-client environment using SGI work stations interconnected through the Internet. The virtual space of the room can be shared with the server (it also works as a client) assigned to the teacher side and the client assigned to the student side for the cooperative work. Images and pictures used for constructing a HyperWorld are sent by FTP from the server to every client before actually setting up the room. The parameters specifying the postures and motions of the avatar and object are transmitted from a client to every other client via the server only when the difference in these parameters has been detected in each cycle time. Setting up the room and putting or removing the objects are controlled by the teacher side only. Viewing can freely be controlled at each side.

(3) Avatars: The avatar used in the prototype system has ten-piece structure: head, trunk, a pair of upper arms, a pair of lower arms, a pair of palms, and a pair of legs. The initial postures and positions of the avatars in the room are specified by the mouse operation at each side. For a cooperative work, the avatar can move to anyway in the room, can change the position and direction of the face for viewing, and can handle an object by hand gesture. The position and direction of the face are detected by the sensor put on the human head. The hand gesture is detected by the data glove with sensor put on the human hand. In this way, the position and direction of avatar's face and the avatar's hand gesture are controlled by the real human motion.

(4) Virtual objects: The prototype system can have 3D objects written in VRML or INVENTOR. 3D objects which are measured by a 3D digitizer and synthesized by computer, are also available.

This system has the function of collision detection, and then the object turns to red when an operator grasps the object.

(5) 3D viewing: At each side they can set a viewing position, an angle, and a zoom in the HyperWorld. Participants at the teacher side and the student side can see the objects from their perspectives or from the avatars' perspectives. A stereoscopic view is available wearing a shutter glasses.

Fig.3 shows the scene of the classroom from the participant's perspective, where two avatars corresponding to the teacher and the student are handling the 3D object of an ancient earthenware and the still picture of students attending at the teacher side is displayed on the wall of the room.

Fig. 3. Scene of HyperClass

Fig.4 shows the scene of the teacher who is manipulating an object by wearing a data glove and shutter glasses.

Fig. 4. Scene of Teacher handling an Object

IV. **TECHNOLOGIES FOR HYPERCLASS**

4.1 Detection of human face direction using template matching

A high-speed detection method for a human face direction using a template matching is proposed for the real-time control of the face direction of an avatar for HyperClass.

The algorithm is as follows.

(1) More than twenty samples of the human faces are taken by camera from various perspectives. And the edges of the face, mouth, nose, and eyes are detected and stored as the templates of facial contours.

(2) A human face is taken by camera, the facial contour is detected, compared with the templates, the distance between the input facial contour and each template is calculated and the best fit template is chosen from the templates with the shortest distance.

An experiment using a set of twenty one templates showed a good result that the directions of a human face in the range of ±90°in horizontal and ±30°in vertical could be measured with the error range of ±2°in horizontal and

±3°in vertical.

4. 2 Real-time synthesis of 3D human face using 2D picture

The real-time synthesis of a 3D avatar' face using the 2D picture is proposed to display the avatar in HyperClass with realistic sensations. With the proposed method, the 3D facial expression of an avatar can be synthesized by texture mapping of the 2D picture of an participant to the 3D face polygon model.

4. 3 3D pointer using a fingertip and an eye

A 3D pointing device using the fingertip and eye of a human operator has been developed for indicating the object in the virtual space of HyperClass. The direction is on the line connecting the 3D positions of his/her fingertip and eye. The color marker is displayed in HyperClass to show the direction. The 3D pointer is more effective when a participant wears a head mounted display device. Fig.5 shows an example of the 3D pointer. The direction of a pointer is **c**.

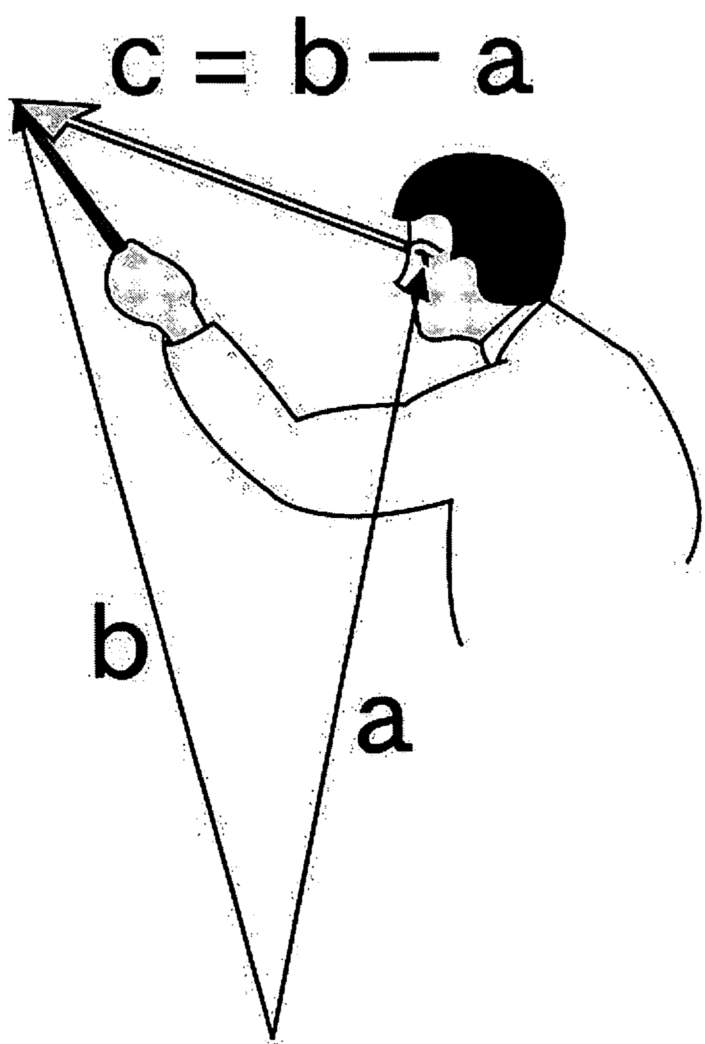


Fig. 5. 3D Pointer

4.4 Cooperative work

To achieve the cooperative work such as an assembling work for the industrial products by a number of operators interconnected through the Internet, we have constructed a scheme where the 3D object can be moved or rotated by a composite force given by them. According to the scheme, a fraction of the movement of the 3D object caused by an operator is translated to an element force vector at each client side, and the consequent movement of the 3D object is determined at the server side according to the composite force vector which is calculated by summing up all of the element force vectors. To evaluate the scheme, we have developed a virtual ball-balancing game using a maze plate which can be handled by two players at the same time. Fig.6 shows an example of a composite force vector. When the element vectors **a** and **b** are given, then the composite vector is **c**.

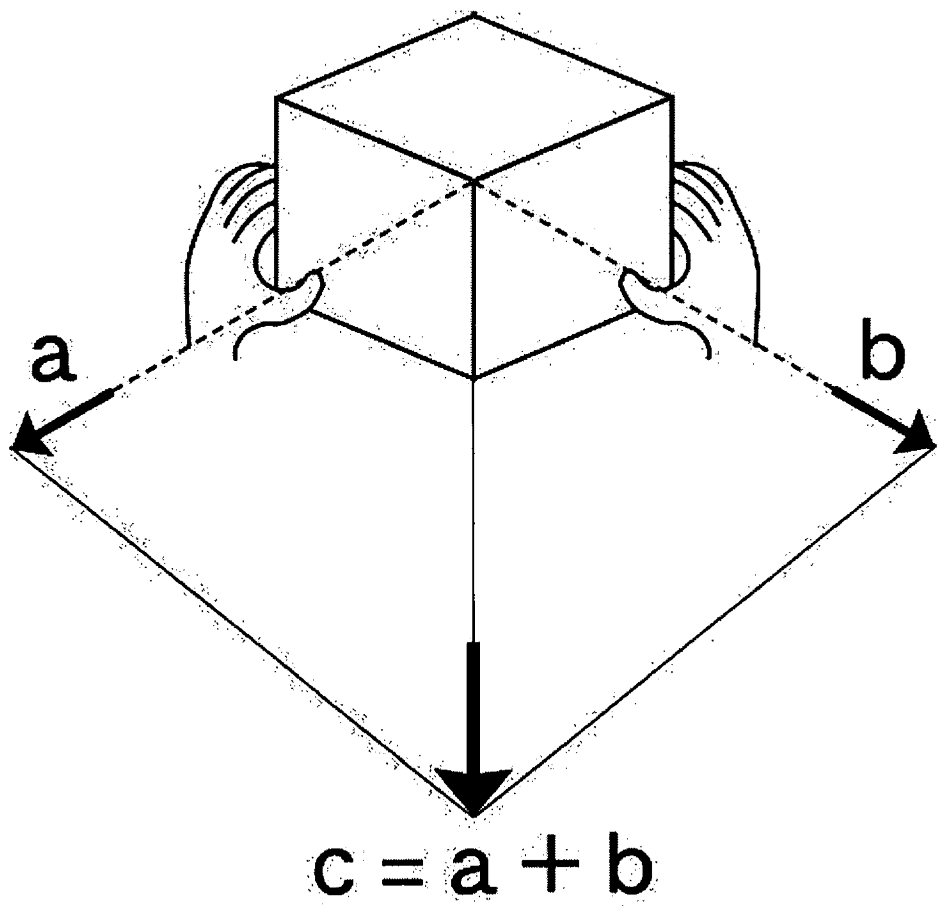


Fig. 6. Composite force vector

4.5 Intelligent coding

An intelligent coding is used to reduce the amount of the data transmitted over the networks. This coding enables the use of the Internet for the transmission of the HyperClass image data in real time. In this system, the human image and object data used for synthesizing a HyperWorld is broadcast from the server to every client before a session starts, and the parameters specifying the postures and motions of the avatar and object are transmitted from a client to every other client via the server in an event-driven manner during the session. The parameters are detected during the session and sent to each side and using the parameters' information, the human and object images that were stored previously are deformed, synthesized and displayed in HyperClass.

V. EXPERIMENTS

We constructed a prototype system and carried out experiments on HyperClass through the communication links. We have done a local experiment of cooperative work using two SGI-Onyx work stations (one is used as the server for teacher side and the other is used as a client for student side) which are located at two campuses of Waseda university and interconnected through 155 Mbits/second ATM link. We have also done an experiment of the object handling in HyperClass by interconnecting a SGI-Onyx work station located at Waseda university (for teacher side) and a SGI-O2 work station located at Victoria university of Wellington (for student side) through the Internet. Fig.7 schematically shows the prototype system configuration including the network for the experiment. The size of the data packets for communication was about two hundred bytes and the packet occurrence rate was about two packets/second for each side. The voice communication was achieved by using Internet telephones on personal computers. These experiments showed good results for the control of viewing and cooperative work, and demonstrated that the system is applicable to the distance education and cooperative work.

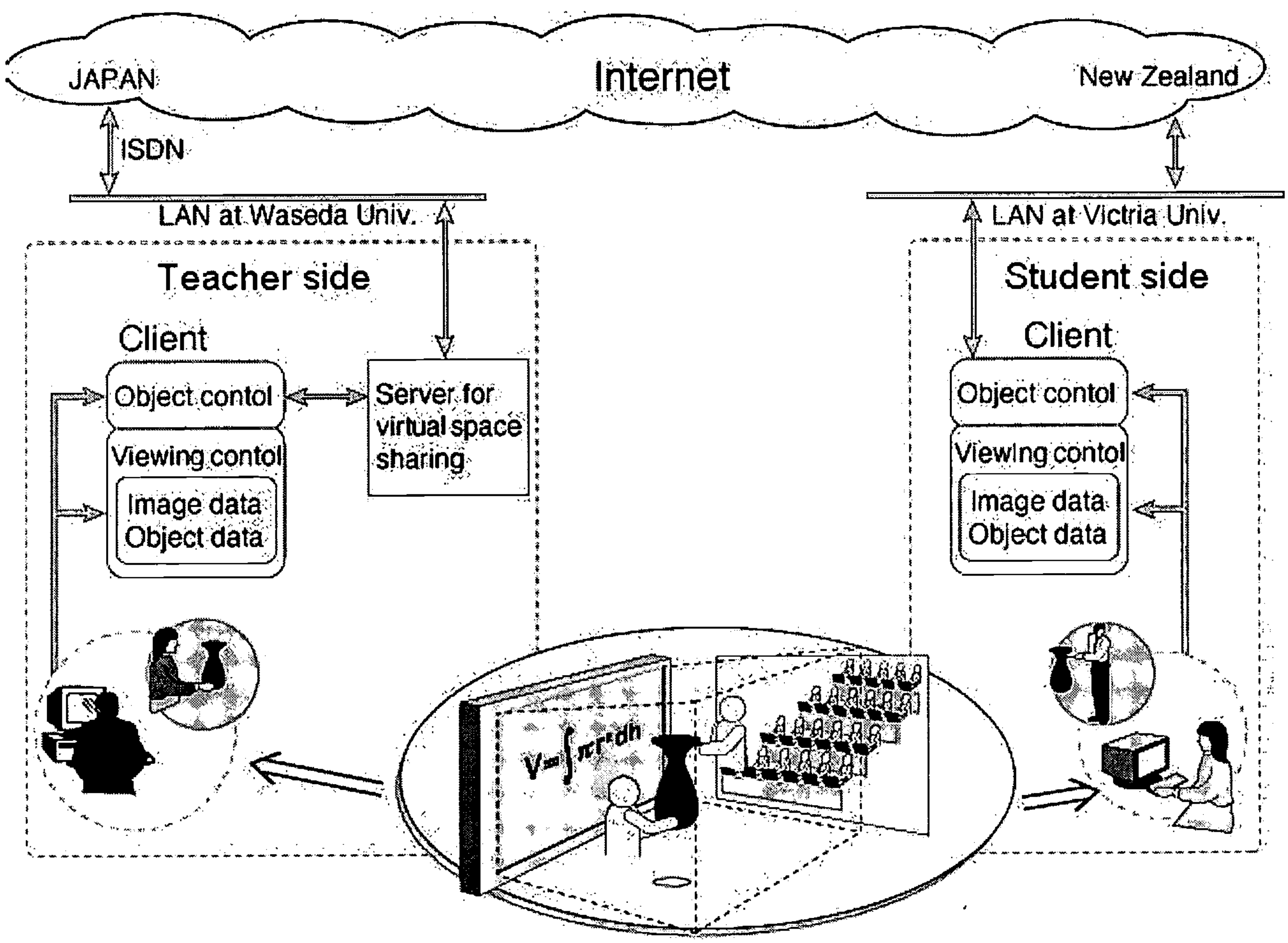


Fig. 7. Experimental System Configuration of HyperClass

VI. CONCLUSION

In this paper a distance learning platform HyperClass has been proposed. The prototype system has been developed and the joint experiment has been conducted by interconnecting between Waseda University and Victoria University of Wellington via the Internet. Through the experiment, the system showed its effectiveness and efficiency for distance education. We are now planning a world-wide experiment using the prototype system and at the same time we are enhancing the system to achieve our goal.

VII. ACKNOWLEDGEMENTS

The authors are grateful to Professor Lalita Rajasingham for her taking part in the experiment and giving informative advice. The authors also would like to acknowledge the great support from VR team of Terashima Lab of Waseda University, especially K.Takahashi, T.Tanaka and K.Matsukawa and the team of Victoria University, especially S.Lonsdale, M.O'Hagan.

VIII. REFERENCES

[1] N. Terashima: "Telesensation -- Distributed Interactive Virtual Reality -- Overview and Prospects, " Proc. IFIP 13th Computer Congress, Vol. 1, No. 1, pp. 49-59 (1994).

[2] N. Terashima: "HyperReality, " Proc. ICRAM '95, Vol. 2, pp. 621-626 (1995).

[3] N. Terashima, et al, "An Experiment of the Virtual University Between Waseda University and Hangyan University through Satellite -- Concept and Perspective," Proc. Virtual University Symposium, Seoul, pp. 36-45 (July 1997).

[4] N. Terashima, "A Distance Education System through Communication Links," Proc. Int'l Seminar on Satellite Multimedia Service Technologies, Seoul, pp. 115-124 (Nov. 1997).

[5] N. Terashima, "HyperClass – An Advanced Distance Education Platform", Teleteaching 98 Distance Learning, Training and Education, Proc. IFIP World Congress 98, Part3, PP. 129–129 (1998).

[6] J.Tiffin & L.Rajasingham, "In Search of The Virtual Class", Routledge, London and New York (1995)

Figure captions

Fig. 1. System Image of HyperClass.

Fig. 2. HyperWorld and Coaction Field.

Fig. 3. Scene of HyperClass.

Fig. 4. Scene of Teacher handling an Object.

Fig. 5. 3D Pointer

Fig. 6. Composite Force Vector

Fig. 7. Experimental System Configuration of HyperClass.

PREL STAR

Distance Learning in the Pacific Islands

James Bannan and Steven Baxendale

PREL, U.S.A.

ABSTRACT

This presentation will discuss the integration and expansion of telecommunications networks in the Pacific and the many challenges to be faced when providing a telecommunications network to the Pacific area.

View Full Text

PREL STAR

Distance Learning in the Pacific Islands

Notes: PREL Star is a U.S. DOE Star School program designed to provide satellite delivered quality educational opportunities throughout the Pacific.

On October 1, 1997, Pacific Resources for Education and Learning (PREL) began a five-year U.S. Department of Education Star Schools program known as PREL Star. Building on the cooperative experiences of the Hawaii Department of Education, University of Hawaii, PEACESAT, Oceanic Cablevision, and GTE Hawaiian Tel, and with the support of the nine other Pacific Entities' Departments of Education, a technical and program services network was designed for the Pacific Region. The project focuses on servicing American Samoa, Commonwealth of the Northern Mariana Islands (CNMI), Federated States of Micronesia (Chuuk, Kosrae, Pohnpei, and Yap), Guam, Hawaii, Republic of the Marshall Islands, and Republic of Palau. Until the formation of PREL Star, this diversified group of Pacific islands was the only U.S. region that had not previously been a recipient of a Star Schools grant.

The PREL Star project serves 1.6 million people living on islands and atolls that are dispersed over an area of 4.9 million square miles, an area of rural, isolated communities struggling with emerging economies, challenging fiscal resources, and many under-qualified teachers. In response to these conditions, the PREL Star program addresses the needs of these communities by working towards U.S. national education goals and meeting federal Star Schools priorities and objectives. PREL Star provides direct programming for students, expanded professional development for teachers, services to the adult community, increased technological capacity for the effective use of distance learning, and the development of a Pacific-wide telecommunications infrastructure in a region where this capability is almost nonexistent.

PREL Star is working with participating telecommunications organizations and the departments of education in the ten above-mentioned Pacific island communities to provide programs and services that are desperately needed in a learning environment without adequate resources, where high tech is often defined as turning on a radio. The majority of school libraries consist of a small room filled with many out-of-print books sent from U.S. mainland schools. Current materials are expensive and hard to come by in this region. Pacific Island people are great at recycling and adapting materials to be used when constructing buildings and in other aspects of daily life, but books and educational materials can not be recycled when they are out of date. PREL Star's collaborating partners contribute three resources—distance-learning programs and instructional-training services, Internet and telecommunications capabilities, and the installation of satellite dishes and other infrastructure development. The PREL Star partners provide a way to bring relevant, cost-effective distance education programming to Pacific schools and classrooms, in many cases, for the first time.

This presentation will discuss the integration and expansion of telecommunications networks in the Pacific and the many challenges to be faced when providing a telecommunications network to the Pacific area.

First, there is a very diverse population spread out over an area one and a half times the size of the continental United States. Only three of the Pacific governmental entities are connected by undersea communications: Hawaii, Guam and CNMI. In the Republic of the Marshall Islands (RMI), there are 113 private and public schools. The RMI schools are located on 75 different islands, only two of which have telephone systems. The rest must rely on single-side band (SSB) radios.

Because it is such a large area with few densely-populated centers, the Pacific region has not received adequate satellite coverage. The satellite signals over the Pacific are weak, and a satellite dish measuring eight meters in diameter must be used for adequate reception.

Second, shipping and travel costs are high. Shipments of equipment to Pacific islands can take anywhere between one and six months to arrive. Infrequent airline flights and high air fares present problems for anyone providing technical assistance to the region.

On the major islands in the Freely Associated States (the Republic of the Marshall Islands, the Federated States of Micronesia, and the Republic of Palau), there are telephone and, often, Internet services. These services are relatively expensive, with phone charges ranging from $2.50 a minute to more than $7.00 a minute. Internet costs range from $20 to $80 a month for up to only five hours of service. Additional time costs from $2.50 to $7.50 an hour. Even at these prices, in many areas, the Internet is still the most economical way to communicate. On most of the remaining islands, single-side band (SSB) radios are the only means of communication.

In addition to the distance-learning and communication challenges, there are also many challenges when it comes to maintaining equipment.

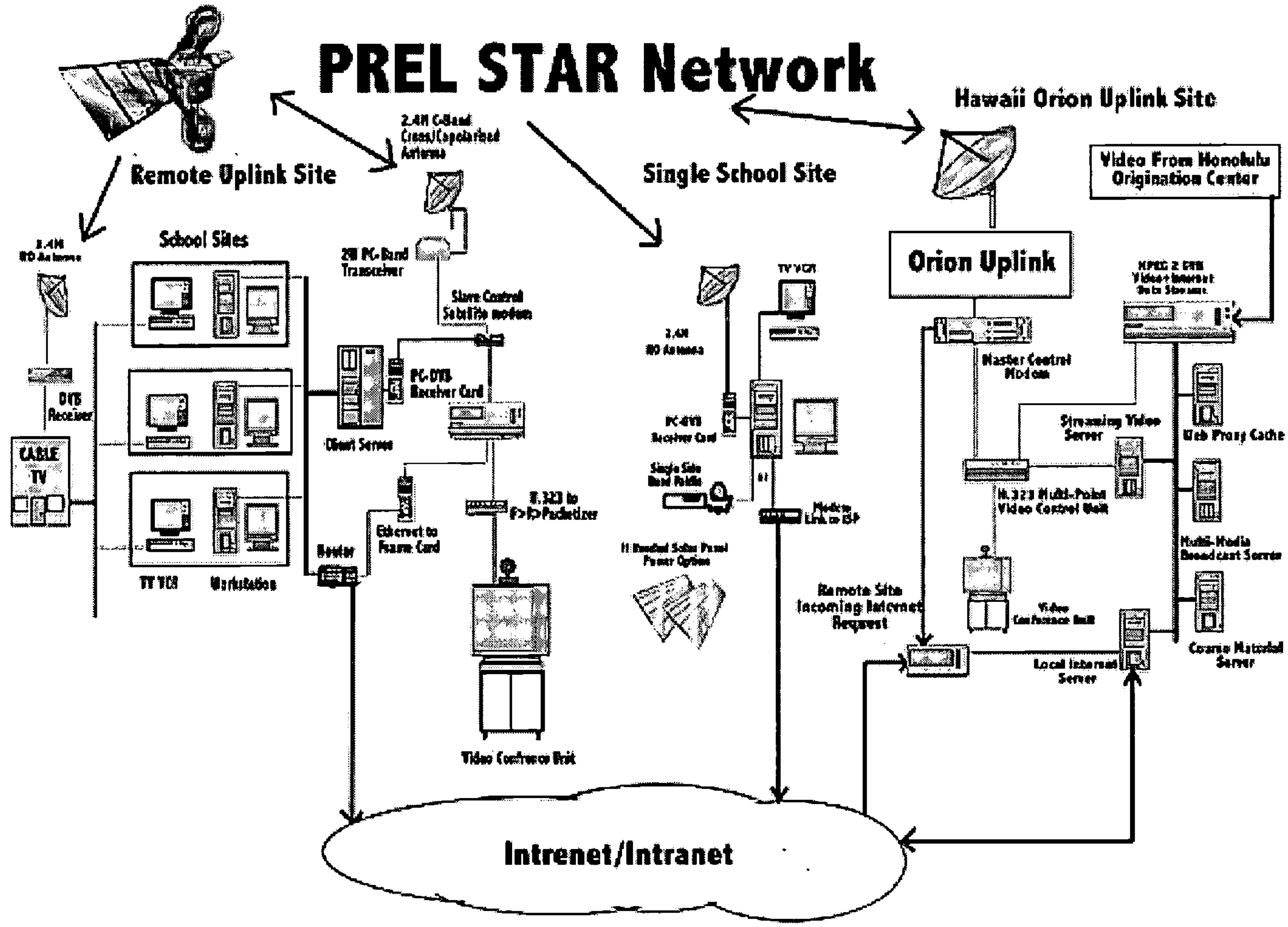
High temperatures and salt air create an extremely corrosive environment that results in short equipment life. A satellite dish considered top quality and durable on the United States mainland must be modified to include all stainless steel hardware when it is being installed near a corrosive ocean environment. In addition, tropical typhoons such as Paka, which hit Guam with 240-mile-per-hour winds in December 1997, are a constant threat to the survivability of downlink sites.

PREL Star is also faced with changing technology formats in the Pacific. For instance, there is no current standard format for digital video broadcast.

PREL Star has engaged a number of companies in the search for answers to the challenge of providing telecommunication services to remote regions of the Pacific. Orion III will provide, for the first time, a satellite with the signal strength needed to service the entire Pacific. Scientific Atlanta's Power Vu compression equipment provides for the highly efficient use of bandwidth for video and Internet services. Proxy servers on the local island networks will be able to capture information to make the repeated use of the Internet more efficient. Stronger satellite signals allow the use of smaller satellite dishes on the ground. These dishes can be made out of fiberglass to withstand the harsh environment, and yet be light enough to be carried to safety in the event of a typhoon.

The planned launch date of the Orion III satellite from a Delta III rocket was October 1, 1998. Unfortunately, in August, a similar rocket blew up right after lift-off, causing the Orion III launch to be delayed until March 1999. The expected life of Orion III is 15 years. It is a Hughes 601 HP satellite with 25 Ku and 10 C-band transponders. Once the satellite is in place, PREL Star will be using 8 megabits per second on one of the C-band transponders. The satellite will be located 139 degrees E. longitude, almost directly 22,000 miles above the Federated Micronesian state of Yap. As a result, many of the satellite dishes in the Pacific region will be pointing almost straight up, reducing the potential for damage from high winds. One reason that Orion III will have such good coverage of the Pacific is because it will be in a central location: a slot in space that has been allotted to the Republic of the Marshall Islands.

PREL Star's network design is customized to meet varying needs within the region. Programming can be received or created in Hawaii, then sent over the Hawaii Educational Network to the Orion uplink site located here on Oahu and transmitted to Orion III. At the other end, it can be received on a 2.4-meter dish located at a school on a small island. This dish can even be powered by solar panels. The signal can be received by the regional office so that the local Department of Education can view the programming and, in some instances, record the programs on tape for dissemination locally until the network reaches all the schools. On islands that have local cable services, the signal can be fed into the cable entry port of the cable company's distribution system so that more schools can be reached at a lower cost. In some cases, these signals can also be transmitted locally via microwave in areas where schools are within a 25-mile radius of the receiving site.



Selected Pacific sites will have the ability to create their own programming for transmission to Hawaii, where it will be retransmitted over the network to all sites. The PREL Star network will have the capability to provide Internet service to remote islands that do not currently have Internet service or have very slow access. Information requests transmitted over the Internet are generally short and take up very little bandwidth. The reply that is sent back to the student, however, is considerably larger as it usually consists of data as text, pictures, sound, and/or graphics. The PREL Star network is being designed so that requests for information will be sent to Hawaii over regular phone lines or from the PEACESAT station on the island. Once in Hawaii, the request will be relayed to an Internet provider who will send the reply—a large (T-1) burst of information—to the Orion uplink site on Oahu. From there, it will be sent out over the large bandwidth to the original requester.

With the decrease in cost of hard disk storage, it is now possible for all the support materials needed for study courses and large multi-media courses to be downloaded to schools at night. When Internet materials are sent, they can be cached on local computers so that they do not need to be sent again when another student requests the same information. Students, even without any outgoing communication, will be able to access vast amounts of information. The cost of two-way Internet services will still be prohibitive on the remotest islands. It may be that as a class watches a video coming in over the satellite system, they will want to get more information on the subject or to ask the instructor a question. The class teacher can use the local single-side band (SSB) radio to contact the main island. The operator on the main island sends an email to the instructor. The instructor electronically gathers the information and replies via his or her web site. All that information is sent to select audiences over a multi-cast data stream. Now, instead of waiting a month or more for a letter to arrive, the students are able to get their information the next morning. Because many different venues exist in the Pacific, it is important to mix and match the technological variety of equipment to cover every possible situation and make the distance-learning dream a reality in the Pacific.

Through a series of meetings and discussions, the network will evolve to meet the requests of the Pacific Island communities served by PREL Star. Several Pacific DOEs have already expressed an interest in sending a moderate bandwidth video (256 Kb) up to the satellite so that they can relay teacher training instruction to their own remote schools. This is will allow teachers to keep up to date on local educational developments instead of having to wait until summer and travel several hundred miles by boat to attend workshops. While the local video is being viewed, the remote island teachers will be able to use SSB radios to call in and ask questions of the presenters. Everyone tuning in to the radio frequency will be able to hear the questions and the responses. The possibilities are endless. With digital video and the Internet, the combinations of information sources, audiences, and instructional courses are limited only by the bandwidth, and that is limited only by funding.

Return to Top View Full-screen

The Virtual University

Higher Education as a Community Activity

Ewan Sutherland

University of Wales, Lampeter, United Kingdom

ABSTRACT

Use of new technologies has transformed the service sector by allowing the creation of businesses which span the globe. Education is being affected in the same way, not least because of a combination of conservatism and growth potential. Universities face difficulties as great as TelCos in adapting to change. There are opportunities to create better links with students providing a higher quality of education. The approach of loading education from childhood to early adulthood means that much is forgotten or obsolete. It is possible to shift from the just-in-case to just-in-time and just-for-you. Changes in the pattern of work, the need for re-training and multiple careers in a single lifetime create demands for education and training, much of it after the traditional upper limits of college. Technology makes it possible to move towards something both more and less permanent. The virtual university operates through electronic media as a global brand, represented by its alumni. Students, professors and alumni can interact and access resources. Graduation become one stage of progression and not an end. Alumni can be linked to bring practical experience to bear on classroom discussions. Any sense of geography is destroyed. Virtual universities will not operate by cramming people into rooms but offer their courses globally, constrained only by language and culture and to some extent by time zone, linking scholars and students around the globe.

View Full Text

The Virtual University

Higher Education as a Community Activity

I. INTRODUCTION

There is considerable evidence that education is being affected by the strategic adoption of new technologies, especially those centered on the Internet. The prevailing conservatism in many universities, some dating back to the Middle Ages, combined with current and future growth make the sector an attractive target for entrepreneurial individuals and corporations. Universities now face difficulties and opportunities as great as TelCos, retailers and bankers. Opportunities exist for new and better links:

- Between students
- Between students and teachers
- Between students and experts
- From students to resources

Together these will increase the flexibility and the quality of higher education. In particular, training can become just-in-time rather than the centuries old tradition of just-in-case; build-to-order, rather than build-to-sell. This is similar to the change of outlook that has been forced on librarians; coming to terms with access to materials rather than holding the materials on paper.

This paper presents a strategic analysis of the potential transformation of the higher education sector made possible by telecommunications and related technologies in terms of the expectations of school leavers and business, the capabilities of technologies, the willingness of alumni, together with the core competences required of universities and professors. Of these issues:

> *"Perhaps the most profound question of all concerns the survival of the university in the face of the changes, the emergence of new competitors. Could an institution such as the university, which has existed for a millenium, disappear in the face of such changes?"*

II. PARALELLS FROM OTHER SERVICE INDUSTRIES

The adoption and application of new technologies has transformed the service sector by allowing astute, imaginative and just plain lucky individuals to create businesses. Some of these span the globe while others occupy a clearly defined niche. They have been able to ignore traditional barriers to entry or to create new means of reaching customers, in some cases creating markets where none existed.

The telecommunications industry presents many lessons and raises many questions in the light of complicated experiences of globalisation, re-regulation and marketisation. Global scope has taken longer to be understood and is being achieved with a slowness and hesitancy which was not anticipated; a messy pattern of failed or aborted mergers and acquisitions has still to be resolved. Some have tried to build organisations and networks others are acquiring and absorbing TelCos and ISPs. Slower still is the building of strategic partnerships between service providers and customers.

The banking sector retains national and regional characteristics in terms of loyalties and preferences. Nonetheless, mergers with insurance and other financial activities are increasing and national boundaries are diminishing in importance. Cards are issued with brand names of corporations which are not banks. Moreover they work world-wide, both for monetary transactions and often for the brand name that they carry.

The world of books and music retailing is being transformed. The appearance of Web-based ordering services saw a shift towards uniform global discounted pricing and launch dates (n.b. Amazon). Whether by mail or by FedEx, physical delivery to most places with Internet access is within a few days. With music there is increasing delivery of content over the Internet, with the potential for revolutionary changes in economies of scale and the opening up of the market to individuals and bands.

Any number of further examples can be found, such as the airline industry or the changes in the various sectors of television. The attempt by News Corporation (the trading name of Rupert Murdoch) to purchase Manchester United, a leading English soccer team, stirred considerable controversy in the summer of 1998. Yet it may be nothing more than vertical integration, a restructuring of the European soccer industry, in part determined by the satellite ownership and their footprints over Europe.

Venkatraman and Henderson provide a framework to evaluate options for information society organisations in terms of:

- Virtual encounters for customers
- Virtual sourcing from suppliers
- Virtual expertise

There is no intrinsic reason why education should be any different from other areas of service sector activity. The forces of entrepreneurship, restructuring, globalisation and so on apply equally to higher education and training. Moreover; the same "virtual" options are available.

III. CHANGING EXPECTATIONS

The approach for centuries has been to load education into the period from childhood through to early adulthood. Among the extremes are the United Kingdom where a degree can be completed by the age of 21 and Germany where it might take until 28 or even 30. The long delay before individuals are able to contribute fully to the economy is increasingly being challenged by individuals, corporations and governments and may already be unacceptable. Moreover, much knowledge acquired in this way is forgotten and some is obsolete even before it can be applied. The need to keep abreast of new knowledge and new practices accelerates from year to year and extends to new areas of employment; few are excluded from these changes.

Demographic change comes in two forms. Firstly, there is population growth, the increase in the numbers of those in the age group which traditionally enters college and university. This is important globally, with the exception of some European countries and Japan. Secondly, there is a widening of the groups which economically and socially are and will be required to participate in higher education in order to find jobs and to contribute to the economy. It is frequently difficult or inappropriate to deliver this at existing sites, while sending students abroad for education can be cripplingly expensive and culturally unsatisfactory. Cheaper alternatives are sought than building new campuses and creating new universities in countries such as Indonesia and Thailand.

Children both at home and at school expect to use computers, CD-ROMs, DVDs and on-line services. They use the Internet to help with school assignments, to select the university which they will attend and for many other purposes besides. For the digital generation surfing the Internet is replacing television in the number of hours "watched". The expectations when they matriculate at university must be taken into account, that they seem to match to a significant extent the needs of commerce and industry is largely beneficial, though not coincidental.

Changes in the patterns of work are driven by globalisation enabled by the adoption of new technologies. These call for re-training and the adoption of multiple careers in a single lifetime. In turn this creates new demands in initial training and at intervals throughout a career.

Graduates are increasingly expected to have accepted responsibility for their own life-long learning. They will seek out the training, education and experiences that they require to build their careers. In many ways individuals need a life-long learning partner, not a distant, if fond, memory of a college.

There will be enormous variations in adoption by universities as they struggle with the technologies:

"The transformation implicit in the introduction of IT to the curriculum are beyond the powers of academic senares—committees of amateurs—to govern or steer. An academic senate assumes that most issues in academic life can be sensibly addressed by ordinary academic, drawn from every department, applying the largely unspoken norms and values of academic life and the lessons of their own experiemce. These are less and less adequate for the problems and opportunities created by IT."

IV. THE ENABLING TECHNOLOGIES

Technology makes it possible for innovators and entrepreneurs to move away from the present conception of the university. The potential of the university in the information society—the virtual university—becomes one of interaction through electronic media. In the extreme case, the university might become a global brand, represented by its alumni in person, in the recommendations they make, on bumper stickers and its contemporary equivalent, the home page.

Tools include those in common use for the Internet, intranets and extranets: electronic mail, distribution lists, newsgroups, chat systems, streamed audio and video, desktop video-conferencing, interactive computer simulations, web pages and Virtual Reality Mark-up Language (VRML). The possible combinations of technologies are immense and are driven by a variety of economically and technically dynamic sectors (not all of which are entirely respectable). Whether termed computer mediated learning, asynchronous learning or some similar term, new models of education and training are being developed using these technologies. They call for design skills both at the course or programme level and for individual pages and objects; a new combination of the artistic, the technical and the pedagogic. Similar challenges are being met in the development of academic journals on the World Wide Web.

The market both for office and SOHO computers (both desk-tops and lap-tops) is supplied with ever more powerful models. Technological trends continue to forecast growing power, while market trends continue to indicate rapid adoption. There has been a massive if somewhat uneven growth of Internet access throughout the developed world and into the less developed world, driven by innovative Internet Service Providers and by expansionist TelCos. Access from offices and homes is increasingly commonplace, while from schools it is becoming ubiquitous. For the truly mobile the combination is the lap-top computer and GSM telephone or hand-held device. This is not to suggest that access to networked personal computers is or will be universal. It will be necessary either for the universities or for the state to ensure access for the poor and the socially excluded.

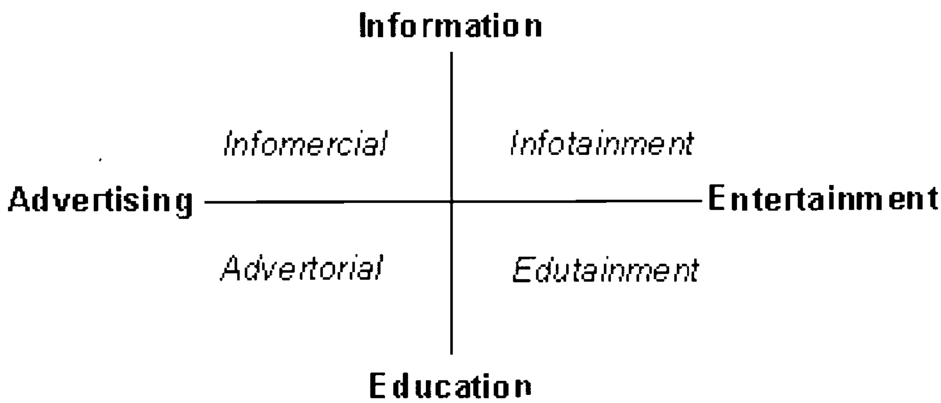
The World Wide Web is already used extensively as an advertising medium for universities, books and other educational resources. Secure servers and acceptable methods of payment have seen the introduction of services to purchase books, music CDs, CD-ROMs, DVDs and software. Some books are supported by web pages which allow access to case studies, discussion and supplementary materials, including support for teachers and tutors. For example, Ray Panko, at the University of Hawai'i has a web site to support and supplement *Business Data Communications*.

Classes at different locations have been brought together with a variety of technologies, including newsgroups, distribution lists and broad-band networks. Video conferencing was used to link two MBA classes in Arizona and in Maryland in a promising collaboration.

Many continuing education and distance learning units have been offering credit-rated modules across the Internet especially since Fall 1997, refining their offerings in subsequent semesters. For example, University of Massachusetts, Dartmouth offers *Topics in Professional Writing: Technical Writing* (ENL 650), a 3-credit course for a relatively modest US$ 375.

Technologies can be used to create a wide variety of services of which education is simply one type of content amongst many others (see figure 1). The edges blur with publishers and television channels moving from entertainment and information towards the provision of education. Similarly, software and equipment manufacturers are moving from advertising closer to education in order to encourage earlier and more widespread adoption of their products and services.

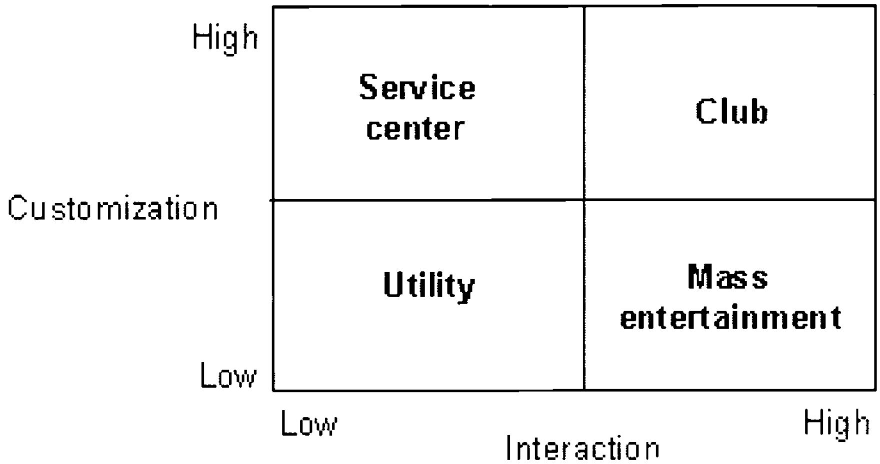
Figure 1 Services on the Internet



Individual web sites can be categorized by the degrees of customization and interactivity (see figure

The aim for virtual universities, if they are to be attractive, is to be in the high-high section, the Club. Universities are obliged to aim for mass customisation, although they presently only offer a medium score on both axes. Too many other suppliers are aiming at mass customization for universities to risk anything else. However, not all students will want high levels of interaction, some will expect the customization but will be content with a more passive role.

Figure 2 Categories of World Wide Web sites



The great danger is when one or more technologies is superseded in a wave of creative destruction, when the energies and learning materials will seem to have been wasted. However, as Hamel and Prahalad argue the only option is to be there, competing for the future.

V. VIRTUAL UNIVERSITIES

For a few years the idea of the virtual university has been explored in terms of technical perspectives looking at the roles of telecommunications, CSCW, virtual offices and databases. Many experiments are underway and some have already failed.

There has been a growth of training programmes in corporations which have been given the designation university, such as McDonald's Hamburger University and Disney University. Virtual university initiatives have been launched by corporations such as:

- British Aerospace
- Motorola University
- Texas Instruments
- Universiti Telekom Malaysia

These corporations are devising new strategies for packaging learning materials for staff, customers and suppliers, some primarily on intranets. This trend seems likely to increase with the focus on intellectual capital, knowledge management and strategic partnerships. Any number of potential entrants can be identified, for example, the leading accounting firms, management consultants and software suppliers.

Academic virtual universities have been established in a wide range of locations, including:

- Africa Virtual University
- Universitat Oberta de Catalunya
- Western Governors' University

One of the most impressive of these is the California Virtual University, where the State of California has brought together the two systems, University of California and California State University, with the Association of Independent Colleges and the network of Community Colleges. Together they provide almost ninety campuses with the academic, computing and library resources and staff necessary to match the virtual resources for the courses being offered. It is intended to extend the reach of postsecondary education in California and to do so cheaply.

Commercial initiatives to create virtual universities in competition with conventional universities include Athena University and the University of Phoenix. For the present, these lack the status and impact of "real" universities.

Underlying the creation of virtual universities is the considerable work in the development of digital libraries, digital galleries and museums. For example,

- Bibliothèque Nationale de France (Paris)
- Deutsches Historisches Museum (Berlin)
- Getty Center (Malibu, California)
- National Gallery of Art (Washington, DC)
- National Library of Scotland (Edinburgh)
- Wilfred Owen Multimedia Data Archive (Oxford and London)

These provide access to a remarkable amount of scholarly and factual material, which is an invaluable support for teaching and research. These can be used directly or repackaged and syndicated for courses.

VI. A COMMUNITY OF LEARNING

Linked by the technology which is already available, students, professors and alumni have the potential to communicate with each other, to form a community or communities in cyberspace sharing access to resources. This allows the concept of graduation to change, marking simply a stage and not a time to depart. Graduates of last year or of thirty years ago can be linked to classes of today to bring practical experiences to classroom discussions. At a simple level, they can be asked to place a logo on their web pages (or can be provided with the space for that page) and offered a permanent electronic mail address at the university.

One aspect of the Internet which has attracted great interest from marketers is the concept of virtual communities. If people will work together freely and in a happy environment that has enormous potential to provide support for a product or service, even to being willing to test early versions. If that community is homogeneous, then it is easy to identify, to channel messages to and also to attract advertising and hence revenue.

The environment for graduates has changed quite dramatically. It is no longer enough to talk about continuing professional development nor to fill bachelor's and master's courses with yet more material in the hope that one day students will be able to recall the material when, years hence, they happen to need it. Faced with a changing environment and complex career changes, graduates need regular up-dating and development courses throughout their career; each in their own pattern. The implication of this is a shift from a one-off relationship, for an intense formative period, to a relationship best termed a "life-long strategic learning partnership". Just-in-case teaching can be dropped in favour of just-in-time and just-for-you learning, triggered by the demands of the graduate. The revenue from this could be extremely attractive.

In a discipline such as telecommunications the pace of change necessitates large amounts of continuing professional development and most engineers require management training at various times as they are promoted. This is currently provided by a mixture of:

- Academic institutions

- Hardware and software suppliers
- Professional bodies
- Commercial trainers

These all lend themselves to on-line and virtual provision, as the ITU's Virtual Training Centre is endeavoring to demonstrate and exploit for telecommunications staff in less developed countries. This initiative is intended to develop into the Global Telecommunications University (GTU). Day-to-day technical and market information is also available and can be incorporated into teaching materials.

The vision of the university as Gothic or Greek buildings set behind college walls is an Anglo-Saxon model established at Oxford and Cambridge and replicated around the world, at places as far apart as Harvard and Melbourne. (Even in cyberspace representations of Greek pillars seem to be commonplace both on web pages and in VRML.) It is a medieval conception which is unrelated to the scale and style of modern mass education. Yet technology now brings the possibility of re-creating that level of interaction and collegiality of dialogue and learning.

An image which must change in this scenario is that of the professor. There are crucial changes in pedagogy and in the roles available to academic staff, other than the few academic stars:

> *"It could well be that faculty members of the 21st-century university will find it necessary to set aside their roles as teachers and instead become designers of learning experiences, processes, and environments."*

The complex issues arising from analysis of data derived from on-line transaction processing have long been known in, for example, the airline business. An on-line university would open up all its activities to data mining, assessing operations at the lowest level of aggregation. One important benefit is the forecasting of demand which this would facilitate. The organizational consequences of such transparency would transform the university and the roles of the academic staff. Courses could no longer be claimed to be essential, they would be demonstrated to be so or dropped. Interestingly it would also be possible for the employers to do the same sort of analysis, whether in their own corporate virtual university or in the use of courses by their employees. Thus they would be able to measure the effectiveness of institutions, programs and modules, even of individual sessions.

While in some ways the idea of a virtual university may seem like a cold technological solution, it can only succeed if customers will accept it. One important advantage it has over traditional distance learning material is the shift from self-paced isolated learning to interactive learning. Figure 3 shows the different categories of learning, in terms of the pacesetter and the mode of delivery.

Figure 3 *Categories of learning*

	Group/teacher paced	Self-paced
On-line	Virtual learning communities MOOs	Asynchronous learning networks
Off-line	Lectures Seminars Case study method	Traditional paper and television based distance learning

This all presents considerable management problems, since it is likely to prove extremely difficult to control and to maintain the same quality.

VII. ANALYSIS: THE FORCES AT WORK

The positive features encouraging developments towards a working virtual university are the expectations of potential students and employers that such technologies be used where they are appropriate and sometimes even when they are not. Moreover, there seem to be people with the vision to create projects both on a small scale and a large scale—there is no shortage of support from venture capitalists, foundations and governments at different levels.

The constraints in higher education are neither technical nor financial but human, in terms of:

- Management of projects
- Willingness of employers to accept new qualifications or those of new "institutions"

- Marking/grading the assessments of students
- Legal authority to award degrees
- Accreditation of new modes of delivery

As in telecommunications, the regulation of higher education is an inordinately complex matter where the limitations of jurisdictions and the problems of extra-territoriality are challenging. Whether the power to award degrees will remain *de jure* or will become a factor of brand-names in the marketplace is an open question. Governments and universities may have power over the awarding of qualifications, but this is of little value if the brand is not valued highly.

The conventional sense of geography is absent in cyberspace—the friction of distance is gone—but differences in cultures and languages remain. Where there is poor responsiveness and delays in transmission across the Internet it is often not the result of geography, but reflects idiosyncrasies of network interconnection and congestion. Cultures contain vital signals concerning the role of students, relationships with professors, the value of education and how people behave; these tend to change more slowly. Overcoming such differences remains a very significant problem.

Virtual universities will not operate by cramming people into rooms on campuses. Instead they will offer their courses globally, constrained only by language and culture, with differences in time zone a minor operational difficulty. Competition between universities is increasingly global, almost independent of location, but dependent on brand name.

The areas where we can see the most rapid development are in graduate vocational training. Already business schools, which operate in the most fiercely competitive of educational marketplaces, are using the Internet and video-conferencing to improve service to their customers and to reach new markets. Fuqua School at Duke University has establised a Global Executive MBA mixing the Internet with study visits in different countries. INSEAD, the leading French business school. is creating a second campus in Singapore. Some business schools have worked with technology partners, a sensible route to share expertise and risk. Corporations have moved to create their own virtual universities, drawing in individual academics or universities where they need them.

VIII. CONCLUSIONS

There is no technological imperative towards virtual universities nor should there be, only the strategic effects of entrepreneurial and technological developments. Nonetheless, it is already possible to deliver a virtual encounter for students, to create an electronic community which provides virtual sources of information and access to virtual expertise. Were one alliance to appear offering, say, a genuinely global virtual business school with all the resources and professional standing that requires, it might well leave only niche markets for other players.

The strategic shift from just-in-case education (or worse, from ancient and revered curricula) to just-in-time learning is not intended to be seen as an industrialization of education. Rather it is a shift to a partnership which guarantees professional development as and when 'students' need it for their work or indeed for their recreation. Though here the word student should also be seen as encompassing graduate students and alumni, those who have qualified and gone on, but who return, sometimes to teach, sometimes to learn, sometimes both. It is to revert to an ancient sense of a university, one incorporating a body of graduates, a community of scholars. Technology now makes it possible to achieve that mediaeval sense of collegiality and to include a much wider range of individuals than previously possible, regardless of location only their ability to benefit from the education and training. A virtual university with its core value of life-long strategic partnership for learning, drawing its customers ever closer will transform the education marketplace.

It is more than a happy coincidence that the technology to make this possible arrives with the need for continuous training, both are created by the same drivers of change in our society and economy.

It would be foolish to claim that forecasts can be accurate, they are not. The extent to which postsecondary education and training will be allowed to evolve rather than subjected to a revolution is far from clear. The intention of this paper is to alert readers to possibilities, bad as well as good.

Return to Top   View Full-screen

Tele Homebook -- A Killer Application of M.O.R.E (Millions Online Residences & Enterprises) Project

Gary Gong and Pauline Chen

Institute for Information Industry, Taiwan

ABSTRACT

The 21st century is the age of information, as it will be symbolized by the pervasive use of information network in this new age. The rapid advancement of information technology and its applications development in the recent years has extended the human intelligence with huge and new capacities, and consequently ignited a new and broad-scale industrial revolution that is changing our ways of conducting business, performing work, learning and even the ways of living. One needs only to observe the rapid rise of Internet in the past five years to understand the extent of the changes.

View Full Text

Millions Online Residences & Enterprises (MORE)' Movement

Internet to the Families through the Tele-Homebook Experiment Program

I. INTRODUCTION

The 21st century is the age of information, as it will be symbolized by the pervasive use of information network in this new age. The rapid advancement of information technology and its applications development in the recent years has extended the human intelligence with huge and new capacities, and consequently ignited a new and broad-scale industrial revolution that is changing our ways of conducting business, performing work, learning and even the ways of living. One needs only to observe the rapid rise of Internet in the past five years to understand the extent of the changes.

In facing the challenges of fierce competition that will confront us in the new Millennium, our government initiated a National Information Infrastructure (or simply NII) development program in 1994. The NII initiative is a long-term mission and commitment, it includes the creation of one integrated network of communication networks that interconnects homes, offices, libraries, schools, government agencies and recreation facilities, through which ubiquitous access to all different verity of activities and services to all citizenry can be achieved. And, in 1997, the Executive Yuan established a policy measure of proliferating the Internet applications and its usage as the central role of the NII promotion, and targeting to reach three million Internet users at the turn of the century three years later. *The Institute for Information Industry* has thus launched the MORE (Millions Online Residences & Enterprises) campaign in June 1997. MORE is employed as a means of rapidly increasing the networked population in Taiwan, and will aggressively be pursued in the next three years for achieving an Internet popularity scale among the general public and families that is sufficient for developing Taiwan a Pan Asia Internet hub.

In new market development, whether it's for a new technology or a new product entry, there is usually a certain length of incubating period involved. Persistent and continuous investment or endeavor, in both or either qualitative and quantitative improvement, would normally be accompanying the market development until a critical mass can be reached. For promoting the Internet usage, there is no exception. The strategy must take both the quantitative and qualitative aspects of the measures into consideration. Per quantitative perspective, the first priority is to accelerate the pace of family (or general public) on net, for attaining our on-line population to a certain economic scale. As for qualitative improvement, our general public (or families) has already had some primary and basic knowledge about the Internet. Energies should be directed to the environment improvement for removing the obstacles that could possibly inhibit the promotion of Internet, and to advocate the public awareness of the benefits brought about by the Internet. The effort includes killer applications deployment for enticing the public on net, and hence stimulating the quantitative expansion of the Internet population. The essence of the MORE Project, undertaken by *the Institute for Information Industry*, places its focus on the ways to entice the general public on net by formulating the measures to proliferate Internet usage in daily life.

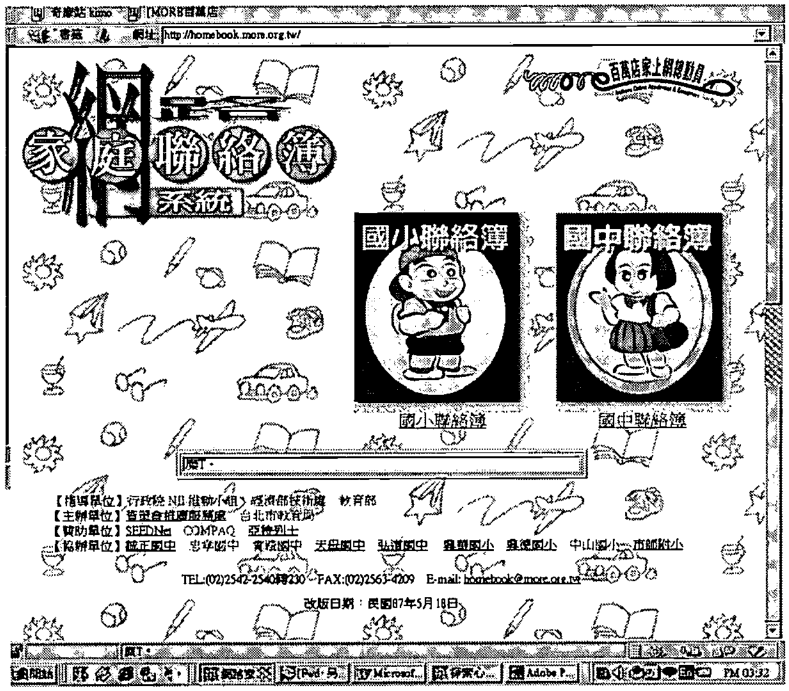
As there are profit and operational benefits motivating the enterprises to use the Internet, what would be the motivation for families to use the Internet?

II. INTENSIFYING THE INTERNET'S PENETRATION TO HOMES

Adoption of the Internet usage by families would gradually cause changes to the behavior of family life, which include the ways of daily living, consumption habits, and learning. As such, reformatting family life and establishing a new interactive mechanism among the family members becomes an important subject where in depth exploration can be warranted.

At the beginning of 1998, there were in total 1.9 million elementary-school pupils, 1.07 million middle school and 770 thousand high- (including vocational high-) school students in Taiwan. Using 22 million populations and 6.29 million households with the average of two students per household as an assumption for calculation, the estimation is that there are more than one million families in Taiwan with higher than elementary school student in the household. Based on this rationale, finding ways to entice these families on net would be a viable strategy for increasing the Internet population in Taiwan.

More over, if we could successfully recruit the students on net first, then it will also motivate their parents on net, as they would be interested in finding out how well their children are doing through on line. The experimental program, "Tele-Homebook Project (http://homebook.more.org.tw) was conceived under this belief for intensifying the Internet's penetration to homes. It is expected that teachers and parents making contact over the Internet will greatly enhance parent-teacher communications, parent-child interaction, school and home interaction, and improve the child's home learning methods. Furthermore, proliferation of Internet to the homes will also bring the benefit of reinforcing information technology education in schools, and inter-school exchanges. By getting both students and homes on-line, Internet contents quality and volume would be improved/increased, as new Internet applications will be created.



http://homebook.more.org.tw/

In Taiwan, education is strongly emphasized and competition for entering better school is fierce. As such, parents care much about the scholastic progress of their children in school. The traditional way of using paperback homebook for teacher-parent communication has been well established for years as a daily routine. In most of the cases, all elementary- and middle school students must record their turned-in homework and tomorrow's homework assignment on to the homebook daily. Should there be examinations taken, the scores must also be recorded in the homebook for reference by the teachers and the parent.

III. TELE-HOMEBOOK - - A NEW COMMUNICATION CHANNEL

The idea of Tele-Homebook is to provide an expeditious and interactive channel for better communications between teachers/parents/students thereby to enhance the progress of the students' learning. The master-teacher of the participating classes would normally enter the information of today's homework assignments, test/examination results, and any reminders for attention by the teacher/parent/student into the school's computer. The parents, through dialup to the school's server from their office or at home, can access the Tele-Homebook information to find out the progress of their children in school. Once on line, the parent could also use email to exchange information with the teacher. This new channel, in addition to the existing ones such as telephone, office visit and the traditional way of paper-back homebook passing, provides a most effective way for school-family interaction. Especially for those busy working parents, they could have learned what their children were doing in school way before returning home from work. This new idea not only can directly or indirectly improve the children's learning, but it will also enhance parent-child interaction as the Tele-Homebook provides a common subject for sharing in the parent-children interaction.

IV. THE BENEFITS OF TELE-HOMEBOOK

It is quite possible, for example, that some parents will have to stay out late until nine or ten o'clock in the evening to return home, and that would be the time for these parents to review their children's homebook in the past. Now, the new mechanism enables these parents to read the homebook information by networking from their office. Not only they could have learned their children's daily activities at the school earlier, but also respond to the teacher faster should there be anything special for which immediate or special attention would be required. The parents could also leave notes or conduct 'discussion' to/with the teacher through email under the same mechanism that is available to them. At the same time, access records are automatically kept in the system's log. Parents' accesses to the system are also automatically reflected to the teacher to facilitate the teacher for better tracking.

V. PRIVACY CONSIDERATION

For privacy consideration, the system is designed with password protection and ciphering mechanism for information recording. Both the teacher and the parent must use password to enter the system. Additionally, each teacher can only access to the student records of his own class, and each parent can only access to the Tele-Homebooks of their own children.

VI. IMPLEMENTATION

The joint Tele-Homebook program was first proposed to the Bureau of Education, the Taipei City Government, for experimentation as Taipei is best equipped in computer systems with the highest on-net ratio among its citizenry. Based on the surveys on parent needs and the availability of the on-line environment and equipment in the school, participation from the teachers, students and parents, all equipped with or accessible to computer system, are selected on voluntary basis. Starting April 1998, several scores of training class on network applications, including seed-teacher and student training, were conducted to the participating teachers, parents and students.

Up to the semester ending in June 1998, the first batch of model-experimentation comprised nine elementary and intermediate schools including Cheng Cheng, Chung Hsiao, Shyr Jainn, Tien Mou, and Hung Tao five intermediate schools, and Hsing Hwa, Hsing De, Chung Shan, and Shih Shih four elementary schools with 68 classes altogether. More than 2,000 teachers, parents and students participated continuously through the Tele-Homebook mechanism daily.

VII. FEEDBACK AND ANALYSIS

A survey conducted at the end of the experimentation revealed that the mass majority of the participants, including teachers, parents and students, were motivated by the additional channel for enhanced interaction and the benefit of new knowledge learning as the main reasons for participation. What emphasized the most among the parents is that the experimentation has indeed offered the opportunity of a new experience of common subjects for sharing with their children. Comparing the traditional way of paper-back homebook with the networked Tele-Homebook, the consensus from the participating teachers is that the new way not only saves the time and breaks the time and distance barriers, but also conveys more information. Especially for the parents, free from time and distance barriers are very important to them.

Analyzing the using habit, most of the Tele-Homebook accesses by the parents concentrated between six to eleven o'clock in the evening at home, while 50% of the accesses done between nine to eleven O'clock.

VIII. CONCLUSION

This experimentation has also helped us to uncover some issues while we are in the midst of vigorous promotion of the Internet. The first issue is the bandwidth. As the national information network is still under construction, network traffic congestion has been the most disturbing problem confronted the teachers, parents and students. The other problem is relating to the availability of educational contents. Even if we could get most, if not all, of the teachers, parents and students on net enthusiastically today, we would be exposed to the risk and embarrassment of poor educational contents on line preventing full effectiveness of using the Internet for networked/distance learning.

What inspired us the most was that the majority of the participating teachers and parents were very positive about the Tele-Homebook project, with strong recommendation broad-scale deployment of the program.

The Tele-Homebook experimentation project, supported by the ubiquitous Internet, provides a convenient and expeditious channel for the enhancement of teacher-parent communication, shared common interests for parent-children interaction, reference to full computerization of school administration, and opens the door for the teachers and families to the rich Internet World. It is expected that the effort would stimulate seventy thousand parents' participation in the program within the coming three years, and hence bringing us one step closer to the full penetration of Internet to the families.

Return to Top   View Full-screen

Building Hawaii's Telehealth Framework:

Will Policy & Planning Overcome Social Challenges?

Jacquee Peebles

Honolulu, Hawaii, U.S.A

ABSTRACT

Telehealth has been in existence for forty years, but still suffers from limited adoption and low utilization by health care practitioners. The alleged culprits for the lack of adoption usually include limited reimbursement policy, out-of-date licensure statutes, ineffective confidentiality and privacy laws, and limited proof of cost effectiveness. Hawaii's telehealth policy framework along with Federal telehealth policy trends will be addressed and associated with the likelihood that broader acceptance and use of telehealth products and services in Hawaii and the Pacific Rim depend on an interface more conducive to health care practice.

This paper refers to the broader term, telehealth, to maintain consistency with Hawaii's legalized telehealth definition. Telehealth means "*the use of telecommunications services, as defined in HRS §269-1, and enhanced services to deliver health and health care services and information to parties separated by distance. Standard telephone, facsimile transmission, or both in the absence of other integrated information and data, do not constitute telehealth services*".

View Full Text

Building Hawaii's Telehealth Framework:

Will Policy & Planning Overcome Social Challenges?

I. INTRODUCTION

Telehealth's progress and diffusion in the health care environment has been slow and limited. Historically, most federally funded telehealth programs have ceased operations after their funding ended. Speculation on program failure often lead to the conclusion that most programs were not structured to be self-sustaining from the outset or structured around health care provider requirements. Additionally, there are myriad's of legal and regulatory issues that must be resolved.

Despite telehealth's slow progress, the federal government continues to invest in telehealth — the total amount of money spent on grants, contracts, and appropriations in this decade is approaching $700 million. The funding supports an assortment of development issues that include legal and regulatory concerns, and technology /telecommunications advances. The following sections review Hawaii's legislative activities along with federal actions.

II. HAWAII'S ACTIVITIES

Hawaii's Governor established telehealth as a priority area for development in Hawaii after examining how other states were using telehealth to address the persistent problems of maldistribution of health care resources. Many Hawaii businesses and the state government envision Hawaii as a world class center for health care in the Asia Pacific region. Hawaii has excellent health care facilities and professionals, with close ties to Asia Pacific countries, so capitalizing on these factors not only stimulates improved health care access, it encourages economic development.

The state government has played an important role in promoting, developing, and supporting telehealth initiatives aimed at improving access to basic health care. Hawaii's Department of Health (DOH) established a Telehealth Planning Project to investigate and develop telehealth policy for the state. The project's strategy was to engage multi-sector participation, and create partnerships between public and private sector organizations. The Hawaii Telehealth Coordinating Committee was formed to address implementation challenges to telehealth for the project's duration. The group identified issues they perceived to be barriers to telehealth implementation in the state and proceeded to act on issues. The project's success was based on the powerful synergies formed from cross-sectoral collaboration.

III. TELEHEALTH POLICY

The following three policy subsections provide a brief and limited overview on the most pressing legal and regulatory concerns often cited in the literature. There is a considerable amount of activity in the telehealth arena by state and federal governments, along with calls to begin discussions in the international level.

1. *Reimbursement*

a. *Hawaii's Policy*

Demonstrating Hawaii's strong community participation and interest in telehealth, HB 2852 (Act 278) was introduced and passed during the 1998 legislative session. The Act defines telehealth and removes the requirement of face-to-face examinations as a prerequisite for reimbursement. Of significant importance, this bill does not specify a specific communications modality as other telehealth reimbursement regulations do; namely, two-way interactive video or store and forward. The definition's reference to telephones and facsimile was a highly contested statement throughout the legislative session. Lawmakers included the statement due to concerns by several organizations that telehealth could increase the potential for fraud and abuse by health care providers.

b. Federal Policy

The lack of reimbursement for telehealth consults, telecommunications costs, and inadequate infrastructure have been cited as primary obstacles of adoption. The Federal Government began several programs intended to address these concerns.

- Under the 1997 Balanced Budget Act, Medicare must pay for teleconsults in Rural Health Professional Shortage Areas effective January 1, 1999

- The Universal Service Fund for Rural Health Care Organizations was designed as a discount program for health care networks.

2. *Licensure*

a. Hawaii's Policy

The practice of medicine is controlled by state-based licensure systems that require a physician to be licensed in the state(s) in which s/he practices medicine. As teleconsultations can cross state lines, the question becomes how to determine "where" the teleconsultation actually occurs. As of 1997, 24 states (including Hawaii) have adopted changes to their practice acts in response to telehealth. Hawaii's Board of Medical Examiners issued a policy decision in 1998 that clarifies SB 512 (Act 364) relating to professions and vocations enacted in 1997.

b. Federal Policy

In the fall of 1995, the Board of Directors of the Federation of State Medical Boards of the U.S. adopted a model state statute (the "Model Act") recommended by the Federation's Ad Hoc Committee on Telemedicine. The Model Act defines the "practice of medicine across state lines" and would require physicians to obtain a "limited license" for this practice. Many believe that the Model Act clarifies licensing issues, but most state boards and legislatures are ignoring the proposed law.

The National Council of State Boards of Nursing recently agreed to promote an interstate mutual recognition compact. Under this arrangement, party states will recognize licenses granted by other party states. Each state will retain the right to sanction nurses who violate state laws on practice acts in the patient's home state.

3. *Confidentiality & Privacy*

a. Hawaii's Policy

A confidentiality bill was introduced in the 1997 and 1998 Hawaii Legislation, but died in a legislative Committee. Policy makers continue to work on confidentiality issues, but are awaiting Federal legislation.

b. Federal Policy

Presently no comprehensive federal law protects people's health records. Congress has begun to form legislation designed to protect medical-record privacy. The Health Insurance Portability and Accountability Act (HIPAA) of 1996 included several provisions relating to the establishment of standards maintaining the confidentiality of personal health information data. Senate action is expected to establish uniform national protections for health care information. Federal legislation would pre-empt most state laws in this area, eliminating much of the confusion associated with confidentiality state laws.

c. International Policy

A European Union directive was formally adopted in 1995 that sets the obligations of those responsible for data processing with many important rights for individuals. Data protection is an area of high legislative activity within the European Union. Eleven nations have adopted basic data protection legislation, and have established regulations on inappropriate data collection and disclosure.

IV. TECHNOLOGY: COSTS AND BENEFITS

There is a variety of technologies used to exchange health information today, but until recently, the majority of programs have focused on real-time interactive video conferencing (ITV) technology. *Telemedicine Today's* data from their "Telemedicine Annual Program Reviews" article reveal the following trends on programs and ITV usage.

- 1993: 10 programs with approximately 100 patients
- 1994: 24 programs, 99 sites, and 2,110 teleconsults; a mean of almost 88 patients per program
- 1995: 40 programs, 498 sites, and 6,267 teleconsults; a mean of 156.6 patients per program
- 1996: 80 active programs, and 21,274 patient-clinical interactions (excluding teleradiology and tele-home health); a mean of almost 266 patients per program
- The average program seeing 50 or more consults in 1996 saw 37.7 consults per site/per year, or 3 consults per site/per month

Current program activity data is only available through 1996, but it appears that programs are starting to take steps to ensure that telehealth becomes more cost-effective and easier for clinicians to use. As indicated in the data from *Telemedicine Today's* survey, utilization is very low per program. According to another 1996 survey, the initial capital cost of ITV telehealth equipment is substantial, as are annual operating costs. This is due to the technical demands of a studio-based telehealth ITV program. These programs are usually located in a room in a hospital and filled with television screens and networking technology to enable teleconsultations. Of the 90% of the surveyed programs using ITV in 1996, equipment acquisition costs ranged from $100,000 - $300,000 per program. Annual transmission costs ranged from $18,000-$80,000 depending on distance and bandwidth. Program unit costs were also very high, reflecting the costs of acquiring and using ITV.

1. *Case Studies & Equations*

Grigsby's perspective on the volume of teleconsults and how it would affect a fictitious group practice of five physicians comes from 1995 program data. If each physician saw 22 patients/day or 500 patients in a 5-day week in our fictitious practice, the small group practice would have seen all 6,267 telehealth patients in eleven weeks and two days. Averaging $100 for each consult, each physician would average $125,340 before practice expenses and taxes. Spreading this revenue across 40 telehealth programs, each program can expect $16,000.

An unpublished analysis examined two different telehealth programs. Program A uses ITV and averages 1.8 hours of weekly system utilization. The average hourly cost per teleconsultation for Program A is $2,219, not including bandwidth. Program B uses ITV and averages a weekly utilization rate of one hour. After analysis of the cost per teleconsultation, the average hourly cost of a teleconsultation is $13,586, including bandwidth. An average medical specialist sees 116 patients /week, so one specialist at Program A could have seen the 696 total yearly telehealth patients in six days, and Program B's one specialist could have seen the 464 total yearly telehealth patients in four days.

The need to develop programs that are not only cost effective but conducive to health professional specifications becomes evident when examining program activity and the cost of ITV teleconsultations.

V. CLOSING THE LOOP - - WHAT'S MISSING IN THIS PICTURE?

We have been selling telehealth as the application that will improve health care, assure universal access to care, and eventually help slow health care costs regardless of geography. We need to take a close look at these assertions. The *Report on Telemedicine and Developing Countries* was prepared for the International Telecommunication Union. The report recognized that telehealth services could be an economical means of achieving national health policy objectives with regard to improvement and/or extension of medical and health care, especially to non-urban areas. However, few developing countries can afford the very sophisticated solutions. Their most pressing need is for low-cost telecommunications and associated facilities for telehealth applications.

One would expect that Hawaii's recently enacted telehealth reimbursement legislation would foster the submission of many telehealth-based claims. However, if Hawaii follows the same path as other states with reimbursement legislation, we will most likely see limited activity. The Hawaii Telehealth Coordinating Committee, which was supported and represented by a large spectrum of professionals around the state, had limited and sporadic clinical representation. This is not an unusual phenomenon, as noted by Melvin Nutig and Lapola et al., in their opinion pieces[11,]. Despite the claims, the majority of clinicians are interested in "future" telehealth, but remain largely uninterested at the present time.

For telehealth to realize its objective, we need to change the focus of our examinations. We have been enamored with the technology, and focused on equipment type and telecommunications. Instead, we should find the most efficient and effective means of delivering health care, and also determine what social and organizational changes are needed to make that happen. The following subsections contain recommendations that could assist in developing programs that achieve high utilization while holding down the costs.

1. *Planning: Determine the Clinical Need First*

Decision-makers and health care professionals are inundated with new and often very expensive technologies. Exaggerated vendor claims and the diverse array of exciting and new telehealth technologies compound decision making. Given the new array of technologies, voice services and telephony tools are often forgotten — but they provide easy, convenient, and affordable access for providers and their patients. Too often, facilities purchase new telehealth equipment with the noble goal of enhancing health care for its clients or improving education for its staff. Unfortunately, these decisions are made without any type of assessment on what the problems are and how technology will correct the problem.

The Telehealth Planning Project developed a Community-Based Assessment Tool because health professionals and organizations in Hawaii want to take charge of and shape their futures via telehealth, but are uncertain where to start. The focus of the tool is broad, encompassing a wide range of factors that determine the health of a geopolitical population as well as the resources that a community can assemble to respond to health needs. The tool was designed to be the first step in a collaborative process that will eventually lead to community-wide interventions.

2. *Integrating Knowledge into Health Care Practice*

Health professionals are continually bombarded with new data, regulations, practice guidelines, technology, and a host of other issues. Trying to sift through this explosion of information and determine the correct clinical care plans for patients is extremely difficult. Many telehealth programs have been introduced and built in isolation, and do not complement or interact with other systems already in place in a health care facility. Many telehealth programs have been designed from a technical perspective without provider participation and guidance.

Integrating and assembling the many pieces of information used in the health care arena in a comprehensive framework will fill the gap that currently exists in most health care facilities or practices. Unfortunately, technology does not yet offer efficient and effective access to the wide array of information that is currently available. Still, if telehealth were developed and planned as an integrated process that prepared existing materials in the most optimal form, it will be seen as a timesaving tool with many professional benefits.

NASA's Multimedia Workstation was designed to be a valuable tool for access to health data and patient information. The system hosts an electronic library along with databases containing information from clinical laboratories, toxicology, pharmacokinetics, and pharmacology. The system also offers 32 different types of health care information that range from patient demographics, history and physical exams, reports and results, correspondence, practice guidelines, along with disease protocols and screens. The designers of the system suggest that when decision support tools, such as the Multimedia Workstation, are incorporated into the privacy of the examining room, we will provide a tool that fills the gap in our current clinical care process.

3. *Online Health Information / Misinformation*

The explosion of internet-based health and medical information also presents challenges to health professionals as consumers have shown enthusiastic response to multimedia health care information. Traditionally, physicians, nurses, and other professionals have been the source of health information for their patients. A 1997 survey found that 15.6 million adult patients, members of patient families, and "well" consumers go on-line to gather information about their mental and physical health. Recently, the issue of online health and medical content quality has been a prominent discussion topic.

Countering the worrisome problem that online healthcare information can be misleading, former U.S. Surgeon General C. Everett Koop, M.D., with Empower

Health Corporation has launched web site, "Dr. Koop's Community." The site offers consumers information on topics such as disease information, treatment modalities, drug interaction, and hosts online discussion groups. Most importantly, the site ranks other health-related web sites using the criteria of credibility, content, disclosure, links, design, and interactivity. This service provides consumers the opportunity of evaluating information at the outset and is one method of countering health misinformation.

VI. CONCLUSIONS

Telehealth fundamentally reshapes business processes and regulations, organizational structure, information technology and knowledge, physical infrastructure, and health care models along with changing organizational values and culture. The means to link together increasingly sophisticated medical departments, offices, facilities, homes, and other points of care continues to evolve at an astounding pace. The real problem with telehealth is not reimbursement or other noted barriers — they are symptoms of a larger problem. We need to address root causes of low utilization of telehealth realistically, and develop applications that serve as tools in which consumers and health care providers find efficient and effective. Working in a collaborative manner to design and develop innovative, useful, and affordable systems that encompass health care requirements, will in turn help transform health care.

Return to Top View Full-screen

Technical Support for Establishment of Telemedicine

between Gomel, Belarus and Nagasaki, Japan

Iwato Asahara, Takeo Nobusawa, and Moriji Kuwabara

BHN Association, Japan

ABSTRACT

The objectives of BHN Association are as follows: Provision of humanitarian aid to developing countries, provision of telecommunication support in areas such as medicine, environmental conservation, elementary education, disaster rescue, etc., promotions of the exchange of information and personnel, provision of humanitarian aid in cooperation with NGOs, universities, institutes, and international organizations.

One of the most sophisticated projects was the Chernobyl Sasakawa Medical Cooperation Project, composed of three major organizations: Radiation Effects Research Foundation, Hiroshima University and Nagasaki University School of Medicine. A direct linkage between Japan and Chernobyl has been established by the donation of modern equipment with various consumable reagents from Sasakawa Memorial Health Foundation. Consequently this made it possible to standardize our protocol of health screening even after the collapse of the USSR.

View Full Text

Technical Support for Establishment of Telemedicine

between Gomel, Belarus and Nagasaki, Japan

I. OBJECTIVES OF BHN ASSOCIATION

BHN Association was established in 1992 and contributes mainly on development of infrastructure of telecommunication in developing countries especially South East Asian countries.

The objectives of BHN Association are as follows:

a. Provision of humanitarian aid to developing countries all over the world and to help promote the general welfare of the global community, utilizing resources and experience in the field of telecommunications.

b. Provision of telecommunication support in areas such as medicine, environmental conservation, elementary education, disaster rescue, etc.

c. Promotions of the exchange of information and personnel with respect to the field of telecommunications, involving countries that are associated with the BHN Association.

d. Provision of humanitarian aid in cooperation with NGOs, universities, institutes, and international organizations which are active in domestic and foreign assistance programmes.

II. BACKGROUND

Applying our technology to the remote-area medical assistance, we have already cooperated with the former USSR, especially Russian Federation and Ukraine since 1992 and 1996 respectively.

In Russian we constructed 120km radio micro wave link between MRRC RAMS(Medical Radiological Research Center of the Russian Academy of Medical Sciences in Obninsk) and Moscow gateway switch.

In Ukraine we:

a. Installed Telecommunication Mobile Satellite System between Kiev's #2 Hospital and medical vehicles patrolling the rural Ukraine.

b. Provided the Ukrainian National Emergency and Trauma Center with a PBX based PHS system.

This time we would like to apply our know-how of telecommunication to the most radiocontaminated areas around Chernobyl, Gomel and Belarus.

Unfortunately there are many radiation victims near the Chernobyl nuclear plant where the accident occurred on April 26, 1986 in Kiev, Ukraine.

A hugeamount of various radionuclides were released from the nuclear power plants. Various levels of medical assistance from both governmental and non-governmental sources from Japan had been involved but concrete medical assistance based on a scientific approach was notstarted until 1991. One of the most sophisticated projects was theChernobyl Sasakawa Medical Cooperation Project, composed of three majororganizations; Radiation Effects Research Foundation, Hiroshima University and Nagasaki University School of Medicine. A direct linkage between Japan and Chernobyl has been established by the donation of modern equipment with various consumable reagents from Sasakawa Memorial Health Foundation. Consequently it made possible to standardize our protocol of health screening even after the collapse of the USSR.

The 5-year-long project started from May 1991 has been completed and data has been collected for more than 160,000children.

The characteristic points of the Chernobyl Sasakawa project are as follows:

a. The most susceptible children, age at the time of the accident from 0 to 10 years old, were targeted and screened, andaccurate information was fed back to the public.

b. The screening wasmainly focused on the possible late effects of radiation and performedby the common procedures of thyroid and hematological examinationsbased on the knowledge and experience from Nagasaki and Hiroshima.

c. Whole body Cs-137 was measured in all the subjects to determine the current radiocontaminated levels and to relieve their anxiety. The medical part of this project has been organized by Nagasaki University School of Medical.

III. THE NEED OF TELEMEDICINE PROJECT IN GOMEL AND BELARUS

Since the radiocontaminated area is vast and the children live sparselyaround these areas, they have already established five main diagnostic centers, Gomel and Mogilev in Belarus, Klincy in Byransk, Russia, Kievand Korosten in Zhytomir, Ukraine. The results have been complied andpublished from the five centers of examinations performed from May 1991to April 1996 including nearly 120,000 children. According to their data, about 3% of the children had some thyroid abnormalities otherthan goiter, upon which they could receive echo-guided fine needleaspiration biopsy and cytological diagnosis. The results revealed thata thyroid nodule more than 0.5 cm in size with abnormal echo findings were found in about 7% of malignant thyroid nodules in children aroundChernobyl, suggesting a high incidence of thyroid cancer in these fiveregions. The patients with thyroid cancer in Belarus have all beenoperated only in Minsk and the diagnosis was confirmed histologically. The linkage between Gomel, where many patients exist, and Minsk, where surgical treatment is performed, is essential but it is still difficult to connect properly between them because of inadequate infrastructure. Therefore BHN Associationhas decided to work together with Nagasaki University School of Medicine to support a technical assistance to promote their specialplanning of Telemedicine between Gomel and Nagasaki under the strongsponsorship of Sasakawa Memorial Heallth Foundation. The sisteruniversity relationship between Minsk Medical Institute and NagasakiUniversity School of Medicine is also a beneficial factor to supportthe establishment of Telemedicine at the standpoint of medical education.

Attention has been paid only on the dramatic increase of childhood thyroid cancer but adult thyroid cancer and othercancers such as lung and breast cancer are predicted to increase in the near future. The improvement of medical diagnosis and treatment is urgent for those radiation victims and the remote area medical assistance is really needed to be established.

Health care for Hibakusha, patients caused by atomic-radiation, around Chernobyl has, however, been hampered because of several tenacious problems despite of various efforts to resolve them:

a. Uneven geographical distribution of health care resources throughout the country including facilities and manpower.

b. Inadequate access to health care on the radiocontaminatetd areas because of not only isolation/remoteness but of radiophobia.

c. Low efficiency in utilizing international support of the total health medical care around Chernobyl from the standpoint of cost-effectiveness.

d. Shortage of drugs and confused medical assistance from abroad.

e. Inadequate supply of modern medical knowledge and techniques.

To overcome the above problems, the accurate information and knowledge for the local doctors and medical staff are needed from the only radiation-exposed country, Nagasaki and Hiroshima, Japan.

IV. BENEFITS

The need for establishing the Telemedicine system in Belarus is apparent and will become an ideal model to spread the same system to the world because of the evidence of numerous patients suffering from radiation exposure in the widespread areas. However, a number of factors can influence the possibility and rapidity with which medicine and health care for Hibakusha accepts, involving the level of technology available, its utility and acceptability, as well as a host of factors unrelated to technology. In establishing the Telemedicine system we must cooperate with staff in Belarus and give them a lot of know-how on medical and technical advancement and support their infrastructures and software as well as hardware. Once the Telemedicine system is established, doctors can provide the highest quality of patient care using Telepathology, namely, early and accurate diagnosis by using image transfer, early and appropriate treatment/follow-up. Furthermore the standardization of diagnosis criteria and common protocol on patient treatment and care are possible. Medical education is also possible in addition to prompt access to the international academic information.

V. OUTLINE OF THE PROJECT

We have just started to search for a possibility of satellite telecommunication between Gomel and Nagasaki because of poor development of telecommunication in Belarus. This is a unique trial aiming to send the abnormal images obtained from thyroid ultrasonography screening at the mobile diagnostic teams in Gomel to Nagasaki University School of Medicine to analyze semi-quantitatively and make a double check of diagnosis in quality (see attached figure).

The consulting results will be replied from Nagasaki to Gomel. Using the same principal, it will be easy to establish Telepathology system in Belarus although once again the infrastructure of image transfer needs to be improved. The demerit of satellite telecommunication is that it is far from cost-effectiveness. Therefore, we definitely need to consider the establishment of ISDN and an optical fiber communication network system.

VI. PROBLEMS

Permission of Satellite Communication using Lynx.

Covering of Communication Fees (between Gomel and Nagasaki).

Establishment of Total Patient Care System.

Image transfer system within Belarus (future problems).

Barrier of language.

Theoretically and practically, the Telemedicine system can be established by the financial support of SMHF (Sasakawa Memorial Health Foundation) and by the intellectual and technical cooperation with Nagasaki University School of Medicine. The main problem is when we can get an official permission to start the international telemedicine from Belarus, only for the purpose of aiming the medical diagnosis and treatment for Chernobyl.

VII. PARTNERS

Belarussian Ministry of Health, Gomel Regional Bureau of Health, Gomel Specialized Dispensary, SMHF, Minsk Medical Institute, Nagasaki University School of Medicine and NTT.

VIII. TIME SCHEDULE

All the necessary machines including the computer system and image transfer software will be set up in 1998. The system will start next year, probably before April 1999.

IX. FUTURE PLAN

In future this system will be directly connected with the Internet system so that local staff can access directly to the international medical and academic information. Simultaneously revolution of information can be achieved through development of a total patient care system using Telecommunication method. This system can connect with and involve in the International Hibakusha Network.

BHN Association would like to cooperate with various types of Telemedicine and assist to develop an international medical care system using telecommunication facilities, so called "Telecommunication Red Cross" project.

X. REFERENCES

Yamashita S, Nagataki S: *Chernobyl and Thyroid*. Thyroid vol:5, p153-154, 1995

Ito M, Kotova L, Panasyuk GD, Ashizawa K, Nishikawa T, Nagataki S, Yamashita S.: *Cytological characteristics of pediatric thyroid cancer around Chernobyl*. Acta Cytol vol:41, p1642-1644, 1997

Yamashita S, Shibata Y (eds): *Chernobyl; A Decade*. ICS 1156, Excerpta Medica, Amsterdom p1-613, 1997

Nagataki S, Ashizawa K, Yamashita S: *Cause of childhood thyroid cancer after Chernobyl accident*. Thyroid vol:8, p115-117, 1998

Return to Top View Full-screen

Rural Telemedicine In Indonesia

(An Approach To Selecting Proper Application)

Samudra Prasetio & Andreas W. Yanuardi

PT Telekomunikasi, Indonesia

ABSTRACT

Indonesia as one of the developing country can increase the health level by using combination between information technology and telecommunication network which known as telemedicine. This paper will discuss about alternative solution on health and medical services for Indonesia rural community in the future. All application services of telemedicine have close relationship with the strategy of implementation of Indonesian rural telecommunication network.

View Full Text

Rural Telemedicine In Indonesia

(An Approach To Selecting Proper Application)

I. INTRODUCTION

As other developing countries, almost 63% of Indonesian population still live in rural areas with low income, poor health level and lack of education also low life expectancy. Development plan of the country is aimed to increase quality of human resource by improving health level, restraint of population quantity and quality, hence it will result some characteristics which exceptionally beneficial to the development. The main constraint faced by the country in efforts to achieve goals above is how to reach the rural/remote area.

The improvement in telecommunication technologies that combined with information technologies recently have created many services, which the characteristics are not only for individual need but also for community need. One of the services that can be used by Indonesian government in order to increase health level, public education and life expectancy is telemedicine. Telemedicine itself can be defined as transmitting any information related to medicine and health problems using electrical signals.

This paper offers and discusses an alternative solution suited for Indonesian rural community in order to increase health level by using telemedicine service. The strategy of implementation of telemedicine services in rural areas will be related to strategy of implementation of Indonesian rural telecommunication network that has been issued by PT TELKOM. The main consideration in this paper is choosing the priority of telemedicine application based on telecommunication technology implementation.

II. MACRO ANALYSIS

The Republic of Indonesia is the largest archipelago in the world, consisting of five main and 13,677 small islands. It is situated between Asia and Australia, streching 5,110 kilometers from west to east and 1,888 kilometers from north to south. The total area is 5,193,250 square kilometers with 39% land territory and 61% sea territory. The five largest islands are Irian Jaya, Kalimantan, Sumatra, Sulawesi and Java. The population density per square-km for each island varies. The population density for Java-Bali (7% of total area) is 880 people per square-Km (58,7% population). In contrast; Irian Jaya has only 5 people per square-Km, 20 in Kalimantan, 100 in Sumatra & Sulawesi.

Health services facilities in Indonesia with the large coverage are hospitals and health centers. Each district has hospital and each Sub District has at least one health center headed by the doctor. Health Center supported by two or three Sub Health Centers that headed by nurses. Most are equipped with four-wheel drive vehicles or motorboats to serve as mobile health centers and provide services to undeserved population in urban and rural areas. At the village level, the integrated Family Health Post provides preventive and promotive services. These health posts are established and managed by the community with the assistance of health center staffs. Each density of doctor and nurse per 100,000 population is 10.73 and 77, while health center and the amount of bed in hospital per

100,000 is 3.62 and 60.5. All data above is an average for national situation, consequently the penetration level in rural area is different from national average (it may be smaller).

Focusing on telephone lines distribution in Indonesia, almost 73% of telephone lines concentrated in Java Island, especially in Jakarta. This thing is really different from the condition in eastern Indonesia, which covers a very huge area but only have 10,6% of total telephone lines in Indonesia.

There are some factors why the problem appears; the characteristics of rural areas (geographic and demographic) are different from urban areas. Hence, market segment for voice bandwidth or other services are still centralized in urban area. If there are no alternative solution to provide telecommunication network infrastructure in rural area, automatically it will emerge unbalanced distribution.

Despite, Indonesian government still has responsibility to conduct some programs related to how to increase life standard, as follows:

- Improving health level
- Increasing life expectancy
- Improving nutrition
- Better education standard

The use of combination between telecommunication network and information technology can help the programs that have been planned by the Indonesian government above, and one of the solutions is the launching of telemedicine.

The readiness of telecommunication network in urban area will give some simplicity in carrying out telemedicine services. Different case will happen in rural area. Based on this problem, it needs good planning to roll out telemedicine services and it has close relationship with the arrangement of telecommunication development phase in rural area.

III. TELEMEDICINE SERVICES APPLICATION

Telecommunication provides technology that can transmit any information electronically between area, which is separated geographically. Telecommunication technologies used by telemedicine are not limited into one technology only, but some of them are satellite, microwave, and fiber optic also copper wire.

Before having further discussion about the implementation of telemedicine services in rural area, it has to be defined first what kind of application that possible to be conducted in telemedicine. Telemedicine involves some kinds of technology and its applications. These services can be classified into three main parts as follows:

- Audio
- Visual

- Data

Audio is the simplest service application from telemedicine. The audio can be delivered minimally by using POTS (Plain Old Telephone System). It is enough to conduct communication between two points to discuss something about health and/or medicine.

The second type is Visual (image transfer). The examples of these services are teleradiology, telephatology, teledermatology and telepharmacy. The utilization of videoconference and transferring process of visual images are the most common technology application used in visual telemedicine.

The third type is Data, include in this type are online access to database and telemetry. The information showed in data telemedicine is usually in digits format. One example is the observation of air force in order to monitor their pilot's health on his plane.

IV. THE STRATEGY OF IMPLEMENTATION OF TELEMEDICINE IN RURAL TELECOMMUNICATION NETWORK

The first phase to conduct above is the identification process in rural areas in Indonesia refers to data from the authority institution also survey. The next process is defining some parameters to make model. Parallel with the first step, is carrying out assessment toward telecommunication technology. It started from copper wire, radio up to fiber optic. The aim of assessment process towards telecommunication technology is proper telecommunication network that suits rural area based on geographic and economic analysis. All above will be discussed detailer in section 4.1.

Telemedicine itself must also have assessment process with specific parameters. The parameters are type of information delivered and the conversion of such information into needed bandwidth classification. The bandwidth classification results some options such as what types of telemedicine application can be implemented related to condition and architecture of rural telecommunication network. Section 4.2 will cover all the description about assessment process in telemedicine.

All of this, of course, is not limited the concept itself from the changes that may happen in the technology, government policy or ignorance of economic aspects.

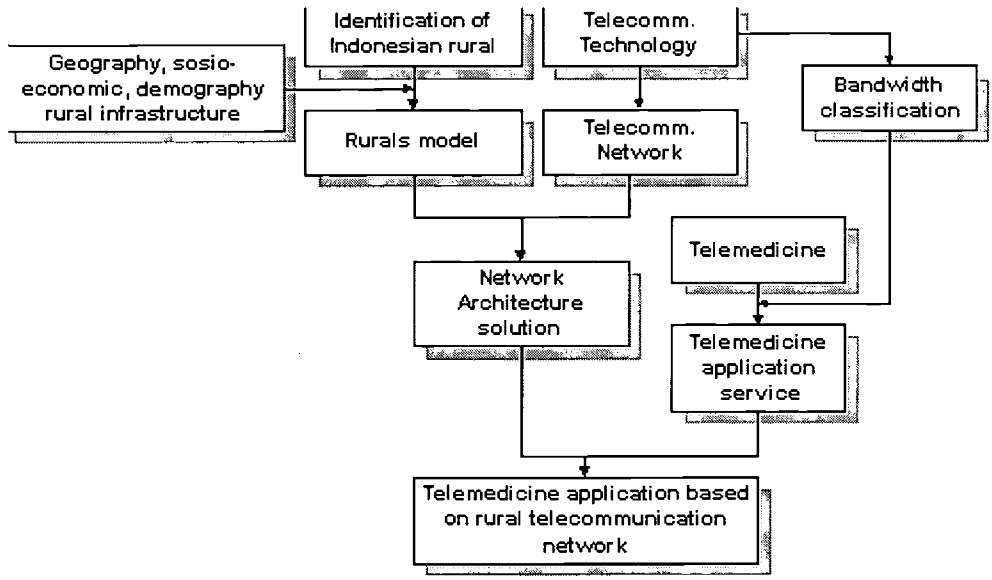


Figure 1. The Method

1. *The Strategy of Implementation of Rural Telecommunication Network*

The first step to provide information technology service is the readiness of telecommunication network. In rural areas, there are a lot of factors contribute to the low level of telecommunication network penetration. Some of them are low population density, economic activity tends into grow slowly and basic infrastructures which are not adequate. Based on this consideration, the effort to provide telecommunication infrastructure in rural area still needs a very expensive investment. Comparing to business oriented it is not a profit program. So in keeping the implementation of telecommunication infrastructure in rural area needs a special approach.

Rural area in Indonesia has many characteristics, which are different one to another. One method to simplify the various rural conditions is making a model. The model itself is arranged based on quantity estimation and demand distribution of an area by considering geographic, social-economic and demographic condition, also infrastructure of rural area.

The approach based on quantity estimation and demand distribution of a rural area therefore result three types of Indonesian rural area, as follows:

- Rural type I,

  The population of this area is concentrated mode and has a chance to be a new urban area.

- Rural type II,

  The second type is an area around urban area. The population of this type is scattered in small group.

- Rural type III,

  Rural type III describes an area that hard to reach. The population of this type is scattered individually in isolated area.

- After getting the three models of rural area, the next phase is the solution for telecommunication network infrastructure for each model. The solution can be given for each model is defined by exploring the capability of a telecommunication technology (copper wire, coaxial, fiber optic, cellular/wireless or even satellite) to cover subscribers in specified radius. The network can be classified into 4 parts:

  - Copper wire
  - Point to Multipoint (FDMA/TDMA/CDMA)
  - Fixed Cellular
  - Satellite

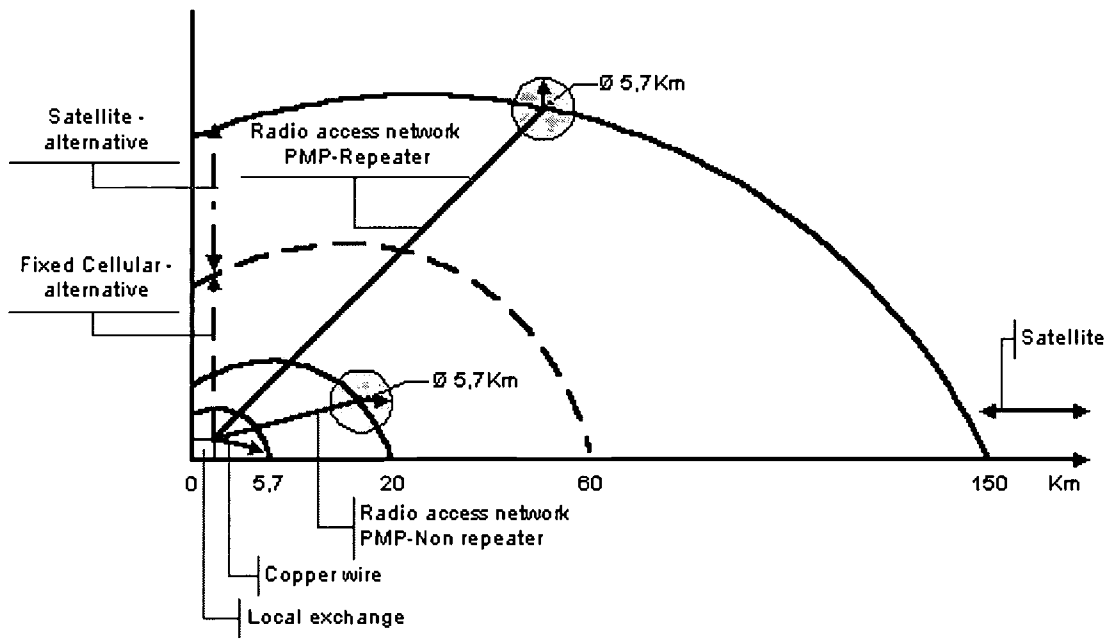


Figure 2. The configuration of telecommunication network

The recommendations from the figure above are:

- Subscribers in rural type I can be connected by the utilization of copper wire
- The implementation of access network based on radio technology will be dominant in rural area type II and III
- The utilization of digital point to multipoint in rural type II without repeater can cover area around 20Km. The utilization of repeaters will increase the area can be covered more than 20Km but less than 150Km
- The exploitation of digital point to multipoint ith repeaters is less beneficial comparing to the use of repeaters more than three hops. Hence, in rural type II may use alternative access

network technology (such as fixed cellular or satellite)

2. *Telemedicine Service based on Delivery Stream*

One of the critical factors in order to provide telemedicine in rural areas is bandwidth limitation. Bandwidth itself can be defined as the capacity of information transmitted in telecommunication line. Higher bandwidth means the delivery process of data become faster. Bandwidth limitation itself refers to the architecture of rural telecommunication network that tends to radio-basis, but the radio itself up to now is still limited just in low speed data.

In light of this bandwidth limitation, there is an implication has to be faced that the utilization of voice bandwidth (POTS) by using copper wire even though can be classified into cheap service but it delivers only small bandwidth. Oppositely, the utilization of broad bandwidth can make appliction such as teleradiology, telepathology, teledermatology or telepharmacy run well, but in this case we have to spend more money for higher bandwidth.

That is why the classification of telemedicine application that suits for each bandwidth is needed. In order to accommodate the statement above, the bandwidth separated into three main parts as follows:

- Low
- Middle
- High

The criteria used in classifying the bandwidth is the recent telecommunication technology, example POTS, ISDN up to ATM. The classification can be seen below:

Bandwidth	Bitrate (KBps)	Access Network	Telecomm. Technology
Low	64 ≤	copper wire, radio, satellite	POTS, include data via modem
Middle	64 ~ 2.048	copper wire, coaxial, fiber optic	DLC, ISDN (BRA/PRA)
High	≥ 2,048	Fiber optic	Frame relay, ATM

Table 1. Bandwidth Classification

Based on table 1 above, it can influence the proper telemedicine application for each bandwidth. The result can be seen in table 2 bellows:

Bandwidth required	Information transferred	Interaction mode	Application type
low	Voice, Still video, Text	Telephone voice interaction, Still images, Video clips with not real-time, Text, Store-and-forward with data acquired and sent for later Review	Audio, Data
low ~ middle	Voice, Motion video Images, Text	Still images, Video clips with real-time, Telephone voice interaction	Visual Images, Data
middle ~ high	Voice, Motion video Images, Text	Real-time one-way or two-way interactive motion video	Visual images

Table 2. Bandwidth required for telemedicine application

3. *The Selection of Telemedicine Application for Rural Area*

Besides consideration between strategy of implementation for rural telecommunication network and the application of telemedicine services, it still has to refer to economic side.

Rural type I

In rural type I, the telecommunication network is dominated by copper wire that has main office on local exchange or RSU (Remote Switching Unit). One subscriber can use POTS minimally, which is the information stream is around 4,8Kbps. By using modem, that subscriber can make a change in health and medicine information in data format. The utilization of transferring data via modem can be set up to 64Kbps.

Further more, in Indonesia there is a regulation that all of local exchange in Indonesia is required to support ISDN services. Observing the economic aspect for rural areas, the implementation of ISDN BRA (Basic Rate Access) does not need additional cost (because the local exchange support ISDN BRA by default). Hence, it effects the telemedicine application can be provided for rural area type I up to 128Kbps, hence the type of information can be transferred including voice, text, images and motions video (ISDN BRA).

Rural type II

The mass condition in rural type II indicated by the people who live around urban area and the pattern is scattered. Thus the telecommunication infrastructure that may be rolled out is still copper wire with tendency to the utilization of radio access network point to multipoint with/without repeater and cellular. Observing above, the average bandwidth is still only voice bandwidth. But for some certain areas that can be covered by copper wire, they can have ISDN BRA service.

Rural type III

Rural type III is a kind of area that difficult to reach, the population is scattered individually in isolated area. Consequently, the telecommunication network is based on radio includes satellite system.

The telecommunication based on radio, until now is still dominated by the utilization of 4,8 ~ 14KBps vocoder. It means that the information will be delivered limited in narrow bandwidth only, and the examples are; voice text and still video.

Rural type	Telecomm. network	B/w Required			Information transferred	Interaction mode
		Low	Mid	Hi		
I	• Wireline	3	3		Voice, motion video, images, text	Still images, Video clips with real-time, Telephone voice interaction
II	• Wireline • Cellular • PMP Non repeater	3 3 3	3		Voice, motion video, images, text	Still images, Text, Telephone voice interaction
III	• Cellular • Satellite • PMP Repeater	3 3 3			Voice, still video, text	Still images, Video clips, Text, 'Store-and-forward' with data acquired and sent for later Review, Telephone voice interaction

Table 3. Telecommunication network vs. Telemedicine application

4. *Virtual Telemedicine Project*

Recently R&D Division – PT Telekomunikasi Indonesia is developing telemedicine service by combining PSTN (Public Switch Telephone Network) and Interactive Voice Respon (IVR) system without any special terminal. Virtual Telemedicine server contains information database about health, medicine and other information related to community based on voice and those information can be accessed by users when they push numeric button in terminal.

In case a user wants to ask something, the question will be stored in server followed notification to facilitator. Virtual Telemedicine involve facilitators/experts who maintain the information content up-to-date version. Facilitator is equipped with automatic information capturing from TV or radio broadcasting and text to speech for the Indonesian language software.

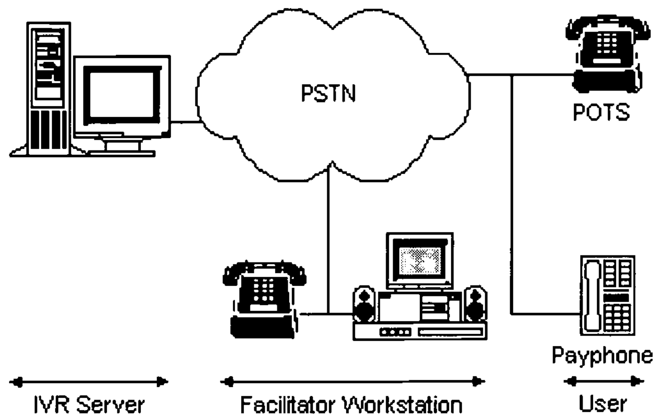


Figure 4. Configuration of Virtual Telemedicine

V. CONCLUSIONS

The implementation of telemedicine for Indonesian rural area has close relationship with the strategy of implementation of rural telecommunication network. The strategy of implementation divides rural area into three main parts:

- Rural type I, concentrated area
- Rural type II, scattered area
- Rural type III, remote area

The consequence above is the tendency of telemedicine application is still use narrow bandwidth (voice bandwidth) with highest bandwidth just ISDN BRA.

VI. REFERENCES:

1. Sulasmono, Halim, "Telkom Approach in New Market Environment for Rural Area", Asia Pacific Rural Telecom Conference, Jakarta, Indonesia, 1995
2. Achmad, Sofyan, "Virtual Tele-Information for Rural Community - An Approach to bring powerful telecommunication for rural community, Canada, 1997
3. Telkom, PT, "Kajian Profitabilitas Layanan Telekomunikasi Rural Tipe III di Indonesia", Indonesia, 1997
4. Telkom, PT, "Rural Information Riched Community", Indonesia, 1996
5. Telkom, PT, "The Strategy of Implementation of Indonesian Rural Network", Indonesia, 1996
6. Inmarsat, "Types of telemedicine services",

http://www.inmarsat.org/inmarsat/html/topics/telemed/report/types.html

7. Inmarsat, "Technologies For Dissemination Of Telemedicine"

   http://www.inmarsat.org/inmarsat/html/topics/telemed/report/technologies.html

8. Ministry of Health Republic of Indonesia, "General Information & Health Development Policy" http://www.depkes.go.id

Return to Top View Full-screen

Making Sense of Today's U.S. Higher Education Market:

The National Trends

Sally M. Johnstone

Western Cooperative for Educational Telecommunications, U.S.A

ABSTRACT

There are over 3,700 colleges and universities in the United States. Unlike higher education in many other countries, the funding for the approximately 1,600 public institutions in the U.S. does not come from the federal government. Each of the 50 U.S. states has both regulatory and funding responsibilities for the higher education institutions within its borders. This means there are fifty different sets of regulations governing how colleges and universities may operate. It also means there is no national central purchasing system for technologies or electronic tools for higher education, and no single way to approach this market. While many states have developed central networks that may do some central purchasing decisions and frequently plan their own networks. In other words, there is no simple plan of action that can apply to doing business with every college or university in the U.S. There are, however, some trends that may help companies understand what type of products and activities will be needed by U.S. higher education are likely to need in the near future and how they might find an appropriate point of entry to the higher education market.

View Full Text

Making Sense of Today's U.S. Higher Education Market:

The National Trends

I. INTRODUCTION

There are over 3,700 colleges and universities in the United States. Unlike higher education in many other countries, the funding for the approximately 1,600 public institutions in the U.S. does not come from the federal government. Each of the 50 U.S. states has both regulatory and funding responsibilities for the higher education institutions within its borders. This means there are fifty different sets of regulations governing how colleges and universities may operate. It also means there is no national central purchasing system for technologies or electronic tools for higher education, and no single way to approach this market. While many states have developed central networks that may do some central purchasing for some or all of the institutions in its state, most institutions make their own purchasing decisions and frequently plan their own networks. In other words, there is no simple plan of action that can apply to doing business with every college or university in the U.S. There are, however, some trends that may help companies understand what type of products and activities will be needed by U.S. higher education are likely to need in the near future and how they might find an appropriate point of entry to the higher education market.

II. THE NEW LAWS

In the last half of 1998, the U. S. Congress reauthorized of the Higher Education Act. Among other things it made the cost of a computer eligible for reimbursement under federal financial aid. This is the first time the U.S. federal government has recognized that a personal computer is as much a part of any student's set of tools as his/her books. Right now, colleges and universities report that almost 45% of all courses taught use e-mail as part of the class. That is up from about 8% in 1994. In addition to e-mail use by students and their faculties, over 50% of both students and faculty use the Internet/World Wide Web on a daily basis. Now students will be able to buy their own computers with money from the largest supplier of grants and loans for higher education, the federal government.

This trend suggests that more and more colleges will get out of the business of supplying massive computer labs and shift to supplying, at most, smaller labs with only very specialized functions. In EDUCAUSE's latest book, Richard Katz predicts: "Affordable multi-media-capable computers will be commonplace, and most leading universities will assume student ownership of such devices." The handful of campuses across the U.S. that now require students to buy/lease laptop computers obviously putting more resources into networking and support as Ellen Chaffey points out in her paper elsewhere in this volume.

III. THE NEED TO MEET STUDENT EXPECTATIONS

In addition to keeping up, the demands for new tools continues to increase rapidly. There is also pressure on higher education institutions in the United States to change the ways they operate. That pressure is coming from new types of traditional students, increased numbers of non-traditional students, the higher costs of doing business without any proportional increases in governmental support, and new technology-based competitors.

New students coming to colleges or universities from the traditional age group have different expectations than students in the past. These new students have grown up in an electronic era in which banking, shopping, and entertainment are all available via a keyboard. Their elementary and high schools may have had computer networks and equipment that are more up-to-date than what they are likely to at their state's public university or college. These students have been working and learning on computer systems at school, at work, and at home that allow them to set their own learning pace, rather than following a pace that a professor sets for a large group. These new students expect high levels of service that take their individual academic needs into account. Frequently, however, this expectation does not match the reality of the practices at traditional colleges and universities in the U.S.

Not only are the traditional aged college students putting pressures on colleges and universities, there is also a dramatic increase in the need for higher education services by older students. In 1996 more than 45% of all U.S. undergraduate students were over 24 years of age. More that 27% were over 30. The number of older students already in the workforce who used higher education for "retraining" increased 21% from 1983 to 1991. These statistics suggest that older students are using higher education in greater numbers than ever.

All these new types of students are not only older, they also work while they study. In 1995-96, four out of five undergraduates reported working. About one in five of these students worked full time and also attended college or university full time. These students have demands on their time other than just attending college and know what it means to deliver high quality service from their own jobs. They expect it of their colleges and universities.

In addition, the states that fund U.S. public institutions expect them to offer services to the growing population of high school graduates. As figure 1 shows, all regions of the U.S. expect substantial increases in the number of people graduating from high school in the next ten years. This has the potential to put higher education institutions into a crisis mode.

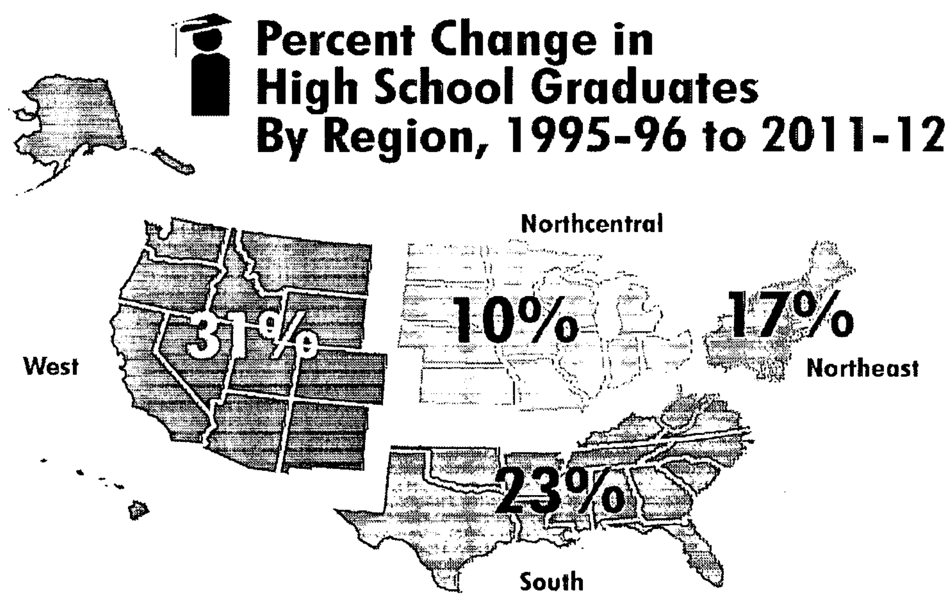


Figure 1. Increases in high school graduates expected in the next decade (WICHE, 1998).

Even though they are expected to serve more students at higher levels of quality, higher education institutions are not getting proportionate amounts of additional public funding to enable them to do so. At a time when the states are being forced to shift funding to social services outside of education, very few states can afford to build more campuses much less continue to support the current model on which most campuses operate. In the 1995-96 fiscal year, for example, the average state increase in higher education funding was 4%; in Medicaid (public health care) 6%; and in corrections (prisons) 9% . As a result students are being asked to pay a larger share of the costs for their education. In 1987, students' tuition covered 21% of the total cost his/her education. In 1996, that share had grown to 32% .

IV. THE DISTANCE LEARNING SOLUTION

One of the ways in which campuses are trying to cope with the increasing demand without matching support is to incorporate technology as a tool to expand their capabilities. Teaching students who do not go to a campus is becoming a common practice. Some are traditional-aged students, but many are older adults who are highly motivated to find the learning experiences they need. In a 1995 U.S. Department of Education survey, one-third of all U.S. institutions offered distance learning opportunities and another one-quarter said they planned to do so within three years. In a 1997 survey of about two-thirds of the U.S. states conducted by the Western Cooperative for Educational Telecommunications, 80% of the higher education institutions reported offering distance learning opportunities. As figure 2 indicates, the type of institution most likely to offer distance learning options for students was a public four-year college or university.

Half of these institutions offered learning opportunities to students in their homes and about one-quarter reached students in secondary or elementary schools. This reaching from the campus to students in their homes and in high schools is a good start as a strategy for dealing with the challenge for greater access to higher education resources without building more campuses. However, it requires colleges and universities to have up-to-date systems that can allow students to have electronic access not only for class work but also for business transactions.

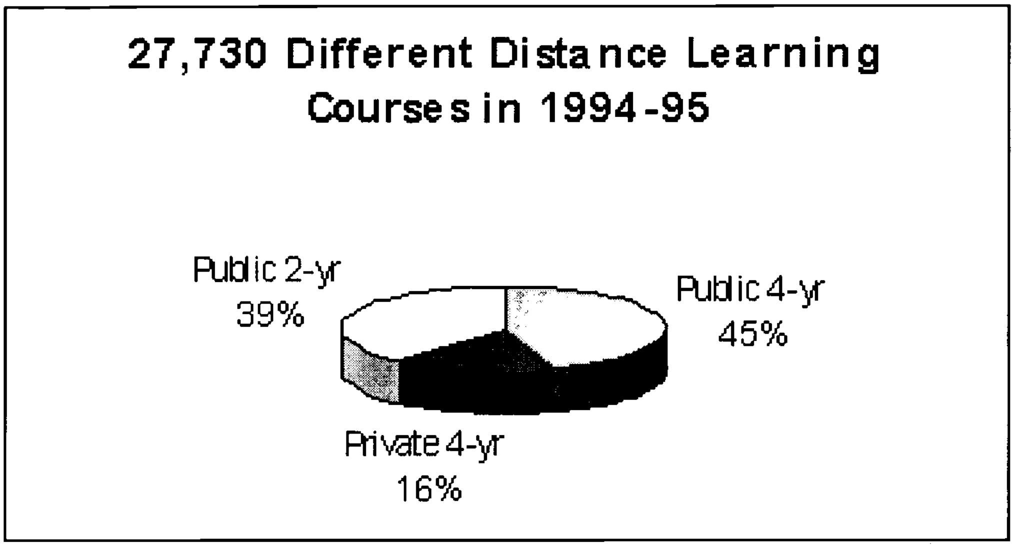


Figure 2. Distribution of types of institutions offering

distance learning in the U.S. in 1995 (U.S. Department of Education, 1997).

V. NEW MODELS AND CONSORTIA

While waiting for the traditional campus-based institutions to transform themselves into high-quality service organizations offering technology-supported instruction, students may choose from many North American alternatives. These choices include but are not restricted to:

- University of Phoenix in the USA offers undergraduate and graduate degrees in convenient community-based facilities as well as electronic opportunities to students via their desk top computer

- Open Learning Agency in British Columbia, Canada offers mediated learning opportunities to secondary and post-secondary students throughout the province and has done so for over a decade

- Magellan University in the USA is a completely electronic campus offering mostly non-credit learning opportunities in partnership with companies that create mediated training programs. They are beginning to develop their own multi-media courseware

- Instituto Technologico y de Estudios Superiores de Monterrey in Mexico offers electronic learning opportunities to over 40 locations in Mexico and to additional sites throughout Latin America. They offer a variety of degrees at these locations

- California Virtual University combines the distance learning resources of potentially over two dozen universities in California for students within and beyond California

- Jones International University is a project of Jones Cable, Inc in the U. S. to provide graduate degrees in business and communications globally primarily via the worldwide web

- National Technological University is 12 years old and offers graduate degrees and training for thousands of engineers throughout the world using video and computer networks

- The Colorado Electronic Community College offers students web-based two-year college degrees anywhere in the world using a consortium of colleges in Colorado

- Western Governors University with 18 member states throughout the U.S. and agreements with institutions in at least five countries began registering students in July 1998. It is designed to offer full one-stop electronic shopping for students regardless of location.

- Open University of the UK became licensed in the U.S. in May of 1998. It is seeking accreditation in the U.S. and already has partnerships with two major U.S. universities.

- At least five more states are actively discussing forming their own versions of virtual universities to serve their internal state needs.

This world of electronic learning is becoming a very competitive marketplace in both the U.S. and in Europe. It is reported to be a $300 billion industry in the U.S. and investment advisers call it a growing market . This market includes not only equipment and telecommunications technologies, but also academic and service products.

VI. QUALITY CONTROL ISSUES

As institutions begin to serve these new, electronically savvy students who do not go to a campus but who do expect the same consumer-oriented approach to services that they get from the banking community and others, it is important to define what constitutes quality service from higher education institutions. In 1996, the Western Cooperative for Educational Telecommunications developed a set of Principles of Good Practice for Electronically Delivered Degree and Certificate Programs (see figure 3). These principles are widely accepted by U.S. and international accrediting organizations that certify the integrity of colleges and universities. They are intended as a guide to policy makers assessing distance learning institutions and are used by institutions in designing their own programs. Each of the several categories have implications for potential providers of products and services. Since the biggest and most public aspect of all of this is the quality of services directly to students, I would like to focus on those referring to institutional obligations to students. A very general summary of these include the following institutional responsibilities:

- Provide honest and timely information to the public about the program. This means that the institution should actually do what it says it will do.

- Students must have adequate skills to begin the program. The student should be told clearly what academic and technical skills he/she should have in order to successfully complete a program.

- Students must have access to needed support. If a student needs access to specialized library resources to be successful in a program of study, it is the institution's responsibility to ensure a means to that access.

- Students must have access to information from the institution and to communication with critical people within the institution including faculty and other students.

All these services taken together reflect how an institution is expected to support its students who do not come to the campus. Several of these items are stated in terms of what the campus must tell its students. They do not require the campus to find where or from whom those services could be available for a particular student. It is anticipated that private industry will recognize these potential markets.

VII. SERVICES MARKET

As part of a project to help institutions increase the quality of service to students studying electronically, the Western Cooperative for Educational Telecommunications conducted a survey in Spring 1997 to ascertain which institutions are doing things well. The results were surprising. Of the 1,000 institutions surveyed, no institutions were found that provided all student services well. In fact:

- 31% provide no special library or bookstore services;
- 55% offer no special training on electronic access to research materials;
- 65% offer students no tools to assess their technological skills necessary for the program; and
- 34% use teaching faculty to provide technical support for students.

These are just a few of the areas that offer potential business opportunities. Some of these are already developing. There are several on-line book venders, but very few widely available, high quality training opportunities for students needing help with electronic access to research materials, for example.

VIII. INFORMED CONSUMERS

In recognizing the inconsistency in services (both support and academic) to students available electronically, the Western Cooperative for Educational Telecommunications began developing materials that would assist students to become *informed consumers*. Informed consumers are in a much better position to find the appropriate academic program and also to recognize what other products and services they may need to be successful. There are few sources for objective information about electronic teaching/learning programs, so it becomes critical for students to have the knowledge and skills they need to ask the right questions of any potential provider of electronic teaching/learning. Students also need to know where they can turn for help with the many challenges they will face as they enter into this new world of learning. Our first approach to this took the form of a brochure that is available on the web. However, to be effective, we realized we needed to reach people who were not necessarily web surfers. A major international publisher agreed to work with us to develop *The Distance Learner's Guide,* which is a comprehensive but easy to read book designed to help students make good decisions about virtual programs. It is intended to not only assist students, but also the institutions that are planning to serve distance learners, and those in private industry wishing to venture into this market.

IX. WHERE MAY THINGS BE GOING ?

With all these pressures on higher education and the emergence of new types of institutions, the question arises regarding what may evolve. We know there are new types of students demanding higher education services. In order to serve these growing numbers of students, new types of providers of higher education are emerging. Not only is there a growing group of electronic providers, new types of organizations are developing that specialize in offering parts of the instructional/educational package. These new providers basically offer services that have the effect of unbundling the comprehensive services traditionally offered by faculty and the degree-granting college or university. These new organizations may offer only testing services, only instructional delivery services, or only a location where a student might have access to technologies needed for communication with a more comprehensive educational institution. At this point in time, the most obvious activities and services that we see unbundling include:

- Instructional activities split from students' support services
- Courses separated into learning modules
- Instruction split into its various components: curriculum planning, courseware development, delivery of information, tutoring students, and assessment.

Dennis Jones, President of the National Center for Higher Education Management, and I co-chair a working group which has been charged with developing a view of the future of higher education for the U.S. National Postsecondary Education Council. We propose that providers will begin to specialize in specific higher education functions. Figure 4 is a graphic representation of what may well be the organizational future for most of higher education. The providers will be new institutions that will use multiple resources to accomplish the individual tasks that are currently bundled together in colleges and universities. We already see provider organizations specializing in the development of content, information delivery, student services and assessment. We anticipate that new industries are likely to develop around the other functions as well.

This could mean that a college or university might develop into the entity that grants a degree or credential but which may not develop its own coursework. The university faculty may design the curriculum for a specific subject area, but different companies that employ teams of academic specialists, instructional designers, and technologists would develop the actual coursework. These would be delivered by an independent telecommunications provider to community locations that contract with other companies to hire and train local or virtual tutors for students. Companies that offer these electronically to the local community site could deliver non-academic support services (for example, library services, bookstores, personal or job counseling). There may be a separate management company that handles all the financial transactions and a company that devotes itself only to testing and assessment. The net result is the complete unbundling of colleges' and universities' traditional functions.

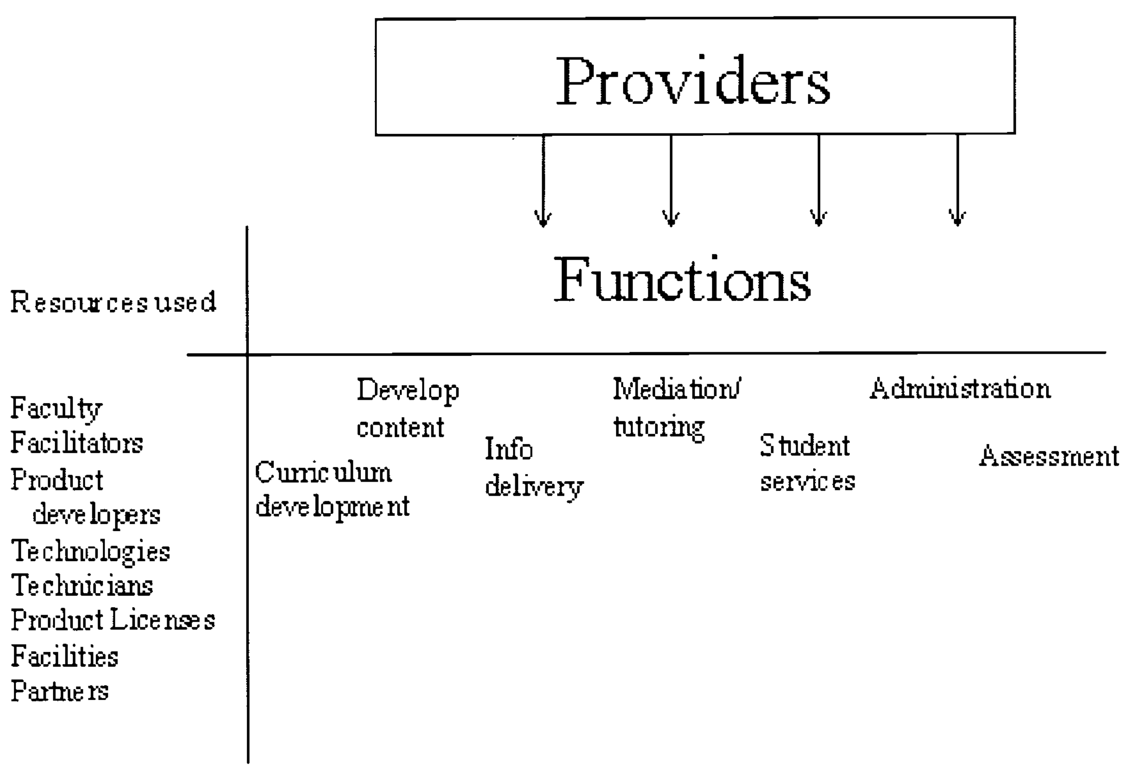


Figure 4. The potential activities new higher education providers could offer and the range of resources they might use.

X. SUMMARY

In summary, the public and new technological capabilities are putting pressures on higher education to do things differently. Both on-campus and off-campus students are likely to be investing in their own equipment and contracting with outside vendors for telecommunications services. There is already an explosion of new organizations filling some of the functions that have been accomplished by college and university campus personnel as the traditional campus services unbundle. These new organizations are designed to accomplish very specific tasks and consequently are probably able to perform them better and cheaper than a traditional campus that was designed for more comprehensive services for a finite number of students who are physically present on a campus. While universities and colleges will most likely retain the guardianship of the core academic disciplines, the way that is accomplished seems likely to change in the coming years. The opportunities for private industry to work with colleges and universities to develop complimentary, profitable services seem enormous.

Return to Top View Full-screen

Impact of Licensing Delays

Ellen Chaffee

President

Mayville and Valley City State Universities

Abstract:

Not available

View Full-text

Learning with Laptops

Click here to start

Making Sense of Today's Higher Education Market:

The State Perspective

STEVEN SMITH

Chief Information Officer, University of Alaska System, US

Abstract:

Not available

View Full-text

Making Sense of Today's Higher Education Market:

The State Perspective

Background

State higher education works in a monopolistic marketplace. The entire basis of the land grant system is predicated on the idea that those institutions exist to meet the higher education needs of a well-defined geographic area marked by state boundaries. Within states the territory is further marked up so specific institutions serve regions of the state. The University of Colorado. The University of Northern Colorado. The University of Southern Colorado. University of Colorado, Colorado Springs. University of Colorado, Denver. Finally, within a locality, the higher education territory is divided between types of institutions: community colleges, four-year undergraduate schools, and graduate degree offering institutions. A nice schema called the Carnegie Classification allows each school to fit into a specific niche, Associate of Arts College, Baccalaureate I College, Baccalaureate II College, Teacher's College, Doctorate Granting I University, Doctorate Granting II University, and so on. The accrediting commissions around the country have a concise set of criteria to evaluate this hierarchy of higher education so everyone knows who they are and whom they serve.

It is a well-defined world. Marketplaces with clear boundaries and friendly competition. There may be private institutions of higher education down the street, but it's a collegial competitiveness. State legislatures know how to fund this higher education world. There may be squabbles between institutions in the state for larger pieces of the public monies, but at least the legislature knows the money appropriated is going into schools in that state for the residents of that state. The institutions are a matter of pride for the state.

Wake up call. Utopia, if it ever existed for a few brief years, is over. The state-funded monopolies of higher education are dead. The bucolic scene of friendly State College and State U serving the happy, captive populace of - pick the state of your choice – has changed to a revved up scene of noise and confusion as the turf is invaded by upstarts offering courses, certificates, degrees, whatever the student wants.

Therein lies the crux of this dramatic change of scene of higher education in the states. The scene has changed, as abruptly as a cut from night to day in a film, from a market led and organized around geography bound institutions run by the faculty to a kaleidoscopic land where the customer – the student – dictates the market and defines the need. Smart entrepreneurs like the people behind Phoenix University move in and capture niche markets.

A generation ago Susie and Tommy went off to a state funded local college and stood in long lines for hours to register and trudged through a curriculum that took about four years to get a bachelor's degree. The student went to the ivory tower. Today the tower comes to the student, and instead of ivory, it asks the student what color he prefers.

Oh, the traditionalists chuckle, this is another blip on the radar of higher education that appears from time to time and we call it distance education. Or distributed education. Or asynchronous education. Or the virtual university. Or correspondence study. Nothing new, you say. Been around for years and with institutional blessings. Like the National Technological University. Organizations like the Western Interstate Commission for Higher Education have been promoting exchanges between state institutions of higher education for years.

Take another look. This time it is different. This is not just the old "education at a distance" dressed up in new clothes. It is a distinctly different animal for several converging reasons.

- Technology
- New players in the education market
- Changing demographics and market segmentation of the higher education customer
- Changing funding patterns

Technology

For the first time we are close to technology that is as invisible and as reliable and as easy to use as the electricity that lights the old lecture halls. We have a common transport. It is the Internet. Internet2 or the Next Generation Internet is resolving some of the standing problems like quality of service and video and voice over the network that have bedeviled the first iteration of Internet. In many ways the Internet is still a very crude beast, but by Internet4 or so, it ought to be a pretty standard, robust and transparent service. That's happening as we speak.

We have a common vehicle for transport. It is the World Wide Web. Again, in an early developmental stage. By the time my 6 year old, who uses the web now, is 16, the web will be so standard, so universal, that it will be as common and as boring as paper and pen have been for several centuries.

What has been lacking is the stuff to fill up those vehicles as they move across that transport. That is the content in the web on the Internet and in terms of this discussion, the curriculum and the applications. People are working on this with tremendous energy. It is still a vast world of early adopters and dead ends. But this too, is quickly maturing. Educators are finding news ways of packaging content and interacting with students both synchronously and asynchronously.

The most significant changes made possible by technology are not only the new ways it allows the curriculum to be delivered, but also the new ways it allows the back room business of education to be conducted. Gone are the days when students need stand in line for half a day to register. They can do it over the phone or over the computer. Rather than searching through four or five catalogs to find equivalent courses, the technology makes it possible for the student to enter a query on the type of course he wants to take and the information comes to him in seconds listing possible courses from several campuses. It is possible to have a virtual university, not only with curriculum but also with the administrative ease that formerly presented insurmountable barriers.

It is possible for these barriers to cease if the institutions have the fortitude to allow the technology to make life simple for students. Therein lies a problem. States have been working in the feudal system outlined above, where every institution has a niche and never shall the niches overlap. In many states the offerings of State U and the U of State are still treated as separate entities. Separate courses, separate degrees, and separate students. What sharing is in place is the exception, not the rule. Lip service is given to all working together ala one for all and all for one, but old habits die hard.

Let me give you an example from my own back yard. Our university system in Alaska has 14 campuses, each reporting to one of three major academic units. We have one administrative system for all campuses, including a student information system. Students at any campus can take some courses offered at a distance.

Last summer I visited with the woman responsible for registration at one of our smaller campuses. She was pulling her hair out. There was a course being offered at a sister campus which students on her campus were taking. Now technically, and I know this is the case because I am responsible for the system, once basic student information is entered in the system, there is no need to enter it again. The reason for the hair pulling registration worker is that, regardless of the fact that students had already filled out registration materials and were in the system, the sister campus insisted on a separate paper registration for this course. The basic information on the form was exactly the same as the information the student had already filled out. To save the students work, frustration and confusion, the stalwart staff was doing the double manual registration. The whole process was slow, cumbersome and totally unnecessary.

New Players in the Education Market

While universities like mine work through the process of cultural change to reinvent themselves with the options offered by technology, new players are moving into the education market and giving the customer what he wants. Course offerings in higher education now cross the moat of state boundaries with the speed of gigabit networks. This kind of thing went on in the past, but only nibbled at the edges of the state higher education monopolies. Now, it is starting to consume the market in great gulps and it has a giant appetite.

The offerings are coming from many sectors. There are the traditional educational players who have offered distance delivery courses and programs for years. These are the schools offering education that has passed the hurdle of accreditation and compete head-on with traditional campus offerings. That club is growing as many large and well established universities enter the market of courses offered at a distance. Name branding will increasingly rear its head.

Others are getting into the market without worrying about the traditional accreditation path. An example is ZDUNet, operated online by Ziff-Davis. For a modest sum, an Internet connection and a web browser, subscribers may take any number of courses that start on a monthly basis. Most of these courses deal with information technology now, but other offerings from other non-traditional providers are showing up as fast as a web site can be loaded.

At the same time large publishing firms and other heretofore subsidiary players to the direct education field are getting into the act. A Harcourt-Brace subsidiary NETg, provides a full line of self contained IT courses. Many of these provide preparation for several of the industry certification programs from Microsoft or Oracle, for example.

Credit and degree by certification, led by new educational models like the Western Governor's University are providing alternative methods to course and program completion. This is changing the funding model for higher education, which I will address later.

The newest player in the field is coming from entertainment and partnerships in education and marketing. Edutainment, as this market is called, has been around ever since Sesame Street hit the airwaves, but once again, the technologies available are making it an enviable opportunity for the Disneys of the world to take an active interest.

The education market is exploding. It is no longer the bucolic, regulated place I described at the beginning of this paper. It is a market in free fall.

Changing Demographics and Market Segmentation

Lifelong learning is no longer a new buzzword. It is the word. There is still the 18-to-22 year old market. But the traditional life model, youth-student-career-family-retirement, has student time peppered throughout it. Retraining is constantly needed. For new jobs. For changing jobs. For changing lifestyles. People are in degree programs, certificate programs, continuing education programs, and no program at all, but just taking a course here and there. This lifelong learner may be a professional traveling and not much interested in fighting the traffic and the parking and the crowds to take a course. If the state college or university or community college down the street doesn't accommodate this professional student, there are plenty who will.

This change has less to do with technology, than with better marketing by some of the new players. The University of Phoenix offers many of its courses in traditional classroom format. They carefully examined the market, saw an opening for busy professionals with a need to get in and out quickly and they worked to meet that need. The University of Phoenix facilities are often in convenient locations for their market, near off ramps of major interstates. This movement is akin to the transformation in cinemas in the United States. In the first half of this century there were large movie palaces in central locations. Those have been all but replaced by the Mall multiplex theatres, which are distributed and closer to their markets.

These demographics for higher education have been changing overt the past couple decades. Again, as the technology has made it easier to continue your learning, it also speeds up this changing education market place.

For example, I went to undergraduate school at the University of Iowa. I took astronomy from James Van Allen of Van Allen Radiation Belts fame. At that time the only people who had the advantage of taking a course from the esteemed astronomer were those, like myself, physically attending the University of Iowa. With today's technological options, you could package the Van Allen content and deliver it anywhere in the world. It could be used for the standard undergraduate fare such as I took, or it could be used as part of a course offered for astronomy lovers with no interest in a degree.

Geography no longer restricts where one can get an educational experience. Yes, the Van Allen content was available through his writings and the books of others in a traditional print medium. Now, an entire interactive course built around his content can be delivered instantly to multiple, layered markets.

In the old paradigm, because I attended the University of Iowa I had the advantage of taking astronomy from Van Allen. And so it went, every land grant university had its academic super stars. Under the old model, unless I transferred every semester (in which case I'd still be in school today, transfer credit policy being what it is), I couldn't benefit from all of these distributed scholars. Now, it is entirely possible for me as student to stay in one place and, through technology, take astronomy from Van Allen, physics from a leading mind in that field, and so on.

Keep in mind when I took astronomy from Van Allen I was one of the teeming masses in a lecture of 700 or so. My interaction with instructors in the class was with graduate teaching assistants. Is this substantively different than my receiving the Van Allen content in some mediated way with a local face-to-face facilitator? Well, yes, the mediated , distributed course is probably richer and offers more options than the old lecture hall variety I took.

As the demographics have changed, so the market for higher education has segmented. Lifelong learning has opened up many new levels. There is the standard 18 to 22 year old, rite of passage student. There is the older undergraduate coming back to school after child rearing or after the factory has closed who may be working during the day. There is the person looking to get in and out with a focused certificate program. There is the working person who wants to turn experience into recognized credits; the professional who is returning to be retrained or re-certified. There is the growing market of retired people who take a variety of courses. I haven't even touched the differentiation in graduate education.

Technology allows us to better identify these multiple markets and to meet their educational needs and not lose your shirt in the process. What may be a limited student population locally can be expanded into a large student base across the state, across the region, across the country, across the world. Similarly, if you have a thin student market for a particular course, you don't have to be stuck with one of two unattractive options. First, to go to great expense to build a course, perhaps even a program to fill a limited demand or, second, to simply not offer the course, turning students away. You can import the course from somewhere else, provide a local contact, facilitator or faculty member as needed, capture the student dollars and expand your own offerings at a fraction of the cost.

Changing Funding Patterns

The changing education market is challenging the way states fund their institutions of higher learning. Here there are more questions than answers, though some new models of funding are emerging.

First, technology has traditionally been funded on the margins and not as a key part of the infrastructure. Hardware and software are often acquired through one-time only capital purchases when they are really an ongoing operational expense.

Second, it costs money, primarily personnel dollars for faculty and their technology cohorts to develop the content that can be delivered in multiple ways. All too often faculty has no incentive for working and distributing with the new tools. Is development and distribution of an interactive CD-ROM any less significant than authoring a textbook?

If states can break down the old geographical barriers so all institutions in a state can serve all students, then the finding formulas based on enrollment no longer work. Who counts, for enrollment dollar funding, the student attending State U but taking a course from Northeast State U and Southeast State U, not to mention WGU. And the mix changes every semester. You can try and keep track of this dynamic and parse the money out appropriately about as easily as you can count the number of angles on the head of a pin. Or you can try a new way of funding.

As courses are increasingly offered without boundaries both within a state and across states, the differential tuition and fees charged to students creates another unnecessary complexity. As more and more the students choose a smorgasbord of courses, paying a host of different fees will be unpopular, unwieldy, and ultimately defeating. We may see the emergence of education brokers coming in who act as value added resellers for students, combining course and degree offerings from many sources and offering them under simple fee structures. There may be different fees for different tracks, say Engineering and English degree programs, but within those programs, the fees would remain the same.

The old state funding for state education presents problems. Is it more cost efficient to create an entire new program to meet the need of a small number of students within a state, or less expensive to import that program, or larger portions of it from sources external to the state. How then does the state legislature appropriate funds for this program? Politicians like to fund bricks and mortar and point to the support they give to old State U. It is a much tougher sale to get funding for an education program where a significant part of the money may flow to providers outside the state. Which brings us to the critical question for state funding. Are we funding to meet the educational needs of our citizens or funding to maintain an outdated status quo of education?

The Western Interstate Commission for Higher Education has been instrumental in working with its member institutions to focus on the changing scene of funding for higher education and information technologies. Dewayne Matthews has done a seminal paper on this issue titled, "Transforming Higher Education Through Information Technology: Implications for State Higher Education Finance Policy."

Emerging Models

There are some hopeful models emerging to meet the changing markets and funding patterns. Several states are dropping the traditional boundaries between public institutions. Students can take courses from any state higher education institution without jumping through a dozen hoops. Cooperation is encouraged in the funding models, so those schools and faculties and administrations that collaborate are rewarded with funds. Courses are taught locally, at a distance and combined with offerings from other educational providers if the state schools can't provide the necessary course.

In Oklahoma they have erased all distinctions between state higher education institutions. All of them cooperate to provide for the educational needs of the people of Oklahoma. Learning Centers have been turned into Responsibility Centers – responsible for the educational needs of the locality. The emphasis is not on mounting new academic programs or investing in new fixed human and physical assets, but finding the existing programs and infrastructures, which meet student needs.

In Kentucky, they have created the Commonwealth Virtual University to coordinate all distance taught courses throughout the state. They have done away with enrollment driven formula funding and have created new funding mechanisms, which encourage collaboration and cooperation and promote buy in from the campuses with matching requirements.

Of course, the Western Governor's University is pushing the boundaries of education across state boundaries; of education by competency; of education by centralized policy but distributed operations. At every gathering of my state colleagues from around the west, and now even nationally, there is the inevitable question, "how is your school participating in WGU?" It is really immaterial now whether WGU succeeds or fails financially for it has already changed the way we look at education.

Directions

State higher education has operated for little more than a century on a model grounded in geography and based on a model transferred from the prevailing halls of academe which included an ordered, faculty-driven, monopolistic model which kept clear separations between too much overlap. That model is no longer applicable. Education, largely driven by possibilities opened with technology, has become an open market with competitors bouncing in from every direction.

The seeds for this winter of our discontent in the state trenches of college education have been germinating for some time. All of the elements have been there. Now the means are there to make this a mass-market reality.

The state institutions can hide their heads, lobby with the state legislatures to continue to fund in the same old ways the same old dinosaurs of our youth. If public institutions within a state continue to draw up lines of demarcation defining turf and keep student's relationships with the school in the same modes with a little window dressing, the future is indeed bleak for these revered institutions. The newcomers to the market place will let the old titans battle it out, all the while grabbing bits and pieces of student share until there is little left for the state schools to fight over.

On the other hand, progressive models such as those in Oklahoma and Kentucky can turn our venerable state systems of higher education into centers of responsibility for meeting the needs of the state's population.

Return to Top View Full-screen

Broadening Information Access by Desigining a Network Security Infrastructure

Roy Ng and **Alain Bissonnette**

CGI Information Systems and Management Consultants Inc., Canada

ABSTRACT

With the exponential growth of Internet, the increase deployment of Electronic Commerce and the demand to broaden the access to information, network manager faces the dilemma of access and control. This paper describes and argues that access to information can be broadened with a well-designed security infrastructure. From the experience in implementing large scale security infrastructure in business and finance communities, both at government ministerial level and private organizations, CGI Group has successful implementations where proper control on infrastructure will in fact results to a broadening access to information.

View Full Text

BROADENING INFORMATION ACCESS BY DESIGNING

A NETWORK SECURITY INFRASTRUCTURE

1.0 Abstract

With the exponential growth of Internet, the increase deployment of Electronic Commerce and the demand to broaden the access to information, network manager faces the dilemma of access and control. This paper describes and argues that access to information can be broadened with a well-designed security infrastructure. From the experience in implementing large scale security infrastructure in business and finance communities, both at government ministerial level and private organizations, CGI Group has successful implementations where proper control on infrastructure will in fact results to a broadening access to information.

2.0 Introduction

Based on recent survey done by Network Wizards, hosts connected to Internet have been increased from 29,670,000 to 36.739,000 on the first seven months of 1998. (Diagram 1). In addition, the increase of Electronic Commerce, Intranets and the wide spread use of Internet e-mails have placed strong demand of accessing to a company's information.

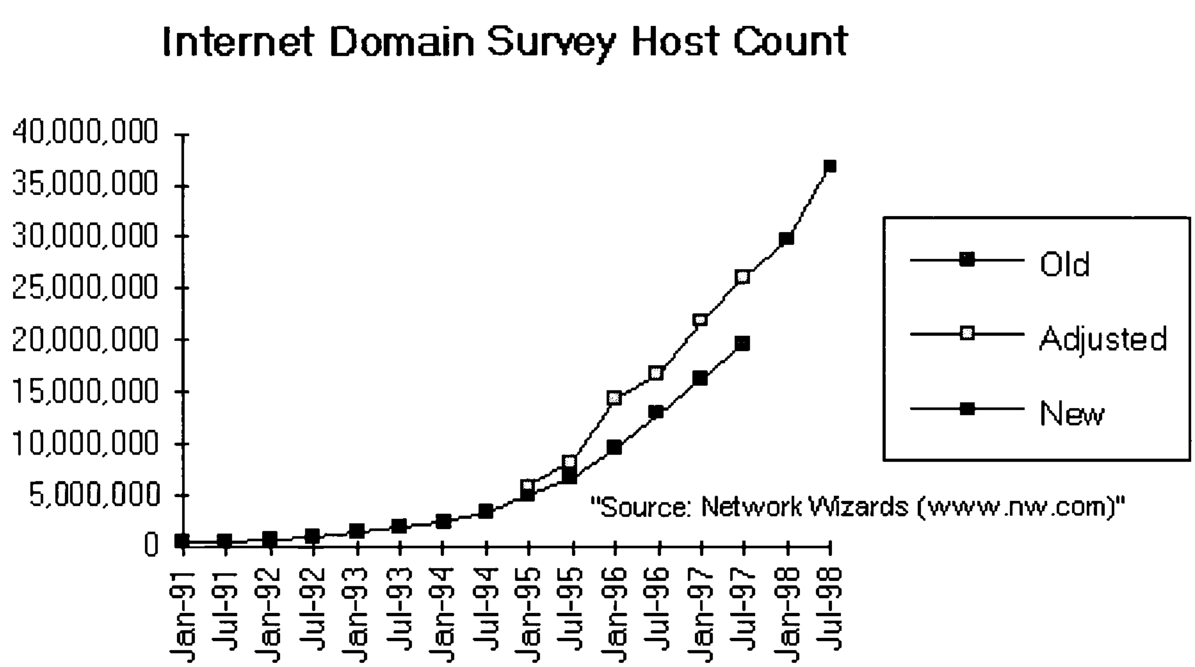


Diagram 1: Source: Network Wizard (www.nw.com)

Network manager faces the dilemma to control the access to information and at the same time allowing the effective operations of the company by proving proper access.

If network access is too loose, it invites frauds. Hackers may intrude the company's information and may result to company loss. If control of access to the network is too tight, business process cannot be carried out effectively, efficiently and competitively.

Network managers need to manage the difficult task of balancing the access and control to the information carried in their networks. Network Security imposes control. Control does not necessary result to the limitation of access to information. A well design network can achieve the appropriate control without the lost of effective access to information.

3.0 Architectural Approach to Data Security

There are many ways to install security measures against loss of company information. Popular ones include the setting up of Firewalls, encryption devices, and software access controls with passwords and privileges administration. Many standards organizations also set clear standards in computer security. These include American National Standards Institute (ANSI)/Institute of Electrical and Electronic Engineers (IEEE IEEE, Federal Information processing Standards (FIPS) and International Standards Organizations (ISO)

One of the many architectural approaches would be to consider the use of security services in Open System Interconnection (OSI). ISO has defined an architectural model for networking in ISO 7498. (Davies, D 1992, Held 1992). Security services can be broadly classified into five groups: (1) confidentiality, (2) authentication, (3) integrity, (4) non-repudiation and (5) access control.

	Layer of OSI					
	Physical	Data Link	Network	Transport	Present-ation	Applicat-ions

Confidentialy:Connections	Y	Y	Y	Y	Y	Y
Connectionless		Y	Y	Y	Y	Y
Selective field					Y	Y
Traffic flow confidentiality	Y		Y			Y
Authentication			Y	Y		Y
Integrity: Without recovery			Y	Y		Y
With recovery				Y		Y
Selective field						Y
Non-repudiation				Y		Y
Access Control			Y	Y		Y

Table 1: (Source: Davies D, P.101)

In the many cases that CGI has practiced, the authors felt that in addition to the practices of data and network security using the OSI models, a prudent security infrastructure will include review and incorporation of existing workgroups recommendations and methodology from various task forces such as IEEE and ITEF. Intenet Engineering Task Force (ITEF). For examples, in the area of security ITEF have specific working groups, focusing on IP Security Protocol (with RFC 1825, 1998), Secure Shells, Transport Layer Security and Web Transaction Security. http://www.ietf.cnri.reston.va.us/html.charters/wg-dir.html#Security_Area).

4.0 Security Threats and Risk

There are many security threats and risk when information is being accessed in a computer network. Threats can generally categorized into Physical and Logical threats. Physical threats include fire, water, power loss, and thefts. Logical threats include frauds, system intrusions and system errors. Physical risk are normally much easier to plan for with scenarios and impacts of occurrence can be studied relatively easily. Two major threats remain a challenge to defend. They are system intrusion and frauds. These two threats are, in many cases, a deliberate sabotage by human intruder. Such occurrence can easily disguised itself as random and it changes in form and access methods

More often, intruders stepped up with new and better intrusive technology when a target company upgrades its security measure. In responds to defending such a dynamically changing system intrusion, many network managers are hiring professional hackers to test their network security periodically. Vulnerable areas are then identified and risk measures can then be devised to secure the loopholes. Reviewing threats and identification of vulnerability and risk assessment can then be quantified. Benlow (1993) has suggested a risk assessment method by using Risk Maturity Index. Risk Maturity Index is the multiplication results of threats, probability of occurrence and impact. (Ng, 1994). National Security Institute has released an article (NCI, 95) describing the top 10 security threats identified by MCI.

5.0 Security architectures

Network and Information Security is an issue that are well recognized by many companies. However, since funding to security project is viewed as activities in cost centre rather than a cost in revenue centre, spending and subsequently, planning for security measure tends to be an ad-hoc basis. The first step in creating a successful security-architecture is to have commitment from senior management for funding and supports to such infrastructure.

What a security-architecture should looks like? Security architecture consists of the followings: (1) Security Policy (2) Organization (3) Business needs both on data integrity and ease of access. (4) Integration with existing network architecture and (5) Company culture and human factors.

5.1 Security Policy

Security Policy refers to the set of defined policy statements, within an organiazation, that describe the "who" and "what" in the access, use and change of company information. Very often, detail set of procedures both architectural and operational will then be further derived. Employees on the factory floor with production line responsibilities can access manufacturing database, but not engineering database. They may not be allowed for any Internet connection.

5.2 Organisation

It is imperative that the responsibility and authority to administer computer security policy within a company be given out appropriately without conflict of interest. In some organiaations, security manager reports to an operations director. Such an organisational structure depicts a conflict of interest. When a production schedule needs to be met in a rush, the operations director may have the needs (motive) and access (authority) to compromise the established security measures. Similar to Human Resources Department, computer security department within an organization should be independent to other departments and be directly reported to the Chief Information Officer or to the President depending on the size of the organization. A security manager who reports to VP, Finance, VP Manufacturing, VP Engineering could be compromising his /her ability to stay independent.

5.3 Business needs in data integrity and ease of access

With the global trends of competition, many companies survived due to a streamline of operations to enhance its efficiency, effectiveness and competitiveness. Business operations cannot tolerate slow respond and tedious procedures to process company information. At the same time, the data security of information must be guard against competitors, industrial espionage and hackers' sabotage.

By understanding the needs of the business and set appropriate policy, a network security manager can play a pro-active role. Process and procedures can be established to address groups of employee that has the specific needs when performing their company duties and functions. For example, instead of refusing any employee's remote access, the network security manager should deploy authentication tools to allow proper access. Current technology includes credit-card size remote authentication devices that dynamically change its security signature every forty-five seconds. With an authentication server located right behind the remote access equipment, users can be authenticated before allow access. Enterprise wide version of such technology is also available for user access. The main component in broadening security access is to review the business requirement, shift the paradigms from control of access to authentication of access. Network security manager should shift from a resource provider perspective to a service provider prospective while upholding the security policies and measures.

5.4 Integration with existing network architecture

The adding of security devices and associated security applications in many organizations have been planned separately from the main network design. With the approach of using OSI model to establish comprehensive security architecture for an organization, it is essential that the security architecture be integrated into the respective network and applications architecture in each OSI layer. In our experience, model provides a methodology and approach towards the integration of security architecture to the existing network architecture. Moreover, one needs to take into consideration the requirement of the organization and customize the extent of integration. Security systems and architecture should be independent of existing architecture to ensure operational collusively while taking the advantages of build in security features on individual system within the architecture.

5.5 Company culture and human factors.

Human make policies and rules for observation by human. Regardless of the best intention in establishing the security policies and rules, they require proper implementation and enforcement. Rules in security impose more time and effort by the users to access the information. Unless a user understands and agrees to the importance of security, bypassing or compromising the security by users to gain convenience, faster access and easier work flow may occurs. The culture of the company in enhancing the security compliance and education becomes important to assist the employee in understanding the importance of computer security. Therefore, part of the security architecture must include a review of company culture and human factor to determine which type of security technology should be included.

6.0 Security technology and Internet

In Internet communications, due to the fact that access of information can be from multiple locations, multiple paths and multiple sessions, three forms of security become important. They are (1) unauthorized released of information, (2) unauthorized modification of information, and (3) unauthorized denial of information. There are many security technologies developed. It varies from simple checksum check to sophisticated encryption and digital signature. In the Internet environment, Secure Socket Layer (SSL), Secure Encryption Transaction (SET) and Secure HyperText Transfer Protocol (SHTTP) are being used to ensure transmission security. Software implementation of security can also employ the use of Public and Private Key and signature. Hardware implementation of security uses encryption boxes that are placed at the sender and receiver locations. "Hardware implementation of products permits more confident binding between the encryption and the key management, limiting the risk that the encryption can be easily stripped from the key management and used independently of key recovery" (McConnell B. Appel E. 1996). In the Intranet implementation, From a network perspective, many Virtual Private Network (VPN) are being implemented.

The technology management division of CGI Information Systems and Management Consultant Inc. provides secure network transportation of financial transactions for many Credit Unions across Canada. Sophisticated Virtual Private Network, Digital Encryption System and a network monitoring infrastructure that not only enables security transactions but also allow multiple access from multiple locations.

7. **Conclusion**

It is important that a security-architecture be integrated with the main network design. The components of a security architecture must include an assessment of threats and risk; the enactment of security policies and procedures. Special review must be made to ensure those proper organizational roles and responsibilities are defined so that there is no conflict of interest to those who are the enforcer and the users to the computer security.

The main component in broadening security access is to review the business requirement, shift the paradigms from control of access to authentication of access. Network security manager should shift from a resource provider perspective to a client service prospective while upholding the security policies and measures.

A wide range of security protocols, hardware equipment is available for security implementation. An in-depth analysis of business requirement can result to a proper design of security architecture. The implementation of such architecture could actually broaden the information access instead of imposing restriction of information. Certainly, the access of sensitive information must only be given to those who are authorized.

Reference:

Benlow, G. (1993) Risk Assessment Methodology Victoria Australia

Davis, D. (1992), Security For Computer Networks John Wiley & Sons

Held, G. (1992) Network Management John Wiley & Sons

McConnell B. Appel E. (1996) Draft Paper "Enabling Privacy, Commence, Security and Public Safety in the Global Information Infrastructure" Interagency Working Group on Cryptography Policy.

Ng, R. (1994) "The Importance of Computer Security to Developing Economies in the Asia Pacific Region" PTC Conference 94.

NSI, (1995) "How to Hacker-Proof Your Computer Systems" http://nsi.org/Library/Compsec/hackproof.html

Return to Top   View Full-screen

Universal Service Funding Mechanism

Compatible to Competition and Convergence

- Universal Service Cost embedded in Interconnection Charges -

Myungya Yang, Dongwong Lee, Whajoon Cho

Korea Telecom, Republic of Korea

ABSTRACT

This paper will discuss the current universal service system of Korea and the measurement of universal service cost and funding mechanism. Firstly, the history and current issues of universal service system of Korea will be discussed. Secondly, the size of universal service fund size will be estimated. Finally, desirable universal service system will be recommended, and the possible impacts on the interconnection charges and competition will be explored.

View Full Text

Universal Service Funding Mechanism

Compatible to Competition and Convergence

- Universal Service Cost embedded in Interconnection Charges -

Introduction

Universal service funding mechanism arises as a major issue of telecommunications policy worldwide. Universal service costs compensated by interconnection charges bring economic distortion as competition and convergence in telecommunications services develop. In the past, when telecommunications services were simple and the number of telecommunications operators was limited, in general, an interconnection buyer and a universal service contributor were the same entity. Increase in interconnection traffic meant increase in corporate revenue. However, interconnection traffic no longer confirms the carriers who to contribute to universal services nor represents carriers' revenue generating power as the newly introduced services were normally exempted from paying interconnection charges due to various reasons, and as differences in values added between services become considerable.

Carriers started to resist paying interconnection charges inflated by universal service cost. They were dissatisfied with the fact that they were the only universal service cost payer although their profits were decreased by competitive operators, such as resellers. Policy makers worldwide have a different point of view from very conservative to radical. In principle, they declare that universal service should be separated from interconnection charges. In a transitional period, however, they allow the obliged operator to collect universal service costs through interconnection charges. They also provide schedules for changes in their policy to telecommunications operators and consumers so that they can prepare for the changes. By the way, Korean government is taking a bit radical still learning efficient regulating method from trials and errors. Korean government revised the established policy without determining the size of subsidy and defining services they are what will be included in future regulation.

This paper will discuss the current universal service system of Korea and the measurement of universal service cost and funding mechanism. Firstly, the history and current issues of universal service system of Korea will be discussed. Secondly, the size of universal service fund size will be estimated. Finally, desirable universal service system will be recommended, and the possible impacts on the interconnection charges and competition will be explored.

History

In Korea, universal service system has not been separated from the interconnection regime. Korea Telecom (KT), which is owned by Korean government (71.2% of outstanding shares), has provided the telecommunications services at affordable prices. In the first stage of competition, carriers paid Korea Telecom a per-minute-based consumer price for interconnection service. Deficit from providing universal services was not recovered systematically, but part of it was implicitly recovered through interconnection charges. As market shares of competitors grew and data for cost in providing services became available, cost-based interconnection charges were applied thanks to the first interconnection Order introduced in 1992. In 1995, Korean government introduced the second Order revising the first Order including NTS deficit contribution system.

Korean government, however, revisited the 1995 Order in December 1997 because controversial issues were debated regarding interconnection charge and NTS deficit contribution system. Major changes in the Order of 1997 are as follows;

1. It prohibits the incumbent operator from recovering common costs through interconnect charges, such as R&D contribution to Korean government, and corporate R&D expenses.
2. 1997 Order adopted a rule that calling-party operators pay interconnection charges to called-party operators. Calling-party requests interconnection to called-party. As a result, for the traffic originated from PSTN and terminated at mobile network, PSTN operator pays cost-based interconnection charge to mobile network operators. According to the previous order, Korea Telecom received only cost-based interconnection charge regardless of direction of traffic. By the way, a fixed network operator, Korea Telecom, and mobile network operators could not reach an agreement on the scope of interconnection cost of mobile network, hence the Order directed them to apply revenue sharing to the traffic from fixed network and to mobile network. Cost-based interconnection charges still applies to the traffic to fixed network.
3. Government-designated service contribution mechanism replaced NTS deficit contribution system NTS deficit contribution system included deficits from operating subscriber line, directory assistance, national security back-up network and wireless network for vessels and shores. Carriers compensated the cost of providing universal services by their interconnection traffic volume. Policy makers revised the regulatory regime because operators raised issues that these services no longer enhanced public interest, and that traffic volume did not reflect profitability. New mechanism subsidizes national security back-up network and wireless network for vessels and shores, and Telecommunication carriers contribute by their revenue. Directory assistance service, which was once subsidized by the NTS deficit contribution system, is not supported by new system
4. Another major change is an introduction of subscriber line charge. In the previous regulatory regime, access deficit was recovered by NTS deficit contribution system. However, 1997 Order adopts per-minute-cost-based subscriber line charge paid by interconnecting operator. It is calculated as follows; interconnection related subscriber line cost less depreciation cost is divided by total traffic volume including local call traffic. Accordingly, LEC absorbs financial responsibility for using subscriber line.

Debates

Although 1997 Order separates universal service cost from interconnection charge, it lacks complementary measures for transitional period. Revising the previous Order, Korean government excluded directory assistance service from government designated service, which was once included in NTS deficit contribution system. Universal service fund,. however, will not be launched until Year 2000. Therefore, cost recovery system will not be effective for the time being. Chronological changes in universal service system of Korea are as follows in Table 1.

Table 1: Changes in universal service system

Year	Funding Mechanism	Services included
By 1996	N/A	No deficit contribution system. Implicitly & partially included in interconnection charge

1996 ~ 1997	NTS Deficit Contribution	Subscriber line, Directory assistance, National security back-up network, Wireless network for vessels and shore
After 1997	Government Designated Service Contribution	National security back-up network, Wireless network for vessels and shores ? Subscriber line in high cost area and directory assistance service are not mentioned in this order

Current Order also has controversial issues. A major issue is that current Order lacks of mutual relationship between policies. Alternative subsidy system is supposed to support a service excluded in new system, or rate increase must be approved. Otherwise, service provider inevitably sustains severe loss. Related law and applicable regulatory regime must be updated to implement these changes. It is necessary to maintain regulation integrated in order to promote coordination between related policies. Regulators should not only establish policy goals to pursue but also take measures for the regulatory regime in transitional period.

Second, 1997 Order lacks of consideration on the country specific market condition and insight on the future telecommunications policy. As rate structure, degree of competition, level of technology development, consumer behavior and standard of living are different from country to country and time to time, interconnection system and universal service system should be operated according to each country's market condition. In order to work efficiently, explicit and comprehensive analysis on these issues is critical. In Korea, however, deficit contribution system for directory assistance, subscriber line and payphone discontinued without any schedule for rate increase.

Third, this Order does not ensure the causation between interconnection charges and universal service cost. In particular, subscriber line cost is normally recovered through monthly rental charge and universal service system. In practice, however, these costs are all embedded in the subscriber line cost, and it is difficult to distinguish one from another. Korea Telecom collects only 24% of subscriber line cost incurred by basic rental charge. It is because Korean government did not approve increase in monthly rental charge, and Korea Telecom failed in rebalancing rates efficiently. Therefore, it is required to determine reasonable level of monthly rental charge to deal with subscriber line regarding universal service system. Research on this, however, is still going on. Needless to say, Korea Telecom should consider subscribers' affordability before increasing monthly rental charge. As interconnection cost is currently calculated using nationwide average cost, defining high cost area with low profitability is still debatable between policy makers and telecommunications operators.

In addition, there is another unsolved problem between PSTN operators and data network operators. Data network operators do not pay interconnection charge to PSTN operators because of government's policy that promotes development of information industry. In addition, data network operators pay only half of the standard leased line price used for interconnection. As a result, it results in a serious loss in Korea Telecom, the interconnection service provider, and Korea Telecom insists that the loss be subsidized by a recovery system.

Internet is the most valuable market in this era and one of the fast growing industries all over the world. Since Korea PC Communication Corporation started to provide database service like AOL and Compuserve, Dacom and Samsung Data System started business, and recently SK Telecom started Internet-based service. Internet users should pass PSTN to access the ISP's network, and this traffic occupies longer period of time than conventional voice does. According to Pacific Telesis' research held in Northern California, Pacific Telesis reported that Internet traffic occupies PSTN average 22 minutes and 10% of Internet traffic occupies PSTN more than one hour, while conventional voice traffic occupies only four minutes. They also insist that 16% of conventional voice traffic did not get through due to the Internet traffic.

PSTN was not designed to process ISP's traffic by its nature. Incumbent local network operators made huge investment on their networks with improved transmission technology, and, as a result, ISPs are expanding their service area. In addition, Internet phone is rapidly replacing conventional voice traffic. Korean government directed Korea Telecom to provide access service to data network at 30% off price to ensure development of information industry. Korea Telecom, however, raises objection to this directive.

The last but not least, this Order does not include issues between fixed network operators and resale service providers. Even though resellers became active for only a year, fixed network operators face a new stage of competition and lose market shares. Table 2 shows market shares of three overseas call services providers in Korea and resellers.

Table 2: Market Share (September 1998)

	Korea Telecom	Dacom	Onse Telecom	Resellers
Overseas Call	64.25%	16.24%	10.41%	9.09%

Resellers are not required to build their own facilities but provide equivalent services as those of common carriers. Currently, resellers are not regulated by the Interconnection Order because they are regarded as consumers. They pay PSTN rate to fixed network operators. Complaints were raised, however, by both parties. Fixed network operators urge that they cannot compete equally with resellers because they are obliged to build its own network and level of regulation they receive is a lot heavier. They recommend to the regulator that resellers should pay special access charges and contribute to universal service fund. On the other hand, resellers insist that payment of usage rate is unfair while telecommunications operators pay per-minute based interconnection charges.

Estimation of Universal Service Fund Size

Various scenarios are prepared in assessing the cost of providing universal services because universal service system itself is not institutionalized in Korea. Cost of services subsidized by universal service system varies by level of rate and degree of development. Subsidy to high cost area, low-income subscribers, physically handicapped people, advanced multimedia services is included in the universal service system of Korea. Universal service contributors does not want to pay for services, which forfeit universality, but universal service providers believe that rate increase is difficult under the current regulatory regime. If universal service is not subsidized, and government does not approve the rate increase, service providers cannot survive in the market.

Cost Estimation Methods

In order to estimate universal service cost, we can easily think of four methods. First, according to total deficit method, 100% of deficit from universal services is subsidized. Korean government once adopted this method from 1996 through 1997. Deficit from subscriber line, directory assistance, wireless network for vessels and shores, and national security back-up network was subsidized by interconnection charges. In 1996, Korea Telecom's total deficit of providing these service was KRW 530 billion (US $408 million) and it accounts for 6% of total telephone market. Proportions of subsidy paid by telecommunication operators were biased because traffic did not make efficient measurement for revenue generating power. For example, Korea Telecom's domestic long distance division and international long distance division paid over 90%, SK Telecom paid 8%, and other small telecommunication operators paid less than 2%. In 1996, non- regulatory revenues were also subtracted to determine the deficit amount, and new carriers like Dacom domestic long distance division were exempted from payment.

This method is applicable in countries where rate increase is almost impossible due to regulation and standard of living. Although ideal universal service and cost calculation method are established and cross-subsidy is completely prohibited, universal service provider cannot survive in the market and inevitably stop investment in network if rate increase is not guaranteed. Total deficit approach is suitable for developing countries where the gap between deficit (= cost – revenue from end-users) and the size of universal service fund. It is inappropriate, however, to apply this method in the long term because it does not provide the subsidized carriers an incentives to improve efficiency. Therefore, it is necessary to decide whether interconnection charge and end-user rate covers a part of universal service cost, followed by consensus upon reasonable rate and long-term rate restructuring schedule. In the long run, universal service cost must be handled only by Universal service mechanism.

Three alternative approaches for cost estimation being discussed are long run incremental cost (LRIC), avoidable cost and auction. First, LRIC is used for costing for universal service and access charge thanks to merits that it overcame the handicap of fully distributed cost. LRIC is based on forward-looking cost and efficient carriers settling relationship between cost driver and cost. United Kingdom and USA attempted to adopt this approach. Top-down model and bottom-up model have been developed in UK, and BCPM, Hatfield and HCPM are introduced in USA. By the way, Each LRIC model has various problems; 1) It is very difficult to understand due to complexity. 2) Since huge amount of information is required to calculate the cost, it is very difficult to be adopted. 3) Errors exist when considering indirect cost-driver in case many cost-drivers are took into account. Especially, bottom-up model ignores the fact that parameters can affect each other because it regards them as an independent, and calculating actual operating cost leads errors because operating cost is treated as ratio of investment cost. It also does not separate direct and indirect capital cost. Above all, LRIC approach cannot be applied until carriers fully agreed upon details because output of cost calculation is different by carriers.

Alternative to the LRIC approach until mutual agreement is avoidable cost approach. Avoidable cost is fully distributed cost determined by historical costing less monetary/non-monetary benefit and cost incurred from inefficient operation. Although it is very difficult to quantify monetary/non-monetary benefit and cost incurred from inefficient operation, it seems to be the most applicable approach in practice because carriers can reach an agreement easier compared to the LRIC approach. Avoidable cost approach is suitable during the transitional period until the introduction of LRIC. Needless to say, this is applicable only if a universal service provider is capable of utilizing financial benefit of monetary/non-monetary and efficient operation thanks to its capital and technology.

Finally, auction is a possible alternative. It replaces the difficulties involved in the above three approaches with market competition. This approach adopts game theoretical perspectives, while aforementioned two methods have been criticized regarding discretionary aspect of variables, time delay due to the model, information asymmetry and agency problem. Operators bid for the auction, and the lowest bidder wins the right of obligation to provide universal service. For efficient operation, regulators should not intervene the transaction, and operators have the right of exit from certain market.

Among aforementioned four approaches, practically applicable ones to Korea are the first, total deficit approach, and the third, avoidable cost approach. It seems to be impossible to apply total deficit approach to Korea because of possible objection of contributing carriers. Therefore, this paper will estimate the cost of providing universal service based on avoidable cost approach. This paper will also discuss the difference between costs of avoidable costing and total deficit approach, and how much contributing carriers' burden can be decreased.

Scope of Universal Service

At first, we have to estimate separate cost of services provided by the incumbent. Next step is excluding services, which lack of public interest. Final step is to determine whether cost of providing those services is fully recovered by revenue generated. Among services using PSTN, For national security back-up network, government should pay for the cost incurred from tax revenues.

Issues regarding pay phone service and directory assistance services are critical parts of universal service discussion. Operators argue that it is not necessary to provide pay phone services because residential phone is installed enough and pedestrians utilize mobile phones. It is also argued that subsidization for the directory assistance is not necessary where competition is introduced. Pay phones, however, should still meet the needs of people with low income who cannot subscribe to mobile services and people in emergency.

In developed countries, directory assistance is profitable business or the cost incurred is recovered fully. In Korea, end-user rate is KRW 80/assistance, which is well below the cost. End-user should be increased to KRW 276 to recover the cost incurred. However, customers cannot afford KRW 276 for an assistance. Therefore, this service needs to be subsidized by universal service fund.

Directory assistance service should provide updated information after yellow and white pages are published. Therefore, these services should be provided at reasonable prices. Since services themselves did not lose universality, it is desirable to be in parallel with rate policy.

Cost Estimation

This chapter will calculate the cost of providing universal services using avoidable cost method. It is appropriate to start calculation from total deficit. Total deficit of Korea Telecom operating services is calculated as is KRW 1,300 billion, which accounts for 17% of total revenue of Korea Telecom.

Estimation of cost of providing universal services using avoidable cost method is following, and Table 3 shows information in detail.

Table 3: Cost of Providing Universal Service (Avoidable Cost, 1997, KRW billion)

Target Services	Total Deficit

Voice Telephony and Access(Subscriber line)	200~300
Nationwide Pay Phone	150
Nationwide Directory assistance	123
Wireless Network for vessels and shores	28.7
Service for Handicapped	17.7
National Security Back-up Network	51.6
Information Super Highway	70.5
Total	641.6~741.6

High cost area must be separated because subscriber line may encounter cream-skimming behavior by new entrants. Its cost is based on deficit incurred from the high-cost area where competing operators are never to enter. Subscriber line of high cost area, however, has complex characteristics caused by consumer price policy, and cost estimation becomes more complicated if its cost is partially compensated by access charges. Deficit from high cost areas is subsidized by USF, and average cost except for subsidy from USF is collected through monthly rental charge and interconnection charges.

There is no explicit standard in deciding the level of interconnection charges and monthly rental charge, and they are decided based on consumer's affordability and general perception against rate increase. Currently in Korea, capital cost of subscriber line is collected through basic rental charges, and maintenance cost is supposed to be collected through interconnection charges. Out of total subscriber line cost, 23% is collected through basic rental charge, 53% is collected through subscriber line charge, and the remainder is the deficit of Korea Telecom operating subscriber line. The remaining amount will be absorbed through future universal service funding mechanism and invisible benefits.

Table 4: Discount plan for people with low-income and people with disability

	Services	Remarks

People with Disability	Voice Telephony using PSTN (KT)	50% off measured local rate & long distance rate
		Free directory assistance service
	Mobile phone Service (SKT)	No connection charge
		KRW 5,400 off monthly rental charge
	Paging Service (SKT)	20% off monthly rental charge
	PC Database Service (Korea PC Comm.)	50% off monthly rental charge
Aging Population	PC DB Service (Korea PC Comm.)	50% off monthly rental charge, over 65 of age
People with Low-Income	Voice Telephony Using PSTN (KT)	Exemption of deposit, connection charge, and basic rental charge
		Free 150 charging unit
		Free rental of phone at the time of installation
Veterans and etc.	Local and domestic long distance (KT)	Patriots and Veterans : 50% off
		Related entity, facilities, government designated schools: 50%
		Bereaved family of fighters for national independence : 30% off
Others(KT)	2,373 pay phones for the handicapped installed(1996) 6,000 copies of yellow pages published in Braille	

Losses from pay phone booths installed in high-cost area must be taken into account, and it is possible to take non-monetary benefit, such as advertisement effect, into account. Cost of providing directory assistance is generally collected through consumer rate and interconnection charges. Currently its rate and interconnection charge are well below cost, and Korea Telecom faces huge deficit. Korea Telecom is willing to raise its rate soon, and apply cost-based interconnection charge to collect its cost.

Carriers have plans to support people with low-income and people with disability. Table 4 exhibits plan for people in need. It is easy to keep 'Pay or Play' policy, although operators would provide services to people with low-income. It is still debatable to decide whether cost of providing discounted service for mobile phone users with disability is within the scope of universal service.

For the enhanced multi-media service, its construction and usage should be handled separately. It is recommendable to launch subsidy system for the discount rather than to control the price. A fund for promoting information society, which has been in operation since 1994, is to be used for investment on the information superhighway. Universal Service Fund should compensate the loss due to the discount. The size of loss, which should be recovered by the USF, was KRW 705 million.

Universal Service Fund Contributions

This chapter discusses the standards that enhance efficient operation of universal service fund, such as amount of subsidy that each carrier pays, classification of funding carriers and carriers qualified for exemption. Amount of subsidy can be determined by lump sum tax, profit tax and quantity tax.

Noam emphasizes neutrality; competitive/ structural/ technological/ geographical/ transitional/ jurisdictional neutrality and applications and content neutrality. Egan and Wildman emphasize contributory and distributive fairness, political sustainability, and promotion of economic efficiency.

Lump sum tax and quantity tax do not reflect funding carriers' affordability and lead deterioration of social welfare. Because profit tax is isolated from market structure and leads maximization of social welfare, theoretically it is the most appropriate basis. However, cost manipulation is possible, and it is difficult to realize its merits. Therefore, even though it is close to profit tax, revenue that is transparent. Value-added revenue is suitable, and, in telecommunications industry, it is revenue less cost incurred for interconnection. In Korea, carries almost agreed with net revenue (total revenue including interconnection charge less interconnection cost) on the standard that determines the amount of subsidy that each carrier pays.

Distortion due to contribution can be minimized as the number of contributors is increasing. Therefore, Every telecommunications company including manufacturers, incumbent carriers, resellers and ISPs should contribute to the fund. However, manufacturers' share of contribution is transferred to the price of the equipment while increasing service costs. Newly entered service providers argued that it bothers fair competition because incumbents already finished their investment and are not influenced by the this changes. Therefore, it is recommended that only service providers except manufacturers should be included in the contributors. Part of the industry insists that the enhanced service providers (ESPs) should be excluded from sharing universal service cost because they impact positively on the revenue of the incumbent providers. The rest of the industry as well as regulator, however, inclined to include ESPs within the boundary because the incumbents will contribute by their revenue, which includes the additional revenue from the enhanced services.

To decide who's contributing to USF, we should clarify the reason why the obligation is generated. USF obligation is socially imposed on telecommunications carriers because they are exclusively licensed for the limited resources (i.e. bandwidth, right of way). Therefore, every carrier should return some benefits accrued by operating the resources to the people who is the original owner of the resources. If we expand the boundary of contributors, burden will be dispersed. However, small companies will be exempted because the collecting from them is higher than the amount they contribute. Universal service providers will also be exempted because universal service contribution resulted in rate increase. After long discussion, Korea regulators decide to include every telecommunications service provider in scope of contributors. Exemption is not yet concluded but revenue and profit will be considered.

The Impacts on Interconnection Charge and Competition

Subscriber line charge is a universal service cost embedded in interconnection charge, and it aims to maintain the monthly rental charge affordable. In Korea, however, the subscriber interconnection charge has been considered as a usage fee for the local loop facility rather than universal service cost. Economic distortion arisen from recovering fixed cost through variable cost is reduced by transforming the per-minute subscriber line charge to per-line monthly charge. This model is found in SLC or PICC of USA.

Government should run compensation programs for services with obligation excluded from USF, such as national security back-up network and information superhighway. This program is necessary until rate increase. In a competitive market, a freedom of exit as well as entrance must be guaranteed. If an incumbent is subject to providing these loss-making services, it will not survive in the market.

Conclusion

Universal service system pursues maximizing social welfare through harmonizing the distribution efficiency and economic efficiency. This system helps to lift the limitation of social activity by subsidizing people who are not affordable to buy telecommunications services. It also provides the level of playing ground among telecommunications carriers by removing inequitable paying condition. Carriers always pay more to the universal service than by-passers if its cost is embedded in the interconnection charge.

Korea experienced difficult rule making processes and stays at the stage of the nationwide universal service. Currently, Korean regulators are in between rate rebalancing and institutionalization of universal service system while the developed countries have almost completed their price restructuring and devote their energies on targeted universal service.

Regulators should set its policy goal different from the developed countries and design a system with right perspectives. Adopting developed countries' policy indiscreetly could result in the incumbent carrier's failure in competition. It is recommended to operate service with interconnection system and to set a schedule for reforming both regulations.

Bibliography

Audit Reports of Korea Telecom, Korea Information Society Development Institute , 1996 &1997

David Lewin & Richard Kee. Interconnect: A Global Guide to Effective Telecommunications. Ovum Ltd, London UK, 1997

DIRECTIVE 97/13/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. A Common Framework for General Authorizations and Individual Licences in the Field of Telecommunications Services, Brussels, 10 April, 1997

FCC 97-158. First Report & Order In the Matter of Access Charge Reform, Price Cap Performance Review for Local Exchange Carriers, Transport Rate Structure and Pricing, Usage of the Public Switched Network by Information Service and Internet Access Providers, Washington DC USA, 1997

Eagan and Wildman, "Funding the Public Telecommunications Infrastructure", Communications Policy Working paper #5, Benton Foundation, http://www.benton.org

E. Noam, "Beyond liberalization III"(Telecommunications policy 1994 18, "The prerequisites to Competition: Two proposals to reform universal service and interconnection

Financial Statements of Korea Telecom in 1996 & 1997

John D. Borrows, Phyllis A. Bernt & Raymond W. Lawton. Universal Service in the United States: Dimensions of the Debates. Bad Honnef, Marz: Wissenschaftliches Institut fur Kommunikationsdienste, 1994

MINISTRY OF INFORMATION AND COMMUNICATIONS 1997- 116. Interconnection Order, Seoul Korea, 31 December, 1997

MINISTRY OF INFORMATION AND COMMUNICATIONS 1995-119. Interconnection Order, Seoul Korea, 25 September, 1995

MINISTRY OF INFORMATION AND COMMUNICATIONS 1992-162. Interconnection Order, Seoul Korea, 12 December, 1992

NERA(National Economic Research Associates Economic Consultants). The Approach to Calculate Long Run Incremental Cost. London UK, 1996

NERA(National Economic Research Associates Economic Consultants). Reconciliation and Integration of Top Down and Bottom Up Models of Incremental Cost. London UK, 1996

Rate Schedule, Korea Telecom, 1997

Rate Schedule, SK Telecom, 1997

Telecommunications Business Act of Korea, 1997

Weller, Dennis. Auctions for Universal Service Obligation. ITS 98 Conference, Stockholm, June 1998

Return to Top View Full-screen

Mobile Satellite Services – Financing and Investor Return

Manish Thakur

Chief Financial Officer

Ellipso, Inc.

ABSTRACT

Not available

View Full Text

Mobile Satellite Services – Financing and Investor Return

Introduction

The much-awaited MSS sector finally commenced commercial service at the end of last year, with the launch of Iridium's global communications system. In commercializing its system, Iridium made impressive innovations including the launch and maintenance of a fleet of over 70 satellites in an unprecedented time period. No less innovative was its financing strategy, raising billions of dollars from strategic, private and public capital sources from around the world before even earning a single dollar of revenue. Iridium is not unique in this. It in fact shares its financing successes with other MSS companies such as Globalstar and ICO Global Communications. New entrants such as Ellipso, of which I am currently the Chief Financial Officer, are very much emulating the same financing strategies.

A note about myself, prior to joining Ellipso I worked for many years as a telecommunications investment banker at Merrill Lynch, spending the last couple of years focusing exclusively on the satellite sector. During that time, I was very privileged to work with a number of MSS companies including Iridium, ACeS, and of course Ellipso.

My talk today highlights the challenges that MSS companies face in raising capital to fund their systems, and then also the investor perspective in funding the various projects. Specifically, I hope to leave you with an understanding of why the MSS industry has been able to raise over $5 billion from the public – people who should arguably be wary of the risks of investing in multi-billion dollar, multi-satellite high technology ventures

The Challenge

The primary challenge facing MSS companies is the sheer cost of the systems and the fact that all the capital needs to be raised prior to the generation of the first dollar of revenue. These systems are technological breakthroughs, involve the deployment of constellations on a scale never attempted before, and require substantial global back-up support. Iridium's capital cost exceeds $5 billion, ICO $4 billion, and Globalstar $3 billion. Ellipso's system cost is much lower at $1.5 billion, and will actually phase deployment so that "dollars-to-first-revenue" is under $1 billion – but that's still a lot of money, especially given the inherent risks of these projects.

Sources Of Capital

So we understand the problem. The question is exactly how have MSS companies financed themselves to date. The answer is an interesting one – and it involves accessing many varied sources of financing:

1. early stage private equity
2. strategic equity (both vendor and telecommunications)
3. classic vendor debt finance
4. public equity
5. high yield finance
6. non-recourse bank loans.

The key to the financing strategies of the MSS industry is to match the source of capital to the stage of the project.

Investor Perspectives – Differing Reasons to Invest

Different investors and/or lenders have differing reasons for being involved in an MSS venture, and so require different sales pitches. In addition, these differing investment aims are also accompanied by differing risk profiles. For example, a Motorola or a Boeing would regard the risks involved in satellite production and launch very differently from a Wall Street investment fund. Similarly, a telecommunications company would have a very different view as to the risk of the size of the market from a retirement fund in California. The critical investment risks associated with MSS can be summarized into four categories, each of which can be mitigated over time, often as a result of other partners or investors being involved to inspire confidence that the risk can be managed.

Risk	***Fundamental Issue***	***Milestones Required to Mitigate Risk***
Technical	Can the project be built?	Well known prime contractor in place with fixed price contract
Regulatory	Does the project have the regulatory approvals in place?	FCC License In-country licenses/partners in key markets
Strategic	Does the project have the right partners to make is successful?	Industrial partners in place (under contract) Well known telecommunications partners in key countries
Financial	Is the funding requirement defined, and what is the funding gap?	Fixed price contract defining cost Strong sponsorship A minimum level of funding in place

Differing investor bases are more likely to be able to tolerate different risks dependent upon their own experience base. For this reason different investor bases are appropriate across the life of the project, as it achieves the milestones required to reduce risk. For the sake of simplicity, I shall outline the various investment pools by the relevant milestone.

Investor Prerequisites - MSS Milestones

Pre-Operational Milestone	***Investor Pool***	***Rationale***
Pre-FCC License	Prime Contractor /Venture Capital	Early stage investors either looking for large contract revenue, or substantial valuation upside
FCC License	Prime Contractor/Subcontractors /Venture Capital	Risk is reduced dramatically. Others with smaller contract potential will be drawn in. Private investors with slightly lower investor risk profile
Fixed Price Contract	Telecommunications Partners/Subcontractors/Private Equity	On establishing the full cost/viability and schedule of the system, non-vendors will be drawn to the project. Satellite vendors typically commit large sums of vendor debt at this stage
Telecom Partners	Public Equity IPO/High Yield Investors	With strategic partners both on manufacture of the system, and distribution of service in place, the public markets are accessible though with valuation increasing on achieving each milestone.
Satellite Construction	Public Equity IPO/High Yield Investors / Commercial banks (with recourse)	Increased valuation. Commercial banks will lend against the hard assets of the Company, typically though only with the support of the system's prime sponsor
First Satellite Launch	Public Equity IPO/High Yield Investors / Commercial banks	As technical risk is replaced by "repetition" risk, banks will start lending on a non-recourse basis.
Commercial Service	Public Equity IPO/High Yield Investors / Commercial Banks	At this stage, all capital markets and commercial banking sources can potentially be tapped.

Investor Return

The above-listed investor pools can be divided into two groups: strategic investors and non-strategic investors.

The strategic investors are investors whose primary output are not simply measured in return on equity invested but for other gains as well. For a satellite vendor, or launch provider the return comes in the form of a construction/integration or launch contract. For a telecommunications company, the return may come in the revenues realized from the operation of the MSS service, and the strategic benefits that it implies. For an insurance company it could come in the form of an underwriting contract. Some commercial and investment banks have also been known to invest in order to lock up financing business.

But for the non-strategic investor, be it the private financial investor, the public equity markets or the high yield debt markets, the project must stand on its own merits – there is no other pay-off. MSS companies must be able to articulate and ultimately demonstrate their commercial rationale. Iridium, Globalstar, and ICO have successfully educated investors on their investment thesis, and the market has rewarded them for this by valuing them at multi-billion valuations. So what exactly is the expected investment proposition that Wall Street is valuing so highly?

MSS – The Commercial Opportunity

As the MSS' commercial era commences, it is important to focus on the *market* for the services being offered. Satellite infrastructure, while interesting, and important from a coverage and cost perspective, is essentially unimportant to the end-user who basically wants access to affordable communications. Ultimately MSS is about telephony.

The world has a telecommunications problem – about half of the world's population has never made a telephone call, and most areas of the world remain uncovered by terrestrial wireless systems (a fact that will still be true many years from now). Satellite as envisioned by MSS is an "instant infrastructure" providing carriers with access to large swaths of territory at relatively low costs. Satellite and MSS, however, is not *the* answer to the world's telephone problem. Rather it is *one* answer to one part of the problem. Satellite will join with fixed wireless, ADSL, co-axial cable or even fiber among others in forming part of an arsenal of telecommunications access solutions that carriers can deploy to reach their customers.

Ellipso has commissioned a study by Arthur Andersen that suggest that the MSS market will reach 40 million fixed and mobile subscribers by the year 2005, which is roughly consistent with other forecasts by Wall Street firms. Even at this market size (a market size which, incidentally can support a number of global and regional systems), MSS will account for about 1% of the world's telecommunications market. So clearly there is demand that the industry can address – and clearly this potential market is huge. The industry's penetration of this market needs to be remarkably modest in order to enjoy success for multiple players. Additionally, while the costs of MSS systems seem high, they pale against the costs of terrestrial alternatives. In fact it is the low cost global coverage that makes MSS such a lucrative proposition. It is this rationale that explains current valuations in the sector, and the fact those investors are willing to fund multiple systems.

The real question revolves around the price points that will allow this market to develop. Satellite services as proposed by Iridium are at steep premiums to terrestrial rates. They are targeted to global travelers whose requirement for constant communications overrides cost concerns. Later entrants such as Globalstar and ICO promise cheaper price points to a broader market under the assumption that the cream of the market is likely to be small and probably well penetrated. Ultimately, Ellipso believes that it can offer a paradigm shift in the cost/capacity equation of satellite technology to allow for price points comparable to today's terrestrial rates.

Right now, however, the markets are focused on Iridium's current pricing plans, and its long term ability to charge steep premiums at a time when the introduction of competition in the telecommunications industry globally compounded by the collapse of international accounting rate regime has questioned all traditional pricing models. The size of the MSS sector cannot be considered independently of price. And the question on everyone's lips is "who's going to pay those prices?"

Market Assessment of the MSS Sector – So Far!

Perhaps the most aggressive MSS company to date in accessing the markets has been Globalstar. This company launched its $200 million IPO literally days after receiving its FCC license and with only a couple of hundred million dollar commitment from a variety of premier satellite vendor and telecommunications companies, such as Loral, Qualcomm, France Telelcom, Vodafone and Air Touch. At that time, Globalstar commanded a valuation of as high as $1 billion! And this at a time, when the very concept of launching 48 satellites seemed far-fetched, even if you could raise what was then billed as a $2.6 billion price tag. Globalstar was able to command this valuation because it was able to convince investors that the present value of its future earnings streams were extremely valuable even when discounted at rates that reflected the high level of risk that a project such as Globalstar entailed.

As time progressed, and investors sensed that both Globalstar and industry as a whole was making progress, Globalstar made significant leaps in valuation. Again these increases in valuation can be justified by the improving risk profile of the project with each milestone achieved, increasing the likelihood of the project's success. In fact, in the case of Globalstar, each *Iridium* launch of satellites caused a boost in Globalstar's stock price, as investors became more optimistic on the sector as a whole. Ultimately Globalstar and Iridium both were propelled to increasingly higher valuations as the sector became a momentum play, ultimately achieving valuations exceeding levels that even the most bullish Wall Street analysts were comfortable with.

A combination of factors burst the Globalstar bubble, bringing it back to Earth, namely a general market decline, the Asian currency crisis effecting a "flight to quality", and a launch failure that pushed back the start of Globalstar's service. Additionally, investors had always expected market turbulence in the MSS industry toward the end of 1998 given Iridium's start of service, and the investor anxiety surrounding the fact that the industry would have to live up to its promise.

Recent months have seen correction to a market overreaction, and Globalstar currently enjoys a market valuation of approximately $5 billion, despite the fact that is has yet to earn a dollar of revenue, let alone income. The question regarding valuation in 1999 is fundamentally altered now that MSS will no longer be measured by future promise alone, but by current results.

Now Show Us The Money!

Wall Street's valuations to date have been based upon a present value of future potential. With the launch of Iridium service that future is now upon us, and all eyes are naturally turned toward Iridium, and its operating results – both technical and financial. Iridium's success is critical for the whole industry as investors look to it for a justification for their investment in the sector. While all the other systems will argue, with a great deal of justification, that they are employing simpler technology at far lower price points, if Iridium is not seen as a commercial success it can not be beneficial for the rest of the industry.

Currently, the market is focusing on three main issues as it assesses Iridium's performance:

1. subscriber uptake
2. ability to deliver high quality service (and successfully bill for it)
3. long term ability to charge steep premiums

It is still too early for any realistic assessment to be made on any of these factors, although the recent increases in stock prices of the sector as a whole suggest continued market confidence.

Ultimately, Iridium's performance in each of these categories over the coming months and years will answer the validity not only of the investment case in MSS, but also the future financability of all major satellite projects be they MSS or internet related broad band projects such as those proposed now which entail even more ambitious technology, at even higher price tags to an even more amorphous market, albeit with the lure of even greater returns. The success of the MSS industry will therefore not only help shape the future of global communications, but also the very viability of the space and satellite sector to provide solutions to match the proliferation of services being demanded by consumers around the world.

Return to Top View Full-screen

GMPCS-After The First 100 Days

Douglas Dwyre

Globalstar, U.S.A

ABSTRACT

Reading the hyperbole about Global Mobile Personal Communications by Satellite (GMPCS), it would seem as though satellite-delivered voice and data is quite possibly the most unbelievable, astounding, even revolutionary technology to come from the telecommunications industry since the telegraph. In reality, satellite communications has been around for years, and has been used by thousands of sailors, remote site managers, journalists and others who couldn't work without being able to communicate with the outside world. Of course up until GMPCS was introduced, these users were tied to large, heavy and expensive equipment.

How, then, did the GMPCS operators manage to turn a lap-top sized phone into a portable tool that was affordable to the masses? Globalstar and its brethren have spent many years and more than a billion dollars to make satellite technology a user-friendly, accessible tool that will easily integrate into the lives of people around the world. It has been a process full of challenges, but one that is finally coming to fruition with the introduction late last year of Iridium and later this year of Globalstar. This paper provides a peek inside that long journey from conception to reality for Globalstar – the second GMPCS company to hit the market.

View Full Text

GMPCS-After The First 100 Days

I. INTRODUCTION

Reading the hyperbole about Global Mobile Personal Communications by Satellite (GMPCS), it would seem as though satellite-delivered voice and data is quite possibly the most unbelievable, astounding, even revolutionary technology to come from the telecommunications industry since the telegraph. In reality, satellite communications has been around for years, and has been used by thousands of sailors, remote site managers, journalists and others who couldn't work without being able to communicate with the outside world. Of course up until GMPCS was introduced, these users were tied to large, heavy and expensive equipment.

How, then, did the GMPCS operators manage to turn a lap-top sized phone into a portable tool that was affordable to the masses? Globalstar and its brethren have spent many years and billions of dollars to make satellite technology a user-friendly, accessible tool that will easily integrate into the lives of people around the world. It has been a process full of challenges, but one that is finally coming to fruition with the introduction late last year of Iridium and later this year of Globalstar. This paper provides a peek inside that long journey from conception to reality for Globalstar—the second GMPCS company to hit the market.

II. A BRIEF HISTORY

From the beginning of its history in the late 1980s as an idea from Loral-owned Ford Aerospace, Globalstar was designed to be the most technologically advanced GMPCS system, but one that was accessible to nearly everyone, not just the wealthy. Several steps were taken to ensure this vision would become a reality.

First, Loral teamed up with Qualcomm, a then fledgling company that was working on a similar satellite project, and was developing a new method of transmission called Code Division Multiple Access (CDMA). Unlike TDMA, which differentiates signals by time slot, thus restricting the reuse of spectrum in nearby cells, CDMA utilizes spread-spectrum communication that differentiates signals by a spreading code and allows the use of the same frequencies all the time, everywhere. CDMA spread-spectrum technology theoretically allows for 20 times the capacity of

TDMA, a significant advantage for any system offering service to the entire world in a very limited amount of radiofrequency spectrum.

Globalstar also designed its constellation to provide the best service to the earth's temperate zones, where the majority of the world's population lives. This meant sacrificing service above 70° North and below 70° South. Eventually, Globalstar hopes to remedy this shortcoming and to give those hardy polar explorers and scientists the type of phone service they need.

Globalstar's founders also knew early on that one of the biggest challenges they would face would be securing spectrum and operating licenses in 120+ countries around the world. In an attempt to make the process easier and less threatening, Globalstar designed its system architecture so that every call would pass through a local gateway, or ground station, which would be owned by a locally based service provider. This architecture ensured that the local regulatory authorities would not lose revenue from long-distance calls, and also allowed them to retain their accustomed level of control, an especially important selling point in some countries.

Finally, in an effort to keep end user costs affordable, Globalstar realized early on that it would have to keep the satellites simple and locate the majority of its technology on the ground, resulting in lower overall system costs. It has done so through the use of "bent pipe" satellites, which act as simple signal reflectors, bouncing the signal sent by the handset back down to the nearest gateway, where the call is switched into the PSTN. In addition, realizing that each local service provider would need to compete within its own market, Globalstar structured its wholesale rates so that local service providers would have the flexibility to price their services according to competitive local market conditions.

III. OVERCOMING THE CHALLENGES

With the business plan, its partners, and the majority of its funding in place by the early 1990s, Globalstar was well on its way to turning a paper project into a reality. But the introduction of a new technology on a global basis has not been without challenges.

1. *Spectrum Allocation*

Spectrum allocation, an arduous process, was begun at the ITU's WARC 92 meeting, where user links in the L-Band (1610-1626.5 MHz) and S-Band (2483.5-

2500 MHz) were first made available for mobile satellite services. Several years later, at WRC 95, the ITU provided C-Band spectrum for feeder links—gateway to satellite (5091-5250 MHz) and satellite to gateway (6875-7055 MHz). At about the same time, however, the issue of GLONASS—Russia's global navigation system—appeared on the horizon.

GLONASS was using frequencies in the band right next to Globalstar's (and Iridium's) user frequencies, a concern for both the Russian government and the U.S. Federal Aviation Administration, which had been planning on using GLONASS as part of its Global Navigation Satellite System (GNSS). Their claim was that GMPCS signals would interfere with GNSS receivers, and, hence, the automatic landing of aircraft, a potentially dangerous situation to passengers.

After intensive study, Globalstar determined that the odds of interference were ludicrously low—for example, the aircraft would have to be *stationary* in the sky directly over the telephone, while at the same time the telephone would have to be less than 150 feet from an aircraft landing, such as a helicopter in horrible weather. Simultaneously, there would have to be no local terrestrial cellular signal in the vicinity of the airport (GMPCS telephones search first for cellular signals) *and* the MSS customer would have to be randomly assigned to channel 1 of 9 possible channels (the GMPCS network can control the channel assignment). Not only that, there are a number of other sources of interference that are potentially much more serious than satellite phones. Eventually, however, a compromise between the satellite interests and the aviation interests was reached, but not without difficulty. The compromise has found its way into European technical standards and will soon be adopted in U.S. standards. Globalstar to this day is working with Russians in an effort to help make GLONASS more robust and less susceptible to interference from all sources.

2. *Licensing*

One of the main challenges faced by companies rolling out GMPCS systems remains the licensing of service. Many countries are only starting to draft their GMPCS policies for licensing. At press time, Globalstar had signed service provider agreements with 117 countries spanning six continents, representing over 90% of Globalstar's business plan. Of the 117 countries, Globalstar Service Providers have secured licenses in more than 30. Like other GMPCS systems, Globalstar will deal with this challenge by rolling out service to select licensed areas at the start of service, and expand as new licenses are achieved.

3. *Satellite Launches*

Globalstar successfully launched its first four satellites on February 14, 1998, and after an additional launch on April 24 1998, had a total of eight satellites in orbit at press time. Unfortunately, during Globalstar's third launch, the Russian Zenit rocket carrying 12 Globalstar satellites crashed on September 9, 1998 due to a second stage computer failure. Like all GMPCS companies that understand the launch risks inherent in satellite companies, Globalstar had built the possibility of a launch failure into its business plan.

However, the story received extensive press coverage that generally did not mention that such a failure was not a surprise given the average success rate of launches. And, in fact, Globalstar did have contingency plans in place. The failure set back the initiation of Globalstar service by approximately three months, and Globalstar now plans to begin commercial service in 3Q 1999. A total of 52 satellites (including spares) will eventually complete the Globalstar constellation. Remaining satellites will be launched on Russian Soyuz and Boeing Delta launch vehicles.

4. *Partners*

As noted earlier, Globalstar has a strong global partnership consisting of some of the biggest telecommunications companies in the world, such as AirTouch, Alcatel, Dacom, China Telecom, Elsag Bailey, France Telecom and Vodafone. Even this solid consortium was not immune to the effects of the Asian financial crisis. In mid-1998 Globalstar founding partner Hyundai pulled out of the partnership to focus on its core technologies. The potential loss was offset, however, by the $37.5 million equity investment from China Telecom, as well as the willingness from Globalstar's other partners to purchase the majority of Hyundai's shares. The remaining shares were bought by George Soros, one of the foremost investors in the world, whose vote of confidence in Globalstar reverberated throughout the investment community.

5. *Competitors*

Globalstar has always stressed that it is partnering with, or complementing, cellular companies rather than competing with them. To be sure, many GMPCS companies have introduced or will introduce multi-mode phones which combine cellular and satellite capabilities, allowing cellular companies to introduce satellite service as a value-added commodity. As such, initially GMPCS operators will direct their marketing efforts toward consumers with a specific need for satellite-based services and toward communities with no access to terrestrial phone service—some 50% of the world's population.

Another potential competitor on the horizon is the cellular "world phone" which will integrate many of the world's cellular frequencies into one phone, allowing a user to travel to many different parts of the world. For those GMPCS companies that rely heavily on cellular roaming as part of their business plan, the new world phone will be a potential threat. Globalstar, however, has always based its business plan on two areas that will remain unaffected by the introduction of the world phone: the cellular extension market and the rural market.

Understanding that cellular coverage is still confined primarily to urban areas, Globalstar believes that the dual- or tri-mode satellite phone will prevail over the world phone, which will not work once the user leaves an urban area. With a Globalstar phone, the user simply switches the phone to satellite mode to make a call, even in areas the extend beyond current cellular coverage. Globalstar also built its business plan around the millions of people who have absolutely no telephone coverage to speak of, people who generally live in rural and developing regions of the world. For these customers, Globalstar has contracted with several manufacturers to create a family of fixed phones and payphones for the rural and developing markets. These markets will not be helped at all by a world cellular phone, and Globalstar believes that this sector of the market will be an important one.

6. *Handsets*

Multi-mode technology means that, at the introduction of service anyway, GMPCS handsets will be slightly larger, heavier, and will have a shorter battery life than typical cellular phones. Globalstar is quite confident that current satellite users will be thrilled to give up their laptop-sized satellite phones for Globalstar's more portable versions, but current cellular users will find an acceptable trade-off as well.

One of Globalstar's competitors addressed the perceived size disadvantage by creating a satellite docking station that accommodates a small GSM phone when the user needs to make a satellite call. Globalstar concluded that carting around a docking station would be too complicated (and easy to forget) for users, and has kept its phones self-contained. Globalstar phone antennas rotate and fold into either the side or back of the handset, making the phones look sleeker and more compact. In the end, while satellite phones are somewhat bigger than their cellular counterparts, Globalstar is confident that many people will sacrifice the smaller size of a traditional cell phone in order to reap the benefits of worldwide coverage.

IV. CONCLUSION

Ultimately, consumers won't know or care whether a company's satellites are bent-pipe or provide inter-satellite links, whether the gateway is in their country or in the next continent, or whether their signal is being transmitted via CDMA or TDMA--except for how those factors affect the quality, reliability, coverage, and price of their satellite phone and service.

Globalstar believes that its technology, architecture and business plan will combine to provide the best voice quality, highest rate of call completion and best coverage at the most affordable prices. GMPCS will be one of the most exciting industries to watch in the next decade, and Globalstar intends to be not just part of that excitement, but a major contributor.

Return to Top View Full-screen

Impact of Licensing Delays

DAVID CASTIEL

President and Chief Executive Officer

Mobile Communications Holdings, USA

Abstract:

Not available

Iridium – Around the World in 80 Days

IRIDIUM
South Pacific

Carlton R. Jennings

Iridium South Pacific, Australia

ABSTRACT

The spectacular worldwide growth of mobile telephony is testimony to the personal desire for mobility and ease of communication. The commercial introduction of the Iridium system has brought the world's only satellite based digital telecommunications system to all people. It works as designed providing customers with worldwide voice, data, fax and paging services using a handheld phone and pager linked to a constellation of 66 low earth-orbiting satellites. Eleven years in development, Iridium began commercial service nearly 80 days ago on November 1, 1998 with service offered in every country that has authorized Iridium services.

Although single protocol roaming today is excellent for those people in continuous cellular coverage, there are huge gaps in coverage and cellular standards. Protocol and standards anarchy makes it cumbersome and often impossible for the traveling subscriber to roam between countries and between networks. Only the Iridium System can provide global coverage through its telecommunications network, providing us the ability to roam across terrestrial cellular network standards while maintaining one number and one bill.

The unique Iridium offer to distribution partners is a truly complementary service to increase customer satisfaction, leading to new revenue streams.

Flexibility of the Iridium system makes it exceptionally unique. Choice of gateways and the ability for signals to bounce from each satellite to each satellite are unique to Iridium. There is no need to rely on or be forced to build extensive, ground structures. Even the billing system, based on the GSM standard, assures global compatibility for easy introduction of Iridium service into existing wireless operations.

Iridium is the only telecommunication operator to offer global coverage with a single package which includes satellite and terrestrial wireless voice, data and paging services with one number, one bill.

View Full Text

Iridium – Around the World in 80 Days

I. THE IRIDIUM JOURNEY BEGINS

Phineas Fogg took a bet during a card game at the Explorer's Club in London to circle the world in 80 days. His fellow club members, more armchair explorers of the depths of a wine decanter than visionaries, bet against Fogg saying that the journey could not be done. They settled in for a snug wait, patient and confidant that Fogg would fail and thus prove that the limits of exploration had been reached. And for the next 2 and a half months, they heard little of his harrowing tales as he sped around the then known world.

Need-less-to-say, Phineas Fogg won his bet as the first to prove that the world could be circumnavigated in less than 80 days. And like Fogg, the global Telecommunications Company Iridium has proved that despite today's armchair explorers, the limits of human achievement continue to know no bounds. It has been a long journey for Iridium. The eleven years of development and deployment leading up to service activation on 1 November last year were often described as a cross between exhilarating, and at times, "visionary". And in the 80 Iridium Service days since November, the experiences have only gotten longer. But the satisfaction of providing customers the reality of the vision of global personal handheld telecommunications virtually anywhere on earth has been enormous.

The idea behind a worldwide wireless handheld mobile phone with the ability to communicate anywhere, anytime was necessarily a woman's idea. In 1985, unable to use her mobile phone while in the Caribbean Sea, the wife of a Motorola executive convinced her husband the world needed a universal wireless telephone system. By 1987, Motorola began development of the vision with what is now the 66-satellite low earth orbit global telecommunications system known as Iridium.

Visionary but doable. That's what Jules Verne suggested with Phineas Foggs' journey, allowing one to follow his dream despite the hardships and naysayers. Like the Greek Pytheas, Marco Polo, Christopher Columbus, James Cook and the visionary voyagers of the Canoes in the Great Pacific Migration, mankind has produced those who seek to develop the vision of what can be done. The Iridium journey has been long, hard and fraught with our own share of concerns but in the end the services are exciting, active and above all, open for business.

Many of the concerns have ranged from the grand to the minuscule but none has had greater effect than applying things like leading edge technology and international political law to the business of global telecommunications. The last 12 months have seen unprecedented progress with the institution of a process like global regulatory regime that began with the GMPCS MoU and now provides for an ITU registry of global telecommunications equipment. And the spectacular success of orbiting and flying 74 inter-linked satellites has no parallel in human endeavor.

II. FIRST STEPS AND PARTNERSHIP

Iridium was established by Motorola to attract global strategic partners for investment and development of the vision of global communications. This development over four years culminated with 17 investors pledging over 2.6 Billion USD to the completion of the project. In 1997 Iridium World Communications Limited was established as a vehicle for public investment in the Iridium System. Iridium also raised final funding through high yield debt. With this additional financing, Iridium LLC completed its anticipated funding needs through commercial service activation, raising close to US$5 billion to fund the ongoing infrastructure buildup and commercialization of the IRIDIUM system.

Now let's talk regional. Each of the 15 Iridium operating companies have an exclusive right and obligation to provide for Iridium services throughout their territories. Iridium South Pacific provides for all Iridium business operations in the South Pacific region. The company markets and sells Iridium services to 25 countries or territories in Australia, New Zealand, the South Pacific and Antarctica, serving the largest Iridium territory on Earth, a 22 million kilometer area with a combined population of over 23.5 million.

An independent operating company, not a franchise, Iridium South Pacific needed to set-up its complete Iridium operations in less than one year... those little thing like sales, distribution and channel development, account management, equipment inventory, tarriffing, service packaging, market segmentation, public relations, customer service, maintenance and billing for the 25 countries and territories located in the Iridium South Pacific region.

It was a very, very fast start-up business. Financing was developed through its investors Bakrie Communications of Jakarta, and DDI Corporation and Kyocera from Tokyo. The vision of these investors, also investors in Iridium LLC and other regional operating companies, was that Iridium was a long-term proposition that would succeed. Other Iridium investors developed similar programs. Like our sister companies, we at Iridium South Pacific are making their vision a reality.

But financing does not customer satisfaction make. Iridium has had to make its global telecommunications a local event and provide a personal experience. That has meant developing local roots, the distribution chain that gets the product and service to the customer. It has meant a redefinition of the value to the customer.

Value in communications has had some strange definitions over the years. The head of the once giant Telegraph Company Western Union once said that the development of the telephone had "too many shortcomings to be seriously considered as a means of communication... (It) is of no value to us." Obviously it had little value to Western Union. That's why today paging and SMS supersede the telegraphs.

Value is relative. Those who have many needs and few communications options place value on the security and reliability of ubiquitous communications. Iridium's product and service propositions have a unique place in the value chain. It is not a service that can or will ever be all things to all peoples. It is a specialized service for those who need it. The key in making Iridium a market reality is simplicity of access. As an example, current wireless customers are able to access Iridium through World Roam.

Iridium roaming partners offer their customers the convenience of keeping their existing cellular phone numbers and single monthly invoices from their service providers while enhancing their service package through access to the Iridium network.

To date, Iridium has over 200 strategic service providers and roaming partners around the world, with additional agreements continuing to be signed in order to ensure global access for the Iridium system.

Over 100 countries have granted full licenses to allow the Iridium system access. In addition, we have identified priority countries that account for about 95 percent of our business plan and making progress with the other 139 countries that account for the fulfillment of ubiquitous world telecommunications service

In the South Pacific region, Iridium has service provider and roaming partners with Telstra, Optus and Telecom NZ.

Service providers are the vital connection between subscribers and the global Iridium network. In most gateways, they are responsible for end-user sales, activation and deactivation of Iridium service, account maintenance, and billing.

However, Iridium South Pacific will fulfill much of these functions in our region.

III. THE IRIDIUM TECHNOLOGY

In the "Gee Whiz" field of satellite and system technology development of Iridium, Motorola has been the prime contractor. There were scores of subcontractors such as Lockheed Martin for the main structure, the solar arrays, the attitude and propulsion systems, Raytheon for the main mission antennas and COMDEV for the gateway and crosslink antennas.

On the ground, at times Iridium resembles other satellite operations with satellite tracking sites in Canada, Hawaii and Iceland. Constellation operations are controlled from the Satellite Network Operations Virginia, USA with a back-up facility in Rome, Italy.

The resemblance to anything else ever deployed for communications stops when you consider the software and hardware technology that allows Iridium to provide global coverage. The most important technical aspect of the Iridium space Network is the North-South and East-West crosslinks that connect every satellite together, thereby linking every customer to every other customer at every point on the Earth.

Wherever the customer is located on or above the surface of the planet, they are always within the footprint of at least one satellite and often two or more. The pattern of 48 beams focused in each 4700 km diameter footprint on the earth is created by the three L-band based-array antenna panels, which is an important technological advancement applied to the Iridium satellites.

The other crucial element is the electronic switching hardware and software that geo-locates the user as soon as their handset is turned on and as part of every call placed on the Iridium system. In essence, Iridium is the only wireless telecommunications system that can provide customers the ability to communicate, anywhere any time.

Motorola and Kyocera, in the ultimate simplicity of a palm-sized handheld phone, make the basic customer interface to the complex technology behind Iridium. Motorola has developed Iridium portable, hand held phones and belt worn pagers. The Motorola Iridium handset will permit both satellite calling and cellular roaming with the same unit.

Kyocera, a leader in cellular telephones in Japan, is manufacturing two kinds of Iridium handsets. The Kyocera satellite-only Iridium telephone is a compact, lightweight tool for global communications for customers who travel to or live in areas beyond cellular coverage. For Iridium cellular world roaming, Kyocera has built pocket phones compatible with the worlds various cellular standards. For satellite calling, each handset is designed to fit into a lightweight cartridge that would provide subscribers an immediate, worldwide satellite connection through the Iridium constellation. The combination of these phones and the cartridge give users the convenience and economy of cellular telephone service where available and the global reach of Iridium satellite calling.

IV. MARKETS & SERVICES

Independent studies conducted by A.T. Kearney, Booz, Allen & Hamilton and Gallup indicated that 34 million people have a demonstrated need for mobile satellite services, with that number expected to grow to 42 million by 2002. Of these 42 million, Iridium anticipates 4.2 million to be satellite-only subscribers, 15.5 million satellite and world terrestrial roaming subscribers and 22.3 terrestrial roaming-only subscribers.

A universal necessity in conducting business today is ensuring that you are never out of touch. Iridium provides the unique solution to provide business with the essential communications tool for business today. This proposition of one phone, one number with the capability to be accessed anywhere, anytime is a message that our target markets - the global traveler, the mining, rural, maritime industries, government, disaster relief and community aid groups readily embrace.

In the macro marketing scale, Iridium developed a global brand marketing strategy that highlighted Iridium's unique offering. Never out of touch, anywhere in the world was the message that advanced the concept that now there was a service that could meet this need. Effective direct marketing, advertising and public relations has ensured that Iridium is the standard for premium mobile satellite service.

The initial Iridium target market has been the vertical market, those of the industry, government, and world agencies that have defended needs and far-reaching communication requirements. Also important will be both industrial and public sector customers. Often isolated in remote locations outside of cellular coverage, industrial users will use handheld Iridium satellite services to complement or replace their existing radio or satellite communications terminals.

Vertical market customers in sectors such as oil and gas production and exploration, mining, cargo shipping, power generation, commercial fishing, construction, and the media will turn to Iridium domestic and international satellite calling as a competitive advantage. Business operations in far-flung regions around the world will have seamless communications among their sites, their employees, and their customers.

Governments, multilateral development institutions, and humanitarian organizations will be among the Public Sector Users who will recognize the Iridium system as a new, cost-effective opportunity for them to manage their communications needs.

Other markets include the traveling professional who is in need of constant communications. Heavy cellular users at home and while traveling, these subscribers will require the convenience and immediacy of both satellite calling and cross-protocol roaming capabilities to keep in touch with their customers, offices, and families at all times.

Other prime Iridium customers will be travelers who spend most of their time in areas where conventional wireless communications are adequate. Yet due to conflicting cellular standards, these subscribers' own mobile phones will not work in many places that they visit. Existing cellular networks will carry most calls made by these subscribers, as they will rely most often on Iridium's cross-protocol roaming to make their lives easier.

In many countries with limited telecommunications infrastructure, national militaries, aid and disaster relief agencies, and civilian administrations of all levels will become Iridium subscribers. Take as an example the disaster relief agencies that have helped victims of Hurricane Mitch that recently devastated Central America. Iridium handheld phones were often the only communications systems that functioned in these devastated areas.

Governments and institutions based in the developed world that have widespread international commitments, often in areas of poor telecommunications coverage, will also rely on the Iridium solution to coordinate their operations more closely, allocate resources more accurately, and deliver assistance more effectively.

The customer uniquely perceives value. That is why the Service Provider will determine Iridium retail pricing. Iridium pricing will, therefore, be variable and flexible depending on the origin and destination of your call and which service you are using either satellite and/or cellular. Our pricing reflects our unique premium services and the ultimate convenience of being able to communicate where others cannot.

V. DISTRIBUTION

In October 1998, Iridium obtained a Global Mobile Personal Communications by Satellite - Memorandum of Understanding (GMPCS-MoU) from the International Telecommunication Union (ITU) across its 188 member country network.

This ensured that the Iridium subscriber equipment carries the new GMPCS-MoU Registry mark enabling unrestricted circulation of Iridium GMPCS terminals across country borders.

The Iridium handsets are the first GMPCS terminals to receive this authorization to use the GMPCS-MoU mark.

Distribution agreements have been negotiated with 260 distribution partners, these include 154 service provider and 153 roaming partner agreements, providing Iridium access to over 150 million wireless telephone subscribers in 121 countries and covering 3.6 billion POP's. Service provider integration and roaming partner compliance testing has been underway with 100 certified and already in commercial service. Compliance testing ensured proper signaling, interconnection, billing system interface, product handling and market readiness training. Compliance testing will be ongoing as additional service providers and roaming partners are added.

VI. CONSTELLATION, HANDSETS, SERVICE ACTIVATION

With the constellation completed, and the first handsets in operation since November, the Iridium system has gone through the rigors of commercial implementation. There have been several upgrades of the network software during the last few weeks with constant improvements in system performance, including robust L-band availability, cross link functionality, call establishment and call completion, decreasing dropped call rates.

Software enhancements will be ongoing as the system matures and commercial customers provisioned. Messaging, introduced just 7 weeks ago includes full alpha and numeric paging capabilities, short messaging services and voice mail, has confirmed the robustness of our paging and system integrity, and demonstrating exceptional performance.

The Iridium billing clearing house, Iridium gateway business offices and service providers and roaming partners around the world are processing call detail records and enhancing subscriber account information o enable subscriber activation. More than 3 million billing records from around the worlds have been processed and tested to date.

Like all good things, shortages occur. Because of demand, the initial allotments of Motorola handsets were globally distributed in late October 1998. Major production ramp-up began just 8 weeks ago. Each Territory has begun receiving incremental shipments following in the weeks and months thereafter. Kyocera made 5,000 satellite only handsets available to the market in November with multi-mode units now in the marketplace. Pagers were commercially available in the market in late-November.

The Iridium Global Customer Care program is designed to provide supplemental customer care for users of the world's first global wireless telephone network, the Iridium system.

As a complement to the customer care efforts of Iridium service providers, the Global Customer Care program supports service providers in offering quality service to customers who have traveled outside their home service provider area. This will ensure a consistent level of quality service is essential to the success of the Iridium system and in meeting the needs of a truly global customer base, representing numerous languages, diverse cultures, and round-the-clock network usage.

Languages representing more than 95 percent of projected Iridium users are inherent in Iridium Customer Care Centers. Translation services are available for the remainder, and the Iridium network will transparently route calls to the appropriate center. No matter where an Iridium user is located, he or she will always reach a customer service representative who speaks their native language.

Three Global Customer Care Centers located in Orlando, Zoetermeer and Sydney are strategically placed to enable the Iridium Global Customer Care program to be able to offer 24-hours-a-day, 7-days-a-week, 365-days-a-year support.

These call centers are inter-linked to Customer Care Centers like the Iridium South Pacific 24-hour center in Melbourne, Australia. Customer calls are answered immediately at one of the three call centers, and the Iridium network will transparently route the calls to the appropriate center, depending on the caller's needs.

These customer call centers' main duties will be: a) consistent 24-hours-a-day-by 7-days-a-week global support; b) easy toll-free (where available) access for Iridium users needing customer care; c)customer care in the caller's language for 95 percent of projected Iridium users; d) timely replacement for a lost, stolen or inoperative phone or pager; e) sales support to Iridium service providers. Prospective Iridium customers will be able to use a telephone number to obtain information about the Iridium services. Depending on the caller's needs, the customer service representative will transfer the callers to the appropriate service provider, or gateway, or otherwise accommodate the caller.

To receive assistance from Global Customer Care, an Iridium customer will be able to call - at no cost - with an Iridium phone. In addition, Global Customer Care will also be accessible from the public switched telephone network (toll-free where available, i.e., in more than 120 countries, or with a terrestrial wireless phone (toll charge).

Iridium's global marketing and advertising programs have yielded outstanding results. More than 1,000,000 prospective customers responded to Iridium print, broadcast and outdoor in-flight advertising and direct mail since the program's inception in late June 1998. Iridium distribution partners have received an estimated 200,000 inquiries directly, through co-branded advertising and direct sales efforts, bringing the total prospect inquiries to more than one million.

VII. IRIDIUM IN THE FUTURE

Iridium is the first and the market definer for global wireless telecommunications using the most reliable and sophisticated technology, at least a year, if not more ahead of its nearest competitors.

The biggest issues facing this new industry as a whole include more open and level competition worldwide and increasing deregulation thereby empowering the customer.

Iridium is an ongoing business and we are currently examining in great detail the markets, technologies, and economy of personal communications in the future.

The big challenge is to design the right system for the market that will exist in the future, in an industry noted for its incredibly rapid rate of change. The desire for long lifetimes that has driven the conventional satellite industry is inapplicable in the mobile satellite industry. It is inconceivable that an infrastructure designed today will satisfy the demands of the market ten years from now. Indeed, mobile satellites have typically been outdated before they are even placed into service.

Iridium will break that pattern by aggressively looking for improvements that can be made with the hardware we have, and by designing future hardware with a degree of flexibility that allow us to adapt to the market conditions of the future.

Return to Top View Full-screen

Digital Satellite Business Communications

Susan J. Irwin

Irwin Communications Inc, U.S.A

ABSTRACT

This paper examines the use of digital satellite technology for business communications and training. It summarizes the growth, composition and applications of private business networks in the U.S., Europe and Asia. The paper identifies the technological and market trends that are changing the way business television is used, with particular emphasis on the migration from analog to digital transmission. It discusses the impact that digital technology is having on private satellite networks as they evolve into broadband multimedia systems.

View Full Text

DIGITAL SATELLITE BUSINESS COMMUNICATIONS

1. ABSTRACT

This paper examines the use of digital satellite technology for business communications and training. It summarizes the growth, composition and applications of private business networks in the U.S., Europe and Asia. The paper identifies the technological and market trends that are changing the way business television is used, with particular emphasis on the migration from analog to digital transmission. It discusses the impact that digital technology is having on private satellite networks as they evolve into broadband multimedia systems.

2. INTRODUCTION

In the competitive global environment in which business is conducted, finding faster and more efficient means of communicating among widely dispersed employees is an increasingly critical need. The phenomenal growth of the Internet is an indication of the seemingly unquenchable thirst for instant acquisition of information. Private Corporations, government agencies and non-profit organizations have been using satellites for disseminating video and data communications since the early 1980's. However, while the number of private satellite networks has grown in number in the U.S., Europe and Japan, the high cost and/or lack of available satellite capacity and ground equipment has limited their usage, and in some cases, squelched their growth. The development of digital transmission and compression which has occurred in the 1990's has increased the availability of satellite time, decreased transmission costs and facilitated the development of new platforms to provide a greater and more flexible distribution systems. Digital satellite networks are increasingly being used for business television (BTV), distance learning, high speed data transmission and a wide range of multimedia applications.

3. DEMOGRAPHICS AND MARKET GROWTH

a. United States

The number of business television networks in the United States grew to over 200 in 1997. For the past five years the growth rate in the number of networks has been steady, at about 20% per year. From 1992 to 1997, the number of downlinks being used for BTV in the United States increased from approximately 31,000 to 74,000. Almost all new networks are digital, and most networks that were transmitting analog signals have now migrated to digital. BTV networks in the U.S. broadcast more than 35,000 hours last year. The industry sectors with the largest number of BTV networks are manufacturing, retail, financial services and IT/telecommunications. Increasing worldwide satellite coverage has made it possible for multinational companies to provide corporate communications and distance learning via satellite to their employees at widely dispersed remote locations. A significant growth area for private satellite networks in the United States has been the large VSAT networks which are used for two way data as well as for business television and interactive distance learning. Also, the implementation of direct broadcast satellite systems (DBS) in the U.S. has led to another cost-effective distribution platform for business communications.

b. UK and Europe

Business television in the UK and Europe grew from 14 networks in 1992 to over 80 in 1997. BTV is concentrated in the automotive, financial services and IT/telecommunications sectors. The number of permanent receive sites is estimated at 23,000 with many networks broadcasting from their country of origin throughout Europe. Several are global in coverage. About three fourths of the BTV networks in Europe and the UK are digital.

Approximately two thirds of European networks are UK-based with about one third based in France and Germany. A growing number of U.S. multinationals have formed Europe-based networks to service their overseas operations. Some of these networks operate entirely independently. Others turn around BTV programming originating from their parent network in the U.S.

Table 1: BTV Networks - U.S. and Europe

	# BTV networks	# BTV downlink sites
United States	210	74,000
UK & Europe	85	23,000

c. Asia Pacific region

Japan

Japan was one of the first countries to adopt the use of satellites for business communications. According to one of the largest Japanese distributors of BTV equipment, the number of networks in Japan grew to as many as 130, but up to 70% of them have ceased operations. Out of approximately 25,000 receive sites that were installed since the early 1980's, more than half are not being used. This dramatic reduction in usage is directly attributable to the economic downturn in Japan.

There are now about 30 private networks operating in Japan, including several educational and religious channels. As in the United States, the users of BTV in Japan come from a wide range of industries, including financial, automotive, retail and manufacturing. Examples of private companies with BTV networks are Tokyo Marine, Nomura Securities, Daiwa Securities, Toshiba, Seven-Eleven Japan Co., Ltd., and The Sumitomo Marine & Fire Insurance Company. There are also several public or semi-public companies with networks, such as the postal service and a number of power and gas companies. In addition, a number of preparatory schools are using satellite networks to transmit their educational courses.

Most of the BTV networks in Japan were installed using analog transmission, and 80% of the networks that are still active have replaced their analog equipment with digital transmission systems.

Australia

The use of satellites for business television and distance learning has been growing in Australia for a number of years and now includes private industry, government agencies and educational institutions. The major states of New South Wales, Victoria, Queensland and Western Australia all have varying stages of satellite educational networks. Two major banks in Australia operate BTV networks as well as one auto manufacturer and one health network. The largest of the BTV networks is operated by the National Australia Bank, which has about 1100 sites and transmits a couple of hours of programming per week. The only interactive distance learning network in the country is the one operated by Ford, which broadcasts about 210 hours of programming per month and is described more fully below.

Given the size of the country and dispersed population, satellites are ideally suited to deliver communications and training, and are used by several government agencies for distance learning. The Rural Health Education Network transmits educational programming to doctors and is comprised of approximately 500 sites in remote locations. One state is using BTV to train its police force.

At the same time that the geography, size (about the same as the continental United States) and dispersed population of Australia (about 18 million people) lend themselves well to the benefits of communications satellites, those same demographic factors have been obstacles to growth of the corporate satellite market. Installation and maintenance of sites and network implementation in such a huge and sparsely populated country are difficult and have been inhibitors to the use of BTV by many companies.

Other Asian Pacific Countries

Outside of Japan and Australia, the primary business television activities are taking place in regional networks, which are growing in number each year. These networks typically are operated by multinational companies that have sales offices, manufacturing plants or distribution centers in Asia. The driving force behind these regional networks is the expansion of existing networks that are based in the U.S. or Europe. Examples of companies with regional networks in Asia are NCR, Shell Oil, 3M, Boeing and Texas Instruments. By installing downlink sites in one or two locations in each country in the region, typically at the headquarters office or at training centers, these companies are able to maintain communications with a widely dispersed remote employee base. And because these companies all have active BTV networks they are experienced users of the medium. Since most of these networks have been installed within the last couple of years; they are generally digital and they employ electronic response systems for interactive distance learning. They transmit regularly scheduled programming, which for the most part is produced specifically for the region. Frequency of broadcasts varies from once or twice a month to two times a week.

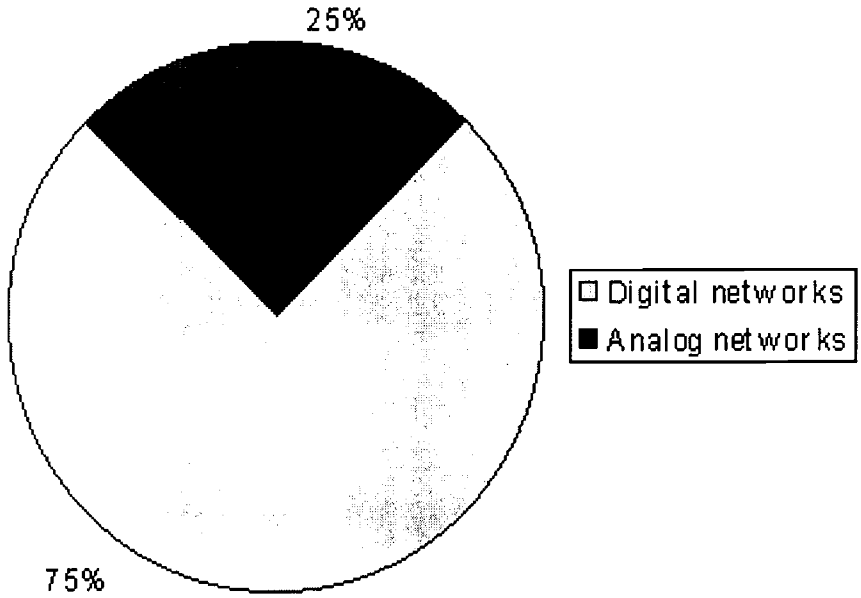
In addition to the regional networks described above, many multinational companies have special event BTV broadcasts that extend their U.S. or European BTV networks to their remote locations in Asia on an ad hoc basis. These broadcasts are almost always analog, and they often use transportable downlinks or locations other than their own sites where a dish is already installed.

Obstacles to growth in Asia

The trend towards loosening the traditionally stricter controls and oversight of the communications industries as found in many Asian nations will play a role in allowing these services and applications to expand in the region. Uplink restrictions and content regulation, as well as entrenched protections of the telecommunications markets in individual countries have contributed to limiting the use of private satellite networks in the past. For example, in Singapore, one of the two primary satellite communications hubs in Asia, BTV services have historically been considered to be telecommunications services and therefore fell under the authority of the monopoly provider Singapore Telecom. As new services emerge, regulatory authorities accustomed to overseeing clearly differentiated services will be challenged to deal with new services that do not necessarily conform to traditional definitions. Fortunately, the trend in Asia is clearly one of regulatory liberalization, which will help create a hospitable environment for the development of innovative new services, like private satellite networks.

According to one international business television service provider that has experienced a fair amount of success in the region recently, the obstacles can largely be overcome by establishing a presence in the region, with a sophisticated operations center, a help desk and local personnel that understand the languages and the cultures. However, they acknowledge that challenges still exist in the form of "monopolistic rules, difficult landlords, local licensing issues, importation restrictions and complicated tax structures".

Chart 1: Worldwide BTV Networks - Digital vs. Analog



2. MARKET AND TECHNOLOGY TRENDS

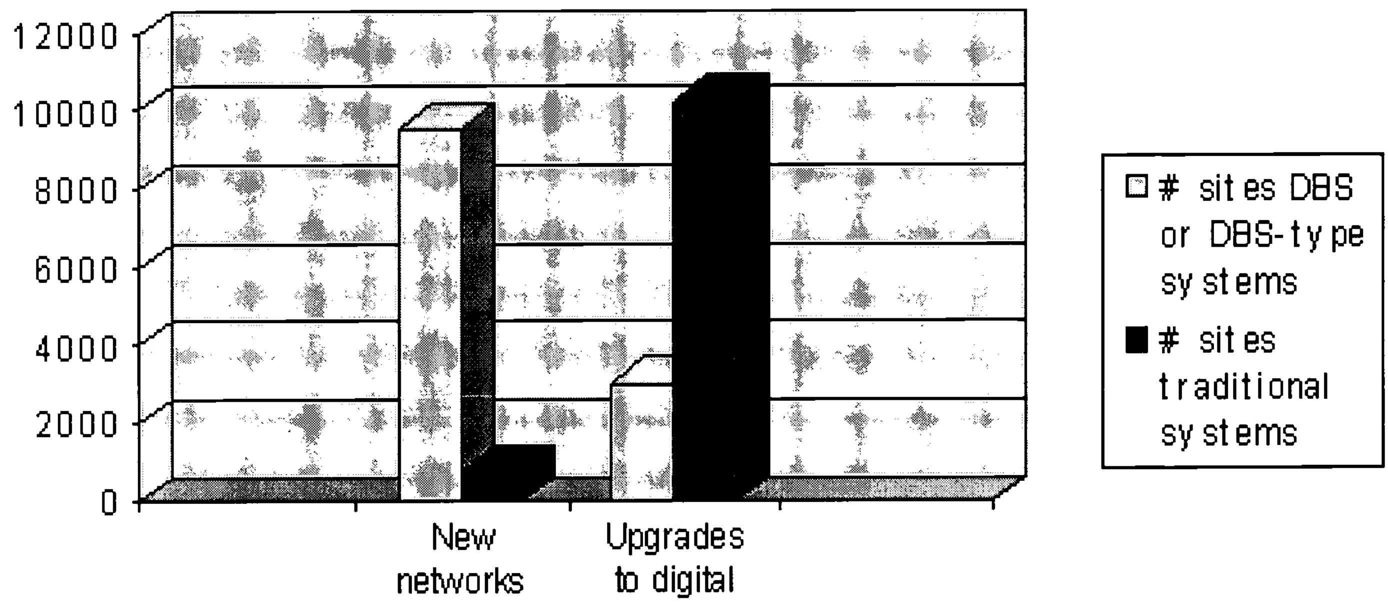
a. Direct Broadcast Satellite (DBS) systems

Taking advantage of the digital compression techniques that were developed for broadcasting high quality video, Direct Broadcast Satellite (DBS) systems began to emerge in the mid 1990's. These systems use high-powered satellites and digital transmission to transmit multichannel programming directly to the consumer, who has installed very small, inexpensive antennas thereby eliminating the need for cable television or terrestrial broadcast stations. Although the U.S. leads the world in DBS subscribers, currently numbering over 10 million, similar systems have also been launched in Europe, Asia, and Latin America. While their business strategies are based on revenues from pay television services targeted to consumers, available channels are being used to a limited extent to provide business television programming to people at work or to telecommuters working at home.

The U.S. DBS operators are charging business users high rates for satellite time, but the lower cost and convenience of the small dishes are attracting growing numbers of new U.S. BTV networks, as well as some of the BTV networks that have been transmitting analog signals with larger dishes and traditional Ku-band satellites. In addition, several manufacturers have modified DBS equipment to be used with medium-powered Ku-band satellites, making it possible to provide video and data to the corporate user who is interested in the lower cost consumer-type equipment, but not in the expensive satellite time or the multichannel entertainment services.

To measure the rate at which BTV networks are being distributed on DBS or DBS-types of systems vs. traditional systems, Irwin Communications tracked 52 U.S. networks that are new or have upgraded to digital in 1997/98. The 34 new networks and 18 upgrades have a total of 23,621 receive sites.

Chart 2: U.S. - New Digital Networks and Upgrades 97/98 - DBS/DBS-Type Systems vs. Traditional



Our research indicates that the majority of new BTV sites are receiving their programming via DBS distribution systems, while the networks that were already operational have elected to upgrade their sites with digital equipment but continue to operate with commercial receiving equipment on traditional satellite systems.

As the newly launched DBS satellite systems mature in Asia and Europe, it seems likely that the trend to make digital channels available for business programming will follow, and the result will be an increase in the growth of digital business TV networks.

b. IDL and Audience Response Systems

A majority of BTV networks are now being cost-justified on the basis of training requirements. Business television is shifting from a predominantly one-way medium for communications to interactive distance learning (IDL). Fast-moving companies with widely dispersed workforces are rapidly adopting new ways to use technology, including satellite broadcasting, to train their employees. This trend is evident not only in the U.S., but also in the UK and Europe, where costly, high-end production (previously limiting the growth of BTV) is being replaced by bottom-line driven, lower cost delivery of training.

There have been important new innovations that serve as tools for the delivery of distance learning. A growing trend is toward the use of automated instructor delivery stations where many of the elements of a TV studio are built into a single unit. These stations are designed so that an instructor can be completely autonomous in directing a presentation.

The growth of training for BTV networks can also be attributed to the growth and sophistication of audience response systems. Used for student interaction and feedback, these tools give instructors the kinds of responses to which they are accustomed in the classroom.

Many of these response systems are designed so that they can be integrated with an automated instructor delivery station. Working with standard presentation software and authoring tools the instructor uses a specially equipped computer to manage the class. The instructor can demonstrate with graphics and videotape, lead interactive student activities and keep track of students' progress. Students at the receive sites each have a telephone-type system that allows them to speak directly with the instructor and to key in responses to questions. Data gathered from these responses is sent back to the instructor site and compiled to gauge student comprehension and performance in class.

The first and most widely used of these response systems is the One Touch System, shown in Figures 1 and 2. Based on the degree of interest expressed in audience response systems, several competitors to One Touch have emerged in the past year, and most, including One Touch, have developed software-based systems, which utilize the PC rather than a tv monitor and a keypad.

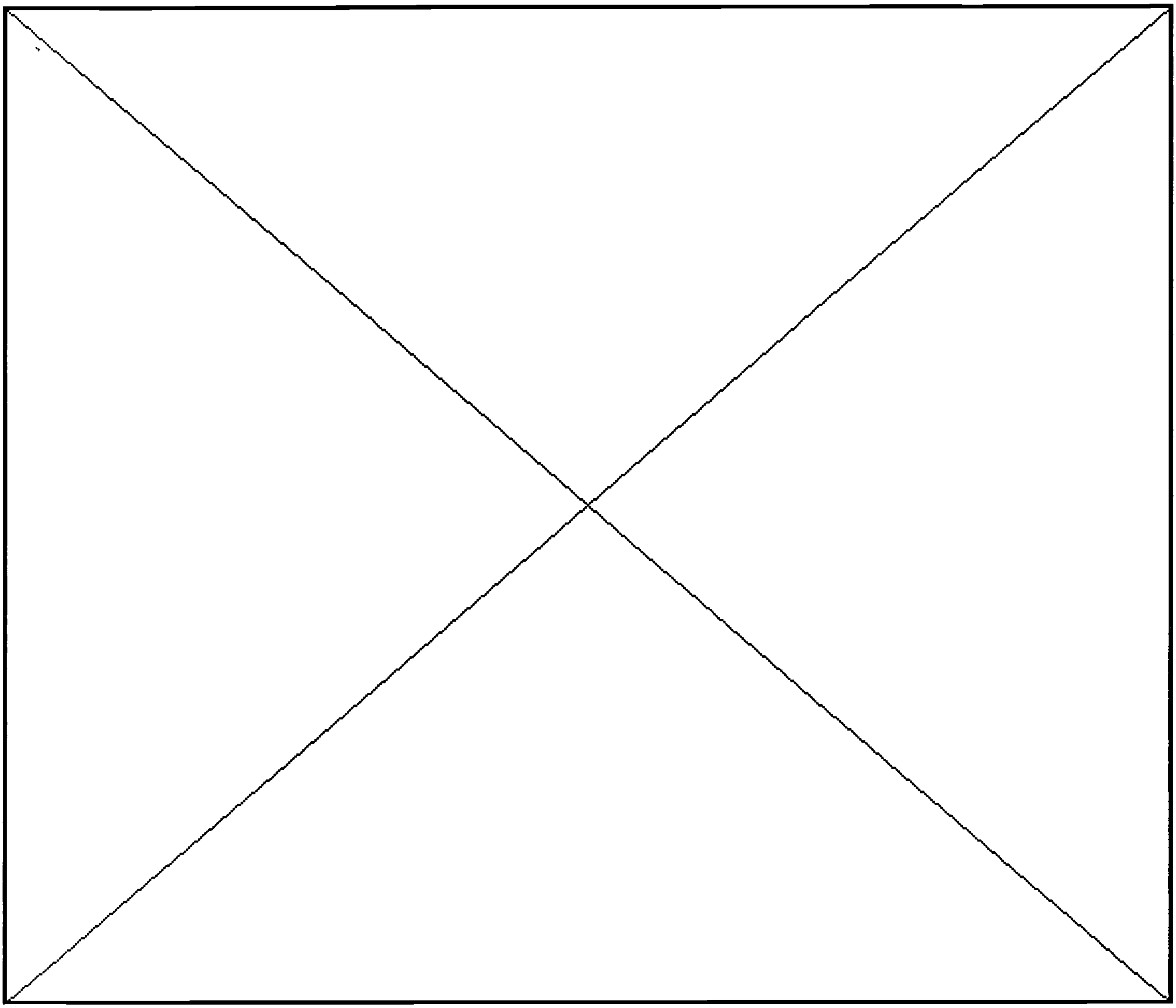


Figure 1 - A Typical Distance Learning Network using the One Touch System

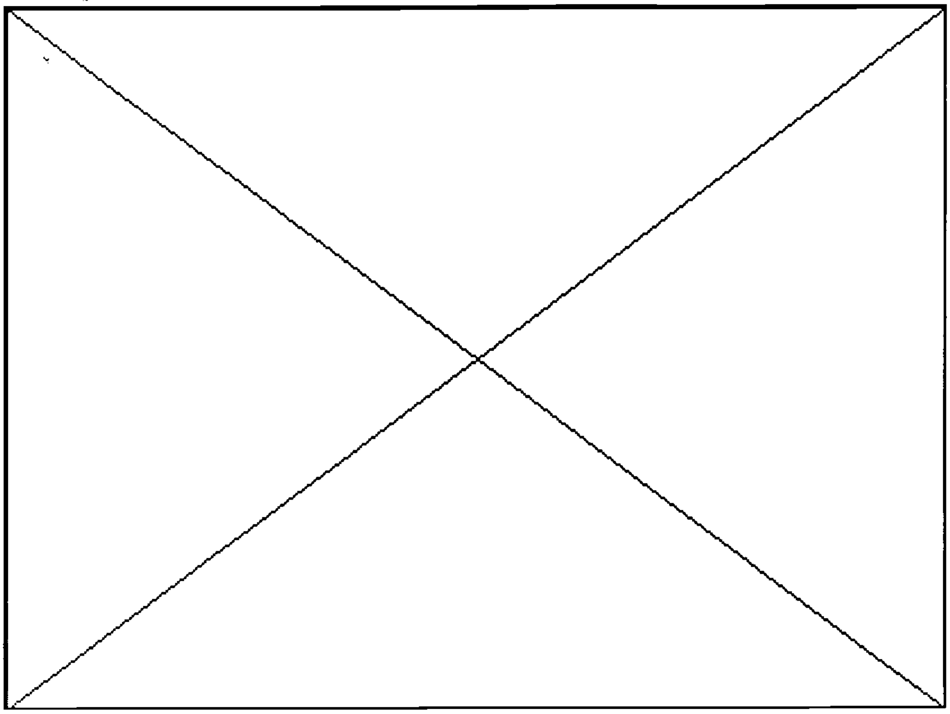


Figure 2 - The One Touch Viewer Response System keypad

c. IP-based Multimedia systems

The convergence of video, audio, graphics and text, plus the growth of the internet and intranets have led to a new generation of digital satellite products and services for business communications. The newest digital satellite offeringsare IP-based, and offer not only high quality video but also high speed data and other multimedia services which will connect in to a LAN, route signals to the tv monitor in a conference room, the pc at the desktop, the data center, the printers, and the fax machines. These new expanded systems are widely expected to increase the market for private satellite networks in the U.S., Europe, and Asia. It seems to be a universal business truth that while corporate training departments often have the greatest need for the satellite networks, the IT departments generally control the telecommunications budgets, and they have traditionally not been strong advocates of BTV. The new IP-based systems appeal to the IT managers as well as to the trainers and corporate communicators.

The newer advanced systems can provide access to corporate intranets, as well as being used to offset distribution of hard product (e.g. published materials, videotapes, CD ROM disks etc.). They are designed not only for live program distribution but also for store and forward applications, so that programs can be accessed on demand for later use. (See figure 3.)

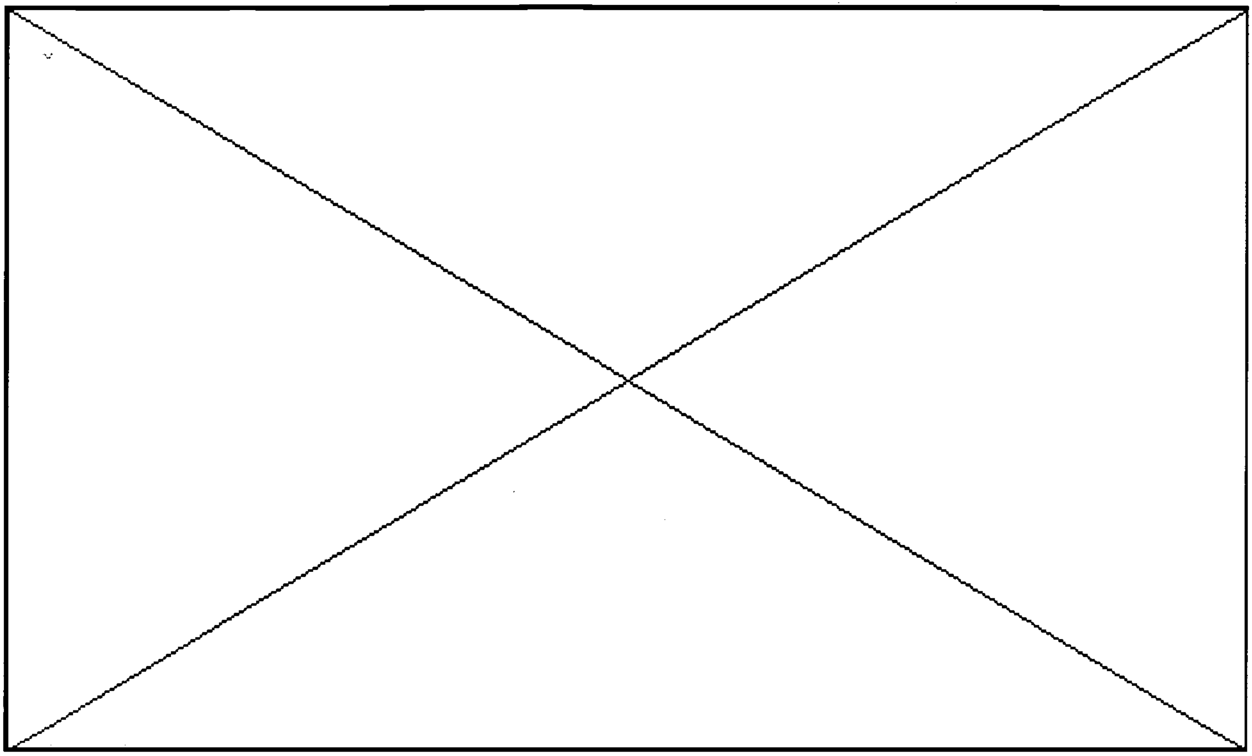


Figure 3 - Satellite multimedia system

While most of the current networks operating have already migrated to digital, they are still used almost exclusively for video, and the programming is primarily received on tv sets. However, in interviews conducted for this paper, business television users and service providers in Japan, Australia, Singapore and the United States agreed that the expanded capabilities of the types of systems described above are critical to the future of this medium. As an example, more than 30% of U.S. networks, in a recent survey, reported that they were actively planning data broadcast applications including using their system for access to a corporate intranet.

3. CASE STUDIES

The following are examples of organizations that are using or implementing digital satellite systems for business communications and training:

- Edward Jones. This large financial services firm based in the U.S. first implemented analog BTV in 1988, primarily as an add-on to its two-way data VSAT network. Now fully digital and expanded to 3,700 locations, its primary goal is to support its local investment representatives with training, marketing and information exchanges. The network broadcasts more than 80 hours a month with repeat programming to different time zones. In addition to using the network as a marketing tool, it is also used to offer a range of interactive training programs for employees, including investment courses, motivational training, basic sales skills programs and classes in new technology.

- General Motors. GM has been operating an analog BTV network in the U.S. since 1984, using it primarily for corporate communications. However, over the past two years, they have installed a sophisticated class room origination facility and have been piloting the use of IDL with a limited number of locations. Now the company has embarked on a plan to install digital receivers at 8400 sites where they will deliver multiple channels of digital video, audio and high-speed data to PC's at the employees desktops for interactive distance learning.

- The U.S. Air Force Institute of Technology created a Center for Distance Learning and a satellite-based broadcast network called the Air Technology Network (ATN). Today, the network reaches all 72 U.S. Air Force bases and teaches a range of required courses to more than twenty thousand students each year. Students in the satellite downlink classroom can see and hear the instructor over the television monitor and can ask questions and interact with the teacher and other students with a live, push-to-talk microphone.

- Ford of Australia. Ford has the only IDL network in Australia, employing the One Touch System for audio and data responses from its 265 dealer sites throughout Australia. According to the Fordstar training manager, "the network is used as a communications tool and for product training, knowledge and skill development of the dealer staff". The company broadcasts around 210 hours per month of programming, 90% of which are live and interactive. They are planning to increase both the size and the capabilities of the network, and intend to use it to transmit data as well as video.

- JC Penney Company. This large U.S. retailer first installed an analog BTV network in 1984, and was unique in its use of satellite television to display new merchandise to buyers and store managers. The network was used constantly and saved the company billions of dollars in travel and shipping of merchandise. The new products could be examined via live video, questions could be asked by phone and the products were ordered, without the buyers travelling to regional headquarters. Then, the company implemented a laser video disk system which replaced the satellite network, and briefly considered closing the network down. However, the training department learned of the new IDL applications, and began to utilize the network for training of store personnel. The network was converted to digital, expanded to all 1350 stores and each site was installed with the One Touch System. The network is used about 100 hours per month, with CD Rom files downloaded as well as live video. The company continues to explore new applications and and advances in satellite technology.

4. THE FUTURE

Satellite networks now use C or Ku-band frequencies, which allow for one-way video with voice or data interaction via phone lines or two-way data with the added cost of a VSAT terminal. Soon after the year 2000, however, the implementation of the planned Ka-band satellite systems is expected to make broadband satellite technology even more available and cost-effective, increasing the possibilities for business-to-business communications by providing more bandwidth and more sophisticated on-board processing. Therefore, in addition to the potential for lower transmission costs, high-speed data and the multimedia services described above, the ability to add two-way data and videoconferencing would be added to the menu of business services at costs that promise to be far below the current VSAT.

While Ka-band satellites may be the long-term answer for providing the digital communications needs of businesses, the newly developed multimedia systems which are emerging now will significantly change the current usage of satellite networks in the near term. Business television networks are evolving into broadband multimedia systems. Communications and training by satellite will continue to become more effective and more tailored to the needs of the audience as response systems become software-based, bandwidth becomes available on demand, receivers allow programming to be delivered live or stored and video, voice, data and the Internet are seamlessly interconnected.

Finally, the future of effective business communications is dependent on the marriage of appropriate applications and technologies. The strength of communications satellites is in their ability to provide distance-insensitive, point-to-multipoint transmission of video, audio and data signals, particularly where terrestrial circuits are non-existent or congested. Advances being made in high-speed terrestrial transmission may offer cost-effective alternatives to satellite distribution of video. The improvements in video streaming over the Internet may significantly reduce the need for traditional broadcasting of video signals. However, for the foreseeable future, communications satellites will continue to be the fastest and most effective way to transmit high quality video signals from one point to many, and the most viable means of reaching parts of the world where the telecommunications infrastructure is limited by geography or population density. The need for business communications to be faster, more far-reaching and more flexible can be satisfied with the satellite technology that is available now.

Return to Top   View Full-screen

Satellite Communications of Telephone Organization

of Thailand (TOT)

Kusolmongkol Suvarnkudht

Telephone Organization of Thailand, Thailand

ABSTRACT

The paper briefs Thailand's telecommunications, presents satellite communications, liberalization and increasing of satellite activities in Thailand at the starting point of structural change phase 1997-1998.

View Full Text

Satellite Communications of Telephone Organization of Thailand (TOT)

I. INTRODUCTION

The "Asian miracle" has, for a while, rested, because of the currency crisis. In a long view, it is good, because, before pacing into the next millennium, the qualitative reform of main components must happen. The Asian countries, in the past, stabilized their currencies by fixing them to the US dollar. Which is good for the low wage/high exporting countries and made them, in the past decade, the highest growth rate countries of the world. But when the comparative advantage of them is outstripped by the new cheaper exporting countries like China, Vietnam. The currency devaluations, of these tigers and tiger cubs, were naturally inevitable. That caused the crisis in the region. The qualitative restructuring must be processed, in every active area i.e. monetary system, finance, infrastructure, human resources, information management and so on, in the manner of a more flexible knowledge-base. Some thinking suggests that if the financial crisis deepen the WTO's free trade agenda may be potentially deteriorated. Regardless of continuous crisis most analysts believe Asia-Pacific (AP) region will continue to be better than elsewhere in the world [1]. However, the crisis, at the present, effects the telecommunications sector and Thailand.

In the telecommunications sector, one of the well-known recommended strategies for Asian supercarrier, in this period, are finding good alliances from the global carriers e.g. Concert, Global One, Cable Wireless etc. The telephone growth rate of AP increased rapidly in the past five years, but teledensity is still low. Therefore, the priority in AP is still basic fixed line expansion even the high revenue of non-basic services.

The Asian carriers will then be able to provide new innovative services such as internet, multimedia and personal mobile satellite services together with correcting of the telephone lack in rural area. Thailand, also, is in this direction. In this economic recovery period, the International Monetary Fund (IMF) has called for Thailand, concerning to telecommunications sector, to open up shares of Communications Authority of Thailand (CAT) and Telephone Organization of Thailand (TOT), the national duopoly telecommunications Organizations, to the public by year 2000.

The privatization of telecommunications operators in Thailand is government policy. The decision to increase competition by selling shares of state organizations and transforming royalty-based concessions into equity is finally approved. The government expects the liberalization in telecommunications by March 1999 including satellite communications. The author will report the liberalization of satellite communications in Thailand.

II. TELECOMMUNICATIONS IN THAILAND

Thailand, situated in South East Asia, is a member of ASEAN countries. It has an area of 513,115 square kilometers with a population of about 61 million and a common boundary with Laos in the north-east, Cambodia in the east, Malaysia in the south and Myanmar in the west. Thailand is divided in five regions : the central region to which Bangkok capital of country is situated, the North with Chiangmai, the South with Phuket, the East with Pattaya, the North-east with Ubonratchatani. The country is grouped into 76 provinces and 65,277 sub-villages (moo-ban).

Thailand's first telephone system was begun in 1881. A general public service was introduced in 1886 with about 60 subscribers. The first exchange system was inaugurated in 1907. The first long distance public telephone service was launched in 1928. TOT was established on 24 February 1954. The first SPC exchange was introduced in 1977. A cellularphone was first adopted in 1986.

Nowadays, there is one government agency (the Post and Telegraph Department, PTD.) and two state enterprises (the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT)) which are responsible for telecommunications under the authority of the Ministry of Transport and Communications (MOTC) which founded in 1890 but adopted this official name on 1 April 1912.

PTD was founded in 1883 during the reign of the famous King Chulalongkorn for the purpose of taking over telephone operations from the Defense Ministry. Its regulatory powers have been significantly decreased due to the establishment of TOT and CAT. PTD controls and manages radio frequencies, *regulates and coordinates domestic communications via satellite through integrated ground stations, acts as the representative of the country in international* activities relating to telecommunications and postal services including ITU, the Universal Postal Union (UPU), the Asian Electronics Union (AEU), and the Asia-Pacific Postal. PTD also studies advanced telecommunications technologies and prepares proposals for government consideration. PTD, has authority for licenses concerning satellite operating and acting by RADIO COMMUNICATION ACT B.E. 2498 (1995) and controls Thaicom satellite monopoly operator by the power of MOTC.

TOT, founded in 1954, is responsible for domestic and cross border telecommunications, will be detailed in other section, *provides public telephone services via satellite* by TELEPHONE ORGANIZATION OF THAILAND ACT B.E. 2497 (1954)

CAT, founded in 1976, provides international telephone services including data communications, radio communications, telegraphy, telex, cellular mobile telephony, postal and monetary services. CAT has implemented the transmission management network to its backbone, with digital cross connect, both configuration and fault management. Three International Telephone Switching Centers (ITSC) are operated by CAT ITSC I is located at Bangkok with 3,000 lines capacity. ITSC II, 3,000 lines exchange, is situated at Nonthaburi being in service from 1996. ITSC III, another 3,000 lines exchange, began in service from 1994 situated at Sri-Racha. These can support the demand forecast of international service until 2,001. CAT provides some parts of international communications via INTELSAT by COMMUNICATIONS AUTHORITY OF THAILAND ACT B.E. 2519 (1976).

The telecommunications monopoly ensured national security and social priority. When Thailand met the boom period around the mid-1980s, it was necessary to expand networks rapidly. In 1991, the Thai Cabinet invited the private sector to participate in telecommunications on a Build, Transfer and Operate (BTO) approach which was very famous and became the model of many developing countries. The Thai government awarded BTO contracts to the private sector for the installation and operation of an additional three million domestic telephone lines, marking the beginning of an huge national project.

The number of subscribers was raised from one million in 1988 to two million in 1993. The line capacity by the end of 1996 was more than six million. In the mid of 1998, the line penetration is 11.81. Whereas ,in September 1995, Thailand had the line penetration only 7.41. The success of BTO proves the deregulation, liberalization and privatization trends.

III. WAIT BUT READY

Liberalization of telecommunications , in Thailand, means change for the CAT and TOT. TOT's profit for the end of September 1997 was good at US$ 370 million on a revenue of $1 billion, 35% profit margin. CAT's profit was $230 million on a revenue of $780 million, 30% margin. But for the BTO private companies, it was different, because of a currency crisis that raised the debt of projects. And the importance for TOT and CAT, is that their privatization will force them to loose their benefits and regulatory right and to compete with other private companies on the same conditions. However, the specialists believe that there still is room for growth in the telecommunications industry in Thailand especially in mobile, multimedia and high speed internet, more over, the basic line expansion is always priority. In the current situation, five of TOT's projects have been postponed and three infrastructure projects have been retained. Some part of Thai telecommunications depends on the currency situation, at least, until the end of the year 1998. The sector will be in "filtered" stage, like the dampened situation that was filtered to a more smooth phase. It is potentially ready to rise again to the highest growth rate of the world once the crisis has gone. The visit of AT&T, Ericsson Siemens, Singtel, Chungwha telecom and so on , to Thailand Telecommunications in 1998 has proved this fact.

The structural currency change may last 1-3 years then most analysts believe that the AP growth will continue to outstrip growth elsewhere in the world. The liberalization and privatization of telecommunications is expected to be a catalyst for this cycle in Thailand.

IV. VISIOIN OF THAI TELECOMMUNICATIONS

Thailand's economic growth, according to UN report in the decade of 1985-1994, is the fastest of the world, 8.4% by average, but now Thailand is in a structural change of finance and banking. The bad loans and investments made this sector weaken. The government expects that the recession will be ended in the third quarter of 1998. Then the recovery phase will start.

Some visions in Thailand predict that the world of privatization, liberalization and deregulation will be regulated by agreements or laws from Organizations at global level like WTO, UN, etc. . That will increase standards of living but it will be more beneficial for developed countries than developing ones the economic competition will be very high. The regrouping of countries will be augmented. The roles of Information Technology (IT) will be increased and diversified. However, such benefit will be fully useful , only if there is the real competition , not just the transformation of monopoly from government to private sectors [2] [3]. Dr. Supachai Panitchapak who is high on the list of candidates to be the next director of the World Trade Organization (WTO) gave Thailand's ten-years vision [3] as follows :-

1. Have an international standard system.

2. Besides domestic liberalization, it is necessary to develop the competence with neighbors and other countries.

3. Set friendly negotiation policy on network interconnection with neighbors and develop Thailand to be a regional center with geographical advantages.

4. Promote Research and Development (R&D) by supporting fund, budget and research institute.

5. Develop full circuit of any supporting industry such as electronic parts, computer, etc.

6. Restructure tax system for supporting related modern business.

7. Search for good strategic alliances for preparing Thai telecommunications in globalization era.

8. Promote Thailand's competence in the world market by improving rules, investments and trade balancing internationally.

Telecommunications has significantly shown a determining role in economic growth, country progress and public welfare, therefore, Thailand should set telecommunications as one of the main strategies for continually developing the country. Thai telecommunications in the globalization era will be expanded and accelerated at a continuously increasing rate. Today, communication over network does not only , mean connection to trade, investment, finance, service and material world altogether ,but also , means connection to an abstract world such as concept, value, learning process and cultural globalization. TOT is fulfilling responsibility in this role.

V. TELEPHONE ORGANIZATION OF THAILAND

TOT was established according to the TOT ROYAL DECREE ON FEBRUARY 24, 1954. The main objective has been to provide domestic and border telephone service for the users throughout the Kingdom of Thailand, since the past four decades ,meanwhile, TOT has also provided other value added services i.e. cellularphone, Datanet, Videotex, etc. to support the business operations, economics and social development nationwide. Table 1 shows some statistics of TOT. Moreover, TOT. co-invests with or permits any satellite operator to interface with domestic network.

Table 1. Some Statistics of TOT for the last 3 years (Source : TOT)

	30/6/1996	30/10/1997	30/4/1998
	1996	1997	1998
Fixed service POTS line capacity	6,635,191	7,005,400	7,296,666
Fixed service POTS line in service	3,862,353	4,846,029	4,958,732
Public telephone line	51,516	65,633	75,029
NMT 470 MHz cellular	52,179	49,399	41,106
NMT 900 MHz cellular	812,070	863,738	852,551
ISDN service (in service)	428	1,053	1,189
Number of employees	26,209	26,111	26,081
Line capacity : 100 population	7.80	11.57	11.81
Line in service : 100 population	6..34	8.00	8.05

Public telephone : 100 population	0.09	0.13	0.17
Paging subscriber	583,612	813,467	782,841

VI. SATELLITE COMMUNICATIONS IN THAILAND

The development of AP satellite communications was very successful. The market could close to 10% of total world telecommunications market by year 2005. The demand for satellite applications will keep growing for at least 10 years in period of 1995-2005. Twelve satellites on average will be launched each year until 2005. Deregulation, new operators, new technologies and services are useful to the causes of this phenomenon. The liberalization of satellite in Australia by the year 1997 and in Thailand by the year 1999 will also accelerate this business in AP region which is the most dynamic market of the world. We can not ; therefore , conclude that the fluctuated satellite market in 1998 is on downward with the currency crisis. The basic services demand is still strong in the forecast.

This section will report the domestic satellites of Thailand which concerns the services of TOT., as domestic and border telecommunications monopoly.

1. *Technology Trends of satellite*

Size, weight and power will be reduced, especially the price will be decreased twenty times in twenty years per one kilograms weight. Deregulation, privatization and liberalization will increase the competition in market and products. The quality of service will be better e.g. BER (10 exp.-11) System Availability (99.99%) propagation delay will be decreased. The ITU-R report on new services(APT meeting 1997) indicates that, in the next few years, we will develop ATM system and SDH submultiplex system in satellite for information superhighway or cellular satellite.

The development directions of satellite are broader bandwidth, less propagation delay, better broadcasting, inter satellite communications, more intelligence. These trends are also applicable with Thai markets.

Trends of Thaicom satellite series are on board processing, two-way signal regeneration, switching and routing capability, steerable beam, cellular beam, Inter satellite Link (ISL.), regional and global network, higher transponders and power multimedia services, cheaper service cost, wider coverage area (source:Thaicom)

Satellite communications is an efficient information infrastructure in the rapid changing telecommunications environment. The advantage of satellite is superb coverage, high flexibility and high reliability. Therefore, we can use satellite system as stand by or supplementary network to any terrestrial networks, both in urban and rural areas.

Domestic satellites were first introduced in 1984. In the first stage Palapa satellite were used by military and major government networks, by the Supreme Command Headquarters and PTD as responsible operator. Besides Palapa, Thailand also rents INTELSAT. and ASIASAT. The first domestic satellite communications, then began.

On 20 September 1990, MOTC invited the private sector for concession domestic satellite projects. The cabinet gave approval on 4 June 1991. This project, thus, became a national project. As a result, The minister of MOTC and Shinawatra Computer and Communication CL (now, Shinawatra Satellite PLC. (SSA.)) signed the contract of domestic satellite operation on 11 September 1991 permitting an eight years domestic monopoly and a thirty-years concession. All old domestic systems must change to Thaicom after their leasing contracts are over. However, CAT is still responsible for overseas communications via INTELSAT.

SSA launched three satellites Thaicom-1 on 17 December 1993, Thaicom-2 on 7 October 1994, Thaicom-3 on 17 April 1997. Main applications are VSAT, Direct to home (DTH) broad casting, Video conference, TV & Radio broadcasting, Satellite News Gathering (SNG), High speed internet. Thaicom also provides foreign services to Cambodia, China, India, Myanmar, and Vietnam.

2. New operators [9]

On 17 March 1997, *the Minister of MOTC gave the policy to PTD concerning liberalization of Thailand satellite communications by increasing the new operators considering to the benefit of national and international*, and therefore increasing the competition in this market.

PTD, therefore, established the **Working Group of preparation study on increasing the new satellite communications operator.** The responsibilities of this WG are to study and analyze the suitability of increasing new satellite operator in the function of transponder competition for the purpose of supporting the future demand before reporting to PTD and MOTC.

The WG concluded that it is suitable to increase the new operator :-

1. Due to, the demand and supply of satellites and transponders in Thailand, and AP. (including ASEAN and Asia(excluding middle east)) (please see

Table 2, 3, 4, 5).

2. The environment of economics social and globalization trends.

3. The end of the monopoly concession contract in September 1999

4. This project will start before full liberalization of overall telecommunications. with the value of 1-5 billion bahts; therefore , the project must be undertaken by the Private Participation is state Activities act B.E. 2535 (1992)

However, the WG noted that the study was scoped only in fixed-satellite service, the KU-band application will be more used, the newcomer must prepare to face the high competition in ASEAN, Asia and AP satellite market.

The transponder capacity of Thailand is now 44+(2) in C-Band and 18+(2) in Ku-Band

The forecasted transponder demand in 2005 is 60.25 in C-band and 31.80 in KU-band at around 8.59 % growth rate.

Table 2. Demand forecast of Thailand's Transponders years 1999-2005 in C-Band

Increasing Rate(%)	1999	2000	2001	2002	2003	2004	2005
3	33.0646	34.0566	35.0783	36.1306	37.2146	38.3310	39.4809
8.5887	36.7501	39.9065	43.3339	47.0557	51.0972	55.4858	60.2513
15	41.2178	47.4005	54.5106	62.6872	72.0902	82.9038	95.3393

[Source : MOTC, Thailand]

Table 3. Demand forecast of Thailand's Transponders years 1999-2005 in Ku-Band

Increasing Rate(%)	1999	2000	2001	2002	2003	2004	2005
3	17.4518	17.9754	18.5146	19.0701	19.6422	20.2314	20.8384

8.5887	19.3970	21.0630	22.8720	24.8364	26.9696	29.2859	31.8012
15%	21.7551	25.0184	28.7712	33.0868	38.0498	43.7573	50.3209

[Source : MOTC, Thailand]

Table 4. Asia Pacific Transponder Supply Forecast

year	1999	2000	2001	2002
MOTC, Thailand	1,601	1,593	1,578	1,506
Other Source	1,245	1,237	1,222	1,150

[Source : MOTC, Thailand]

Note 1. Other sources : Goldman Sachs, Euroconsult, Research, Asia Sat

2. Unit in Transponders

Table 5 Asia Pacific Transponder Demand Forecast

Source	Year	1999	2000	2001	2002
	%increase				
MOTC,	12	1121.13	1255.67	1406.35	1575.11
Thailand	7	977.58	1046.20	1119.24	1152.81
Other Sources	7	1114	1192	1276	1365

[Source MOTC, Thailand]

Note 1. Other sources : Goldman Sachs, Euroconsult, CIT Research, Asia Sat

2. Unit in Transponders

3. *Mobile Satellite Service (MSS)*

Besides fixed satellite service, there is also MSS or Global Mobile Personal Communication by Satellite (GMPCS) or Satellite phone (Satphone) which is the mixed applications between Cellular phone and Satellite communication system altogether on the purpose of communication to anyone anywhere by anytime in voice, data, fax paging and multimedia, and the user terminal will communicate directly to the satellite. [4]

There are many MSS projects, which will be born before year 2000, invested by international telecommunications groups. They cost many billion US$. The advantages of MSS are superb coverage area by satellite performance, global service : one terminal one number on every country, and probably high subscriber forecast based on huge cellular phone demand forecast. The terminal models, therefore, are designed to be in dualmode, satellite mode and cellular mode working complementary to each other.

The customers are separated in 7 groups; International Business Traveller (IBT), Industrial Manufacturing, Management level of company, Government, Maritime, Aeronautical, In-bound Tourist and general people, the biggest group. The coverage areas are divided in 3 groups; national coverage, regional coverage, and global coverage. Two satellite switching trends are satellite with grounded switching and the more complicated satellite with on board processing and ISL. (Inter Satellite Links). The advantages of the later one are independent to ground station, cheaper investment in ground infrastructure, independent to local operators, reduction of taxes and royalties from ground service, less political problems, increasing route selectivity and opportunities of delay reduction. [5] Two kinds of oriented service are; Data communications and mobile telephony.

Three kinds of satellite Earth Orbit are GEO., MEO., and LEO.. The advantages of LEO. are lower power consumption, and low propagation delay. The disadvantages are hard to control, complicated technology, needed many satellites, shorter life time, higher risk. The advantages of GEO. are cheaper terminal, lower risk, long life, wider coverage. The disadvantages are expensive satellite per unit, and high delay.

There are five MSS systems that will open projects in Thailand during 1998-2000 (Please see Table 6 .) At the beginning, the terminal prices will be about 800-1000 US$. The tariff rate will be about 1 US$ per minute.

Table 6. Five MSS systems being opened in Thailand

system	satellite technology	cellular technology	Coverage area	local entrepreneurs	Service opening

Iridium	LEO (780)	TDMA	Global	Thai Satellite Telecommunications	September 1998
ACeS	GEO (36,000)	TDMA (GSM)	AP and global cellular roaming	ACeS regional Services	July 1999
Globalstar	LEO (1,400)	CDMA	Global	Global star Thailand	1999
ICO	MEO. (10,355)	TDMA	Global	CS Communication	2000
APMT	GEO. (36,000)	TDMA	AP and Cellular roaming	Future hitech	2000

April 1998 [4]

VII. THE SATELLITE COMMUNICATIONS IN TOT

There are three kinds of satellite services in TOT as follows :-

1. *Domestic satellite communications*

TOT has applied the long distance system among provinces since 1964. In 1989, the system became all digital microwave system. That year, in November 1989, Typhoon Gay damaged Southern Thailand including the main microwave systems. The telecommunications between upper and southern Thailand was cut off. The restoration was very hard due to flooded area. It lasted thirteen days to put all systems in normal condition. MOTC has, consequently ordered TOT to protect its terrestrial communications. TOT ,therefore, implemented its first domestic satellite system as,

1. Reserved Routes for supporting heavy traffic hours

2. Emergency Route in case of disaster

Acumen Co.Ltd. was awarded the concession on 27 June 1990 for 15 years operation with 10 Earth stations, 17 meshed routes, 1080 circuits. The hubstation with Network Control Center (NCC) is in Bangkok. Other nine stations are distributed in different provinces. Seventeen routes are interconnected to twelve PSTN exchanges of TOT.

2. *Integrated Satellite Business Network (ISBN)*

After signing the domestic satellite contract, TOT and Acumen Co.Ltd. signed another continuos contract, ISBN, on 20 March 1991 for 15-years operation. The ISBN service is value-added service that provides data, voice among Host Computer (or database center) and its data terminals through satellite communications and digital data network nationwide. Two types of earth station are classified as; Personal Earth Station (PES) providing both data and voice services , and secondly Telephony Earth Station (TES) providing only voice. ISBN is also used as a reserved network in case of disaster. TOT, moreover, provides the ISBN service to border countries such as Combodia, Laos and Myanmar. Please see Table 7 **statistics** of ISBN terminals.

Table 7. Shown statistics of ISBN terminals

Year	1993	1994	1995	1996	1997	
Number of ISBN Stations	214	340	684	889	1,002	

3. *Rural Telephony Satellite Project*

The aim of the project is to expand the telephone service in remote areas which have no access to a telephone service i.e. subvillages (moo-ban), tourists localities, etc.. Satellite equipment, the installations of hub stations in telephone exchanges, together with remote stations in community centers and/or service area on islands, in the mountains, and other remote areas which no other radio systems could reach. The project would install, in 1998, 8,948 rural satellite telephones in Thailand. This project catalyzed the dynamic of satellite communications in 1996-1998 of this country.

Thailand approved the National Masterplan of Telecommunications Activities Development (NMTAD) on 4 November 1997. The direction of plan, responses the government policy concerning to rapid environmental change caused by information era, is more dynamic and flexible regulatory process, increasing competition at regional and global level. Its objectives are constructing the Information Technology (IT) Infrastructure as fundamental economic, revising organization roles, Liberalization and privatization, Consumer protection, Development of Human resources relative laws and Research and Development, Initiating Thai telecommunications manufacturing and pushing Thailand to be regional center [7] [8].

According to NMTAD, The first important step is full liberalization in Thailand within 1999 then develop to fully global liberalization in 2006 as agreement of WTO. TOT have to transform from state enterprise to company, then find the strategic partner to hold the share not more than 25% at last, become a full public company.

The Telephone Organization of Thailand ACT B.E. 2497 (1954) has to be canceled. All concession contracts with TOT have to be transformed in private contracts. The study of this transformation is on process. The satellite communication contracts both in MOTC and TOT have to be also transformed. However, The liberalization of satellite communications will certainly be originated. That will initiate some satellite dynamics in Thailand and AP region in 1999.

VIII. CONCLUSION

Thailand has faced with unrequired currency crisis, since mid of 1997. It will long about 1-3 years to be recovered. The suitable qualitative improvement, in this crisis-based opportunity, will make Thailand change from low wage country to more knowledge-based country. The deregulation, liberalization, and privatization of Thai telecommunications would be one important catalyst of the process. Every step should be paced carefully including TOT's transformation and privatization.

Thailand's liberalization of satellite communications, in 1999, will coincidingly happen in this period. In these few years, the satellite growth of Asia-Pacific region is in peak period. Not only , Thailand' satellite growth rate is not, the same as other developing countries, slowed by crisis owing to TOT's VSAT rural telephony and other valued-added services,(i.e. high speed internet, TV broadcasting, etc.) but also the second satellite liberalization of AP region, behind Australia, will catalyze new demand, new market to this region. Moreover, Thailand will face five new MSS in service during 1998-2000. This is the trend of barrier breakdown in region. If it is true, The high potential demand will rise again plus in this satellite market.

TOT's privatization has in details, to wait government policy. The ASEAN hub can be real with the merging of terrestrial and satellite networks in geographical advantage. The well-prepared border telecommunications can rapidly expand to South East Asia Region with the good intention of telecommunications liberalization.

IX. REFERENCES

[1] Feeling the pressure, Melissa Riley-Tones, Asian Communications, June 1998

[2] Vision 2030 : Thailand in the next three decades : militarian view , Wattachak (daily journal) , issue 3746 , 30 April 1997.

[3] Vision in Thai Telecommunications,Kusolmongkol SUVARNAKUDHT, National Communications Day's Yearbook 1997 ,Ministry Of Transportation and Communications(MOTC).

[4] Mobile satellite services, Krungthep thurakid, Journal April 1998

[5] Laser satellite network, Arnon and Kopeika, Proceeding of IEEE vol.85 No.10 October 1997

[6] National Masterplan of Telecommunications Activities Development, MOTC July 1997

[7] IT 2000 Social Equity & Prosperity "Thailand IT Policy into the 21 st century, NECTEC, Ministry of Science and Technology

Return to Top View Full-screen

Satellite TV Broadcast Market in China

Lin Sun

China Telecom Resources, U.S.A

ABSTRACT

Satellite television broadcasting (STB) in China has experienced significant changes during the past 15 years. It began in 1985 by leasing C-band transponders on the Intelsat Indian Ocean Region (IOR) satellite (Intelsat IV, 66 degrees E). In 1988, China launched two Dong Fang Hong communications satellites (DFH-2A-1 and 2A-2), and they soon became the primary media for TV broadcasting. In the early days of development, satellite TV was used to cover remote areas where conventional microwave relay was costly to deploy and maintain, and the shortfall of space segment supply and limitations in transmission technology seriously restrained STB's potential.

View Full Text

Satellite TV Broadcast Market in China

I. INTRODUCTION

Satellite television broadcasting (STB) in China has experienced significant changes during the past 15 years. It began in 1985 by leasing C-band transponders on the Intelsat Indian Ocean Region (IOR) satellite (Intelsat IV, 66° E). In 1988, China launched two Dong Fang Hong communications satellites (DFH-2A-1 and 2A-2), and they soon became the primary media for TV broadcasting. In the early days of development, satellite TV was used to cover remote areas where conventional microwave relay was costly to deploy and maintain, and the shortfall of space segment supply and limitations in transmission technology seriously restrained STB's potential.

II. SPACE SEGMENT =

The essential driving force behind STB development is space segment supply which has significantly increased the viability of STB and expanded its role from supplementary for remote areas to the mainstream of mass entertainment. CTR estimates that by 1998 total space segment supply (available to China) reached over 170 transponders, including 26 for STB (one for DAB). Figure 1 lists space segment supply and STB channel lineups currently operational in China.

In addition to STB, increase in space segment has also contributed to the strong surge of communications networks, especially private VSATs. For example, China is a major customer of AsiaSat-1 and APStar-1 for its domestic voice and data (interactive and broadcast) services in the region with 36 DOMSAT stations (IESS Types A and E) as part of PSTN backbone and more than 8,300 VSAT stations for various applications including voice, data broadcast and interactive data.

Since 1990, space segment supply has followed a parallel pattern. The first is from foreign sources represented by AsiaSat and APStar. Since 1990, both companies have made a total of seven launches and reported two failures (AsiaSat-3 and APStar-2). Faced with the recent economic downturns in Asia and declined demand for space segment, both companies have lowered their objectives for transponder lease ratios and operating revenue, and even have postponed some subsequent launches. The region is expected to experience a period of oversupply especially in Ku-band, which will likely aggravate competition in transponder leasing price and customer churns.

The other source is domestic including the DFH series and purchased in-orbit satellites. Although DFH only holds a small share in the domestic space segment market (about 11% in 1998) and is faced with increasing difficulty in competing with foreign satellites, it is premature to conclude that China will abandon its space programs. Satellite technology is a strategic building block of China's defense infrastructure and transmission media for its vast size and the deep concern for national security, it is determined to continue its own research and development on the technology with some help from foreign companies. An alternative is purchase of in-orbit satellites which turned out to be cost-effective. By far China has purchased two in-orbit satellites (Spacenet-1 renamed ChinaSat-5 in 1993 and Spacenet-2 renamed ChinaSat-5R in 1997), and they have provided some interim solution mainly for domestic satellite network (DOMSAT).

Figure 1

**Lineup of Satellite TV Programs
(As of October 1998)**

Satellite	Position	Operator	Band/Transponder #	Program	Format	Transmission	Coverage
APStar-1A	134°E	APT Satellite	C/2B	Ningxia TV	PAL	MPEG-2	Domestic
			C/2B	Chongqing TV	PAL	MPEG-2	Domestic
			C/2B	Gansu TV	PAL	MPEG-2	Domestic
			C/2B	Hainan TV	PAL	MPEG-2	Domestic
			C/3B	Shandong ETV[1]	PAL	Analog	Domestic
			C/4B	CCTV-1[2]	PAL	Analog	Domestic
			C/5B	CETV-2[3]	PAL	Analog	Domestic
			C/7A	Guizhou TV	PAL	Analog	Domestic
			C/7B	CETV-1[3]	PAL	Analog	Domestic
			C/8A	Yunnan TV	PAL	Analog	Domestic
			C/8B	Zhejiang TV	PAL	Analog	Domestic
			C/9A	Tibet TV	PAL	Analog	Domestic
			C/10A	Sichuan TV	PAL	Analog	Domestic
			C/10B	Shandong TV	PAL	Analog	Domestic
			C/11A	Xinjiang TV	PAL	MPEG-2	Domestic
			C/12A	CCTV-7	PAL	Analog	Domestic
			C/12B	CCTV-2	PAL	Analog	Domestic
AsiaSat-1	105.5°E	AsiaSat	C/11	CCTV-4	NTSC	Analog	Regional
AsiaSat-2	100.5°E	AsiaSat	C/3B	Henan TV	PAL	MPEG-2	Domestic
			C/3B	Qinghai TV	PAL	MPEG-2	Domestic
			C/3B	Fujian TV	PAL	MPEG-2	Domestic
			C/3B	Jiangxi TV	PAL	MPEG-2	Domestic
			C/3B	Liaoning TV	PAL	MPEG-2	Domestic
			C/5A	Inner Mongo TV	PAL	MPEG-2	Domestic
			C/5A	Guangxi TV	PAL	MPEG-2	Domestic
			C/5A	Shaanxi TV	PAL	MPEG-2	Domestic
			C/5A	Shaanxi TV	PAL	MPEG-2	Domestic
			C/5A	Anhui TV	PAL	MPEG-2	Domestic
			C/5A	Jiangsu TV	PAL	MPEG-2	Domestic
			C/6B	Guangdong TV	PAL	MPEG-2	Domestic
			C/6B	Hunan TV	PAL	MPEG-2	Domestic
			C/6B	Hubei TV	PAL	MPEG-2	Domestic
			C/6B	Heilongjiang TV	PAL	MPEG-2	Domestic
			C/9B	CCTV-4	PAL	Analog	Regional
			Ku/4	CCTV-3--8[4]	PAL	MPEG-2	Domestic
			Ku/5	Hebei TV	PAL	MPEG-2	Domestic
			Ku/5	Tianjin TV	PAL	MPEG-2	Domestic
			Ku/5	DAB[5]	Audio	MUSICAM	Domestic
			Ku/5	Beijing TV	PAL	MPEG-2	Domestic
			Ku/5	Shanxi TV	PAL	MPEG-2	Domestic
			Ku/9	CCTV-4	NTSC	Analog	Domestic
Galaxy-3R	95°W	PanAmSat[6]	Ku/13	CCTV-4	NTSC	Analog	US/Caribbean[7]
PAS-2	169°E	PanAmSat	C/1	CCTV-3, 4, 9	PAL	Analog	Pacific Rim
PAS-3	43°W	PanAmSat	C/15	CCTV-3, 4, 9	NTSC	MPEG-2	Africa
PAS-4	68.5°E	PanAmSat	C/1	CCTV-3, 4, 9	PAL	MPEG-2	SA/ME[8]
PAS-5	58°W	PanAmSat	C/9	CCTV-3, 4, 9	NTSC	MPEG-2	Americas
SinoSat-1	110.5°E	Sino Satellite	TBD[9]	Shanghai TV	PAL	MPEG-2	Domestic
Total Transponders Used			26				

Notes: [1] Provincial educational TV network. [2] China Central TV, national network. [3] China Educational TV, national TV university. [4] Scrambled. [5] Digital audio broadcast by the Central People's Radio Station (32 stereo channels including foreign languages). [6] A subsidiary of Hughes Electronics Corp. [7] For direct-to-home (DTH) service. [8] South Asia/Middle East. [9] As of October 1998; broadcast scheduled in November.

Sources: CT Resources; State Administration of Radio, Film &TV, 1998.

The year 1998 marked an important milestone for China's space segment market with at least two crucial additions. In May, ChinaStar-1 (Lockheed Martin A2100A) was launched which carries 18 C-band (12 x

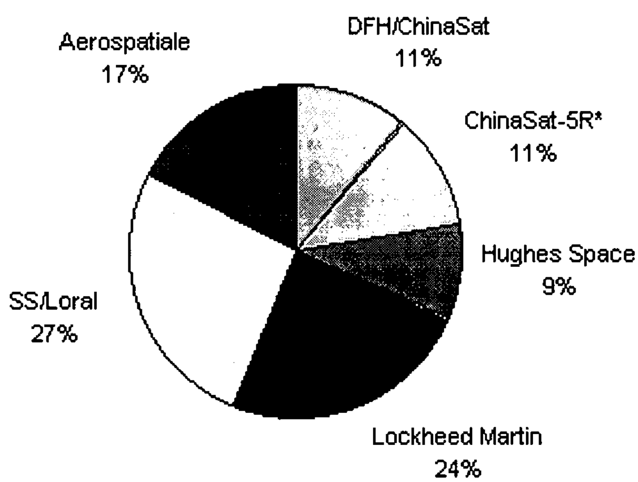
36MHz and 6 x 72MHz) and 20 Ku-band (16 x 36MHz and 4 x 72MHz) transponders. In addition to its high capacity, ChinaStar-1 renders a high transmit power with an EIRP of 41dBW (C-band) and 52dBW (Ku-band, center beam) capable of transmitting high-quality video broadcast with an antenna size of no more than .5m. In July, China launched SinoSat-1, another powerful satellite supplied by Aerospatiale (Type 3000 bus) with 24 C-band (36MHz) and 14 Ku-band (54MHz). Compared to ChinaStar-1, SinoSat-1 incorporates DTH digital video broadcast service with a Ku-band EIRP of 50dBW and specifically targets China as a primary market. In addition, a ChinaSat-8 (Loral 1300) is scheduled for launch in December 1998 with 36 C-band and 16 Ku-band transponders that is also intended for DTH service.

The launch of the two rival satellites has not only supplied additional space segment especially in high-power Ku-band, but also heralded a new era in China's satellite communications where alternative operators can now compete with ChinaSat (a virtual monopoly) in providing quality segments and customers. As a result, new strategies and alliances have been developed such as the entry of Aerospatiale and joint development in on-board components such as antennas and amplifiers. These developments have transformed China's space segment market to a higher diversification that is expected to continue in the future. The market share in space segment available in China is shown in Figure 2.

Figure 2

Market Share by Satellite Suppliers

1998



*Notes: * Previously Spacenet-2 purchased in 1997 by ChinaSat.*

Shares include C- and Ku-band transponders and scheduled launches.

Source: CT Resources, 1998.

III. **SMATV**

Traditionally, STB market in China is divided into two segments, SMATV and DTH (see next section). Satellite master antenna TV networks began in 1985 after China's DOMSAT (domestic satellite network) went to operation. Typically, an SMATV system uses one or more large size antenna (4.5-5m for C-band) with motorized tracking system to ensure accurate pointing and reception quality. TV signals (analog and digital) are then demodulated, demultiplexed (in case of multiple video carriers) and de-scrambled (in case of pay programs). In China, most SMATV systems are operated by cable TV companies that mix satellite signals with other program sources and transmit through coaxial cable networks. Depending on the network capacity and cost factors, a typical cable TV network in major metropolitan areas delivers between 20-25 channels of programming. CTR estimates that by 1998, there are about 1300 public cable TV networks in China covering about 70 million households.

SMATV started as a means to reach areas where over-the-air broadcast could not cover due to the line-of-sight effects. As the demand for more programs and diversity continued to grow, SMATV has become an indispensable mass media for most urban households; in many cases, it is replacing conventional TV broadcast. SMATV service is inexpensive relative to average household income (about US$2.5-4 a month), which has significantly contributed to its success considering its reception quality, wide selection and programming for special interests. It is expected that digital satellite broadcast will gradually phase out analog SMATV networks beginning in 1999, taking advantage of savings in space segment, scrambling, and expandability in value-added services such as video-on-demand, pay-per-view and information service.

In recent years, SMATV has begun to evolve from serving general interest to specialized programs that target specific audiences such as children, education, sports, and movie. Some networks also carry programs in local dialects to appeal to local audience and ethnic groups. Since the early 1990s, overseas programming entered China by way of regional satellites including AsiaSat and APStar. However, some of the coverage and the western reporting style were taken by the Chinese government as hostile and subversive, and have been banned from public reception since 1993, except for commercial establishments that cater to foreigners such as hotels and luxury condominiums. In reality, however, the policy has not been strictly enforced due to the ambiguous definition and difficulty in dismantling antennas in individual homes.

Although foreign programming is illegal by official policy, there have been increasing signs that the Chinese government has gradually relaxed its stance toward foreign news organizations and TV programs. For example, Phoenix Satellite TV (PST), a production company based in Hong Kong, began to broadcast its programs into China since early 1996. The program is carried by AsiaSat-1 and broadcast 24 hours a day. Apparently, its orientation of pro-China and soft entertainment has won permission from the Chinese government. Ironically, part of Phoenix is owned by Rupert Murdoch's News Corp., which was the culprit that caused anti-foreign programming campaign in 1993. It is unclear whether the success of PST is an indication of market opening, or just an isolated case due to its close ties with China (partially funded by the Chinese media).

SMATV is a huge and profitable market in China sustained by the large number of audiences and strong cash infusion from advertisers. Total operating revenue (including advertising) will see an annual growth rate of 16.4%, reaching US$8.4 billion by 2005 (Figure 3). On the other hand, it is no mistaken that broadcasting is an official business in China with strong political obligations and severe punishment terms, no non-government SMATV ownership or operation is permitted, and the probability of change is slim in the foreseeable future.

Figure 3

Revenue of SMATV in China

(1998-2005)

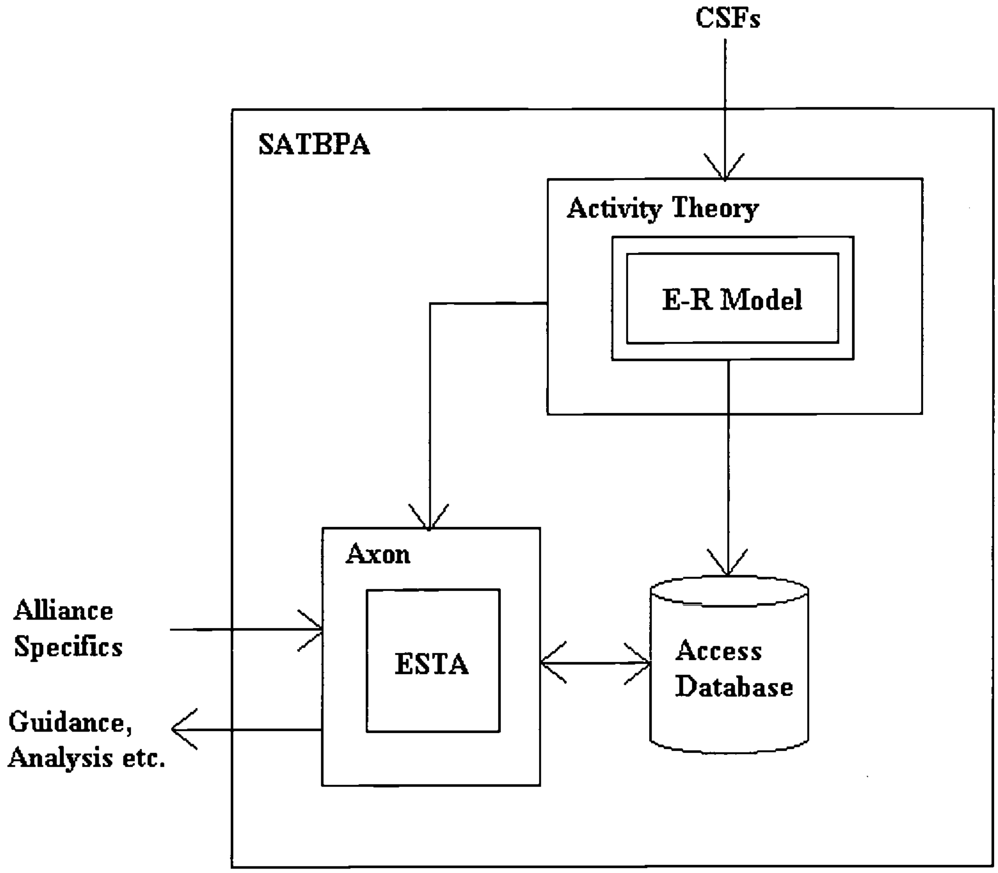


Figure 3: Compatibility framework.

Note: Including value-added services, e.g., VOD and supplementary information services.

Source: CT Resources, 1998.

The following aspects will likely have direct effects on SMATV development in China during the next few years.

1. Television is the most pervasive electronic media in China which ultimately presents high potential for entertainment (program production, distribution and cable TV network construction) and a whole new services, including telephony and information services (data broadcast and Internet access). In fact, trials of multimedia services (VOD and Internet) have begun in selected cities using fiber optic as the local distribution media and satellite as a long-haul feed.

2. It is expected that all provincial and some local (municipal) STB will be launched by early 1999. The current analog STB programs will remain for sometime due to investments in headend, satellite receiving equipment (antenna, LNB, and baseband), and leasing contract with satellite operators. The migration to compressed digital SMATV systems has been underway that, over time, will render tremendous savings on

transponder leasing, per channel costs, and expandability to integrated services. By October 1998, total digital STB channels exceeded analog (1.8 to 1). The ratio is expected to increase to 7 to 1 by 2005 (including DTH services, see Figure 4).

3. As the result of recent launches, more Ku-band transponders have become available for SMATV. At present, most SMATV programs are on C-band due to the scarcity of Ku-band supply. There is a high likelihood that some of existing services will cut over to Ku-band in the next few years, and the new programs will adopt Ku-band as a mainstream media for SMATV. Although the quality of Ku-band signal is more susceptible to rain and other environmental conditions, the degradation can be reduced by increasing C/N margin (antenna size, polarization level, LNB noise temperature). Moreover, Ku-band requires smaller size antennas that reduces requirements in installation, tracking, and wind load.

4. As SMATV/cable TV administration, the Ministry of Radio, Film & TV (now the State Administration of Radio, Film & TV, SARFT) has the technical capability, operating experience and financial support to compete with China Telecom networks, by far the country's virtual monopoly. Although the SARFT lost its government functions as the result of restructuring last year, its core assets have been retained. For example, SARFT still owns and operates China's massive over-the-air and cable TV networks, and it continues to develop a national fiber optic backbone with 33,000 km deployed in major urban markets. In addition, SARFT has conducted trials for multimedia services in selected cities that provide VOD, videoconferencing, Internet access, cable telephony and stock market trading. It is apparent that with more fiber cable deployed in local cable TV networks, the scope of SMATV will inevitably extend to communications services which, in turn, will generate more demand for the space segment especially Ku-band.

5. To a certain extent, the dissolution of Ministry of Posts & Telecommunications (MPT) and establishment of Ministry of Information Industry (MII) is a positive sign for China's SMATV market. First, the new SARFT is detached from government functions such as industry regulation and arbitration, which may have relieved itself from certain political obligations but concentrate on technological and market development. Second, in recent years, China has been under tremendous pressure in joining the World Trade Organization (WTO) whereby it must fulfill a long list of promises, including opening domestic telecom services market, that may have ripple effects on the SMATV market. In the wake of rapid market development and a more agile SARFT, SMATV will likely present a viable opportunity to foreign investment. Nonetheless, the change, if any, will be gradual and incremental, and Chinese companies will hold majority interest and control operations.

IV. DIRECT TO HOME

Satellite DTH market in China is still at an early stage in development with strong growth potential and some uncertainty. In order for the market to attain growth momentum and overcome uncertainty, several issues must be resolved.

Compared to SMATV, DTH service is much simpler in hardware configuration and pointing/tuning process. A typical DTH kit (minimum) consists of a small aperture antenna (typically 1.2-1.8m for C-band and .35-.5m for Ku-band in China), an LNB feeder, and an IRD (integrated receiver-decoder) receiver. Additional LNB, computerized antenna tracking system and multi-switch are needed if programs come from two or more satellites or different frequency bands. Compared to SMATV/cable TV distribution system, DTH is easy to set up, designed for personal use, and does not incur monthly charge (except for scrambled programs).

The analog version of direct broadcasting began in China in 1990, when a number of domestic and foreign video programs became available to China after AsiaSat-1's launch. By 1993, total TVROs grew to 100,000 before the government decided to ban individual satellite reception in fear of increasing exposure to western media and reducing viewership for domestic programs. The campaign lasted for about a year, but the policy was never strictly enforced due to the difficulty in soliciting households and dismantling antennas. The policy turned out to be more of a temporary measure for political purposes, so that it was abandoned later without official explanation. The market regained some growth with restrained momentum due to the concern of government repercussion and less appealing DTH programming.

According to official statistics, there are 300,000 TVRO stations in China including digital DTH. CTR research shows there are between 800,000 and 1 million terminals in use, especially in suburban areas where SMATV/cable TV networks do not cover and many well-being residents can afford the price of hardware. Most of TVROs are located in the eastern and central regions.

China's DTH market has the following characteristics that affect its future growth in one way or another.

1. The government policy toward DTH is ambiguous. The policy that led to the crack down of TVROs in 1993 has never been reinstated, but there is no new DTH initiative either. Apparently the government is taking a "wait-and-see" approach to let the market grow on its own terms before time is appropriate to make an assessment. It also suggests that the government recognizes the benefits of DTH market and what it may contribute to the quality of life and general economic development. The somewhat relaxed regulatory environment will encourage antenna and IRD suppliers, and pay TV service providers for marketing and sales; but on the other hand, it also presents high uncertainty in which direction the market is headed and whether the current growth can be sustained.

2. DTH is faced with strong competition from SMATV. Although some DTH enthusiasts have tuned to as far as Palapa, Thaicom and JCSAT, most DTH programs are on the same satellite(s) that also serve SMATV customers. DTH can appeal to personal interests like foreign programming, but the person must be able to understand the language which limits the number of potential audiences. Unlike the West, China has not developed a market that exclusively target DTH customers in terms of program format, fee structure, and volume. There are active discussions lately in the Chinese broadcasting industry on development of a policy framework, and program production and distribution, in anticipation of an early development of DTH market.

3. Price for DTH setup can be a prohibitive factor for growth. At present, a complete DTH system costs between US$640-1,500, including antenna: US$180-550, LNB: US$50-75, and IRD (imports): US$410-850. The total price is significantly higher when a service fee is charged (for pay programs, at about US$2,500 a year). Since 1997, there has been a strong surge of domestic IRDs (about 30 different brand names), most have comparable features such as Chinese language menu, dual SCPC/MCPC operation mode, dual Ku/C reception, and power-off memory setting. More important, domestic IRDs have very competitive pricing (as low as US$250), which also has had a strong impact on imports. At present, competition is essentially among products from China, Taiwan and Hong Kong, taking a lion's share of 75%.

This price range is way too high for most Chinese whose average income is just about US$1,200 a year, which will likely have long-term effects on DTH growth in China. One of the main reasons that contributed to the rapid growth of analog TVRO in the early 1990s was the low price (US$250 in average), and the same rationale is relevant to the DTH market to bolster demand and encourage competition. In order to lower the price to a more acceptable level, major IRD manufacturers must find ways to transfer core technologies such as DSP and tuner for local assembly. CTR believes the pace of DTH technology in China will accelerate once the market demonstrates sufficient momentum for growth and large-scale DTH programming on Ku-band proliferates.

4. Following the trend in the US and elsewhere, DTH technology and products will continue to improve and generate commercial incentives for equipment manufacturers. For example, C/Ku integrated LNB and dual-IF IRD enable reception of both C- and Ku-band programs; integrated antenna/feeder kit can simplify installation. It is expected that with more programs on Ku-band, these issues will become a strong marketing tool for manufacturers and distributors. Innovative products will not only leverage a company's competitive position, but also help lower the price that ultimately generates sales.

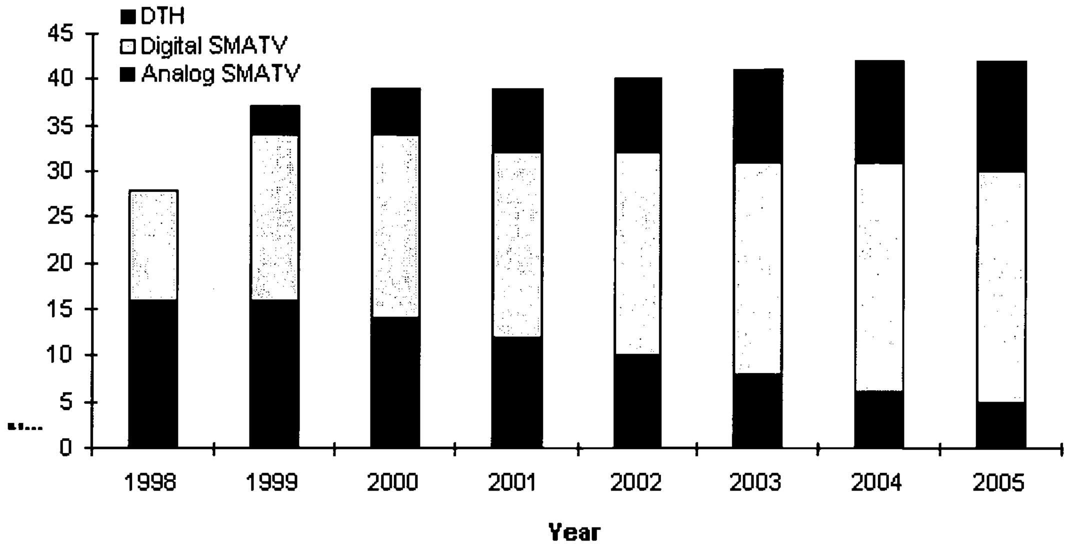
5. Programming. At present, there is no production specifically designed for DTH in China; much of DTH activity is on foreign satellites in the region. The potential peril in this aspect is that if most future DTH households will only be able to receive foreign programming in addition to regular STB, it may invoke negative reactions from the government. There have been discussions on how to develop an industry mechanism that coordinates production and trade of DTH programming, as well as scrambling techniques for pay TV and the possibility of value-added information services.

At present, policy for DTH service in China is sketchy and inconsistent. However, every indication appears to be positive that the government is taking a laissez-faire stance at least for the short- or mid-term. Meanwhile, the market is being pushed by both official broadcasting administration (SARFT) and industry groups (such as China Electronics Industry Association and Broadcasting Equipment Association). Another peripheral force is DTH enthusiasts who are not only actively engaged in finding new satellites/channels for DTH programming, but also publish newsletters covering a wide range of subjects on DTH service, from satellite acquisition, signal strength measurement, to product comparison and pricing. In May 1998, China launched *Satellite & Cable TV Weekly*, a new magazine dedicated to the SMATV and DTH market, with some government endorsement and participation. Although the people directly involved in digital DTH are still small in number, their lobbying effort may have strong impact on policy making amid abundant space segment supply, and the awakening of a potentially profitable market for video production and distribution.

Figure 4

Space Segment for DTH Service in China

(1998-2005)



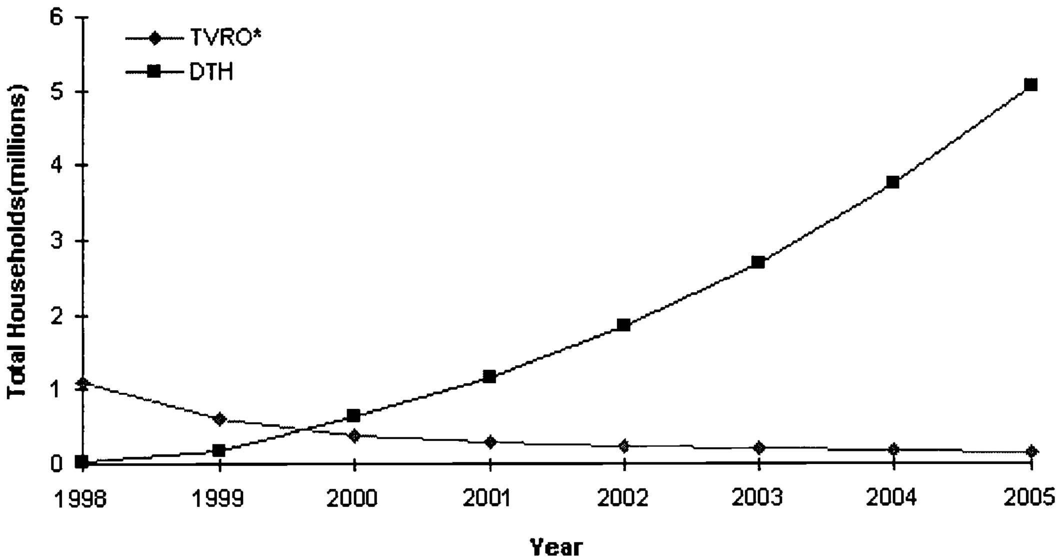
Source: CT Resources, 1998.

China's DTH market should see an increasing activity beginning in 1999 both in the number of users and program availability in the region. It is estimated that there are more than 600 STB channels in the Southeast Asia region, and nearly 500 channels are broadcast in compressed digital format. Moreover, Chinese language channels have grown to more than 40. The recent addition is the launch of ST-1, a communications satellite jointly owned by Singapore and Taiwan. The satellite has an effective coverage of China's most populated regions. Despite the sensitive issues of content particularly that of foreign origination, technology and the perceived opportunity to capitalize on the market will eventually prevail with continuing development of a market economy and increasing freedom in media and the entertainment industry. CTR expects a steady growth pattern in DTH services, reaching 12 transponders and a coverage of over 5 million households by 2005 (excluding analog TVRO, Figure 4). During the same period, number of analog TVROs will experience a steady decline due to programming phase-out, inferior operation-cost ratio (space segment, uplinking, limited capability), and the surge of programming on Ku-band (Figure 5).

Figure 5

Projection of DTH Households

(1998-2005)



*Note: * For analog broadcast programs.*

Source: CT Resources, 1998.

The growth of DTH will heavily concentrate in urban areas, especially in the eastern and central regions, estimated at about 80% of total DTH households, and certain rural areas where a well developed local economy will generate higher disposable income and demand for more variety in media consumption.

V. CONCLUSIONS

The future of China's satellite TV broadcast market will be essentially pushed by DTH sector, which the country seems to be on the verge of a strong take-off. Analog SMATV will see a gradual decrease due to the government policy of gradually phasing out the number of uplink programs and migrating them to the compressed digital video format (MPEG-2/DVB). Digital SMATV, though had some strong growth during 1994-1996, will likely stabilize due to the finite number of uplinks and programs available (ultimately 40-45). When programs exceed this threshold, operating revenue may decline caused by decreases in audience exposure, advertising, and increasing costs in uplinking equipment including space segment. Moreover, as a large number of urban households have already hooked up to cable TV with satellite feeds, there will be a diminishing margin for additional operating revenue.

The decrease of analog satellite TV broadcast also will have a negative effect on TVRO, most of them were set up during the early 1990s. As more space segment has become available and more domestic and regional satellites are carrying digital video programs, the prospect of DTH as a major STB market sector in China is becoming very attractive, especially for remote areas where conventional TV and SMATV networks are not feasible.

To a certain extent, DTH does not engage in direct competition with SMATV among some urban population groups, because it provides personal freedom by offering a great selection of programs which are unavailable on SMATV for mass audience. DTH also can provide special programming for different interests such as sports, music and movies that will have strong appeal to the young urban population. Another potential of DTH service is to provide value-added information services to a large number of households, such as newscast and information bulletin board.

DTH in China is also faced with uncertainties in two aspects. First, the government's policy on DTH development is unclear. By far there is little official regulation on developing domestic DTH market, such as restrictions on setting up antennas and receiving foreign programming, which can be taken as a sign of let-go, but it can also leave room for the government to step in when it believes the market moves too fast or for the fear of out of control. In a market that is heavily affected by policy, suppressive regulation can have serious consequences on company strategies, public psychology and growth momentum. The other potential hurdle is market conditions, which include 1) there is a lack of coordinated effort in video production, distribution, and uplinking. Without a government initiative, the establishment of such an industry group will be difficult; 2) at present, the DTH market is acting on its own with little marketing activity from leading manufacturers or distributors. As a result, most consumers are not aware of the service and sources to obtain the product. This inactivity may have been caused by concerns of unpredictable regulation; and 3) despite drastic drops, price for a basic DTH kit is still considered high given the public interest and average household income. The short-term effect of high price will be the largest constraint for service penetration especially when there is limited option for alternative programming. The entry of domestic products has forced the price down, but again an unclear policy could undermine the effects of competition.

Despite of these issues, DTH in China should see an adequate growth rate for the next few years given China's vast size, dispersed population and the strong demand for media and entertainment. The country experienced serious setbacks in direct satellite broadcasting in the early 1990s that was taken by many as an indication of a premature market; in-depth analysis, however, rejects the notion of linear inference for a complicated market environment like China and shows that the market is making steady steps toward a promising future.

Return to Top   View Full-screen

System Signaling Seven (SS7) Deployment in Canada's

Remote Territory Using Satellite Based SCPC DAMA Architecture

Michael Martin

Telesast, Canada

ABSTRACT

As a solution for remote communications, geo-stationary satellite based voice and data technology, and the associated infrastructure are improving at a dramatic pace. Where once plain old telephone service or POTS was the acceptable standard for remote areas, the demand for greater capability, improved voice quality and ubiquitous supplementary services has changed the landscape.

The purpose of this paper is to share with PTC members Telesat's planned development and deployment of a System Signaling Seven (SS7) platform to a recently implemented satellite based telephony and data network servicing twenty-six isolated villages throughout northern Canada (specifically located in the provinces of Ontario and Quebec).

View Full Text

System Signaling Seven (SS7) Deployment in Canada's remote territory using satellite based SCPC DAMA Architecture

Introduction

Telesat is presently undertaking a major network upgrade program in cooperation with Hughes Network Systems (HNS) of Germantown MD. This project involves the development and implementation of SS7 (in compliance with Bellcore GR-246) to an existing Telephony Earth Station (TES ™) Demand Assigned Multiple Access (DAMA) network presently serving 26 remote communities in Northern Canada. The anticipated completion of this program is 2nd quarter 1999.

System Signaling Seven protocol is definitely nothing new and has been actually been discussed in detail on many past papers presented to the PTC. SS7 was originally introduced in1976 and was documented by the CCITT in the early 1980's. What is new is the development of a fully functional SS7 platform, as the signaling protocol, which will replace the existing MF signaling architecture as part of an existing DAMA satellite network. The associated features e.g. CMS & AIN of SS7 are intended on improving the service to the isolated serving area. This protocol is anticipated to also allow for easy deployment of future applications not yet developed.

History

The original infrastructure (star based SCPC system) supporting these communities had been in place since the early 1970's. Although very reliable, it offered only adequate voice quality with very slow fax or inband data. Also, all calls from one remote village to another were double hopped through the southern-based hub and often ran into echo problems due to the limited capability of the technology from that day. The double hop also created an inefficient use of space segment and earth station resources.

In 1989 Telesat began a detailed engineering search for replacement technology which would offer greater capability, improved voice quality and more efficient space segment utilization. The Hughes Network System TES™ product was selected from many possible vendors primarily because it was the most advanced from a network control standpoint and at that time offered greater flexibility in switch/peripheral interface capabilities. It should be appreciated however that many vendors like Scientific Atlanta, ViaSat, Gilat and STM have similar products and functionality today.

DAMA Implementation

Telesat then spent the next several years and a few dollars working with HNS to bring the product up to acceptable standards. This would allow TES™ to provide both the necessary functionality and most importantly the ability to operate and survive in Canada's harsh remote environment. HNS did an excellent job adapting our inputs into their product and creating the required code, which supported the functionality and stringent operational requirements. As a result, the system was deployed and placed into service in 1995.

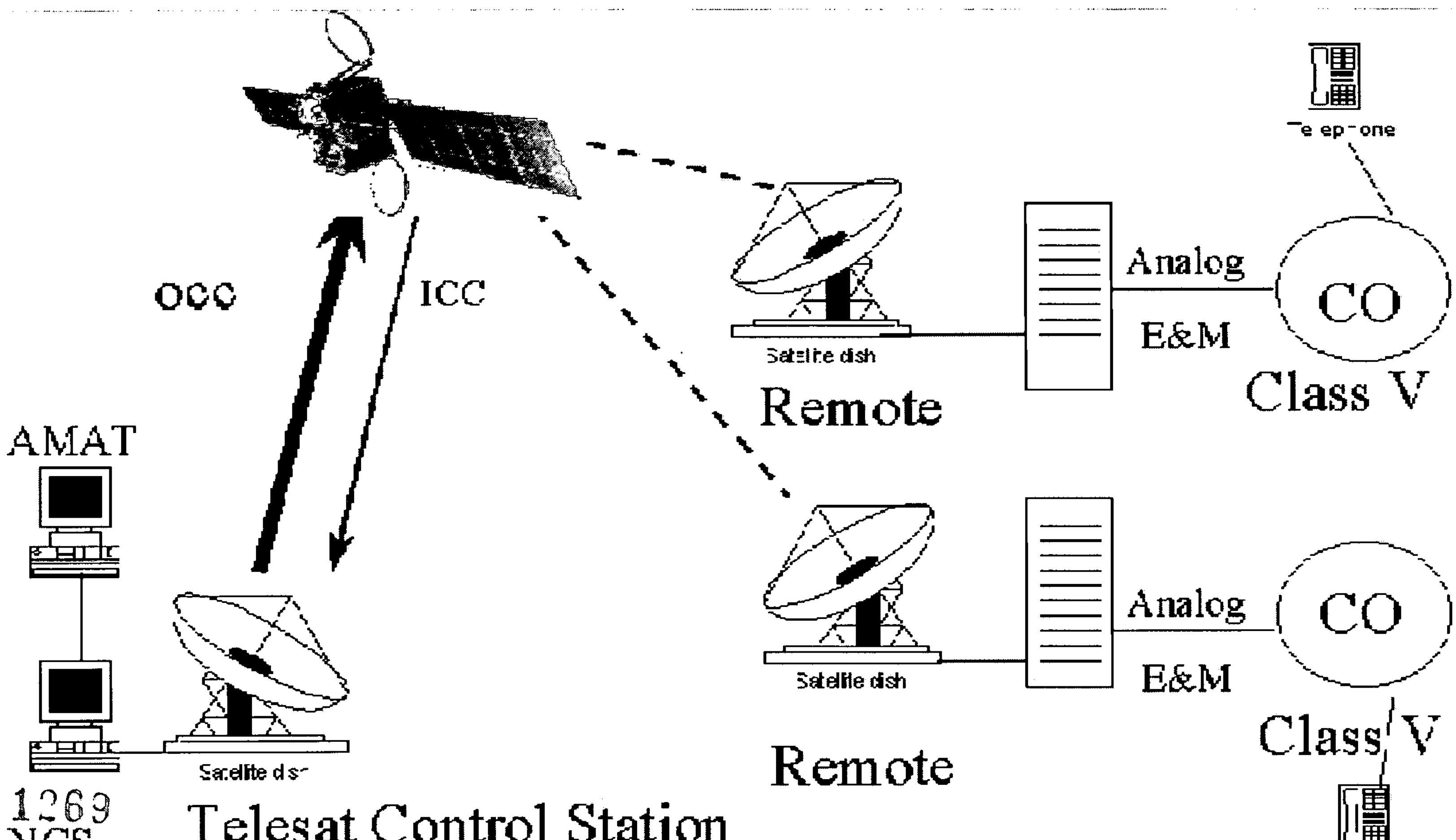
267

Bell Canada is the end client (to Telesat) of this particular network, (other similar networks are deployed across Canada for numerous Provincial Telcos including BCTel, Sasktel, MTS and MT&T) responsible for providing the end residential and business telephony services to the Northern Ontario and Quebec customers. Their infrastructure employs Nortel DMS 10 switches (Class V) at the isolated villages connecting to DMS 200 toll switches (Class IV) for southern-based calls. The system supports any voice interface to communicate with any other, that is to say; DTMF, DP, FXS, FXO, TIE, MF Class V, MF Class IV interfaces are all supported and translations are made in real time during the call set up.

An AMAT billing processor was also developed by Telesat and CGI as a supplementary device to capture remote to remote billing records. This system periodically polls the Network Control System (NCS) ASCII call records and moves the necessary records into the Bellcore AMA format. Daily the Telco Regional accounting office collects the records from the AMAT.

Overall, the network has performed extremely well providing reliable, toll quality (32Kb/s ADPCM) voice, fax/In-band capability and very efficient space utilization with single hop, full mesh, remote to remote calling capability.

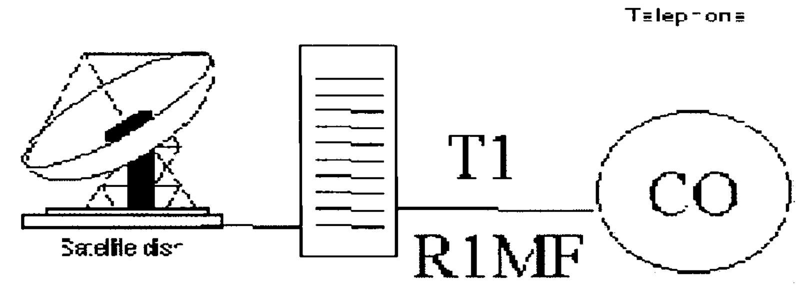
Figure 1 – Original DAMA network Configuration



1269

1270

Allan Park, Ontario



Quality Results

Interestingly enough, the improved network (voice quality and single hop functionality) created an instant demand for additional trunks. The anecdotal proof was in terms of immediate increased network traffic. The subscriber Erlang load increased such that the satellite DAMA pool had to increased by just under 40%. This clearly demonstrated that voice quality (improved even further through single hop capability and improved voice coders) supports greater revenue potential. Improved fax and in-band data capability would also explain a portion of the dramatic network utilization increase, however this was only at 4.8kbps.

Based on the user acceptance of the new network, and the anticipated functionality of the satellite platform, Bell was prepared to consider making the remote locations ubiquitous with their terrestrial based network. In 1996 Telesat was approached by Bell Canada to evaluate the challenge of taking the network to a new level – that was, adding SS7 functionality to the satellite network. This would allow the implementation of new features including CLASS™ services and potentially switched data services. This would allow Bell the ability to offer high quality, ubiquitous service throughout its serving area, and ultimately setting itself apart from the competition.

High Level Upgrade Description

The present system configuration, which utilizes MF addressing techniques, was specifically designed to improve transmission quality and most importantly eliminate double satellite hops. With this system, calls only utilize the space segment when the call is in progress through the DAMA access technique. The existing NCS effectively acts as a broker for the network by virtue of recognizing call requests. Dynamically assigning satellite trunks and routing the call to the appropriate earthstation/switch.

In converting from MF to SS7 technology, the NCS will have to act as an SS7 equipped Tandem Switch, or more precisely a "Virtual Tandem" between the remote end office and their Gateway/Toll Switches already located on the PSTN. In the physical network, as a tandem switch, it can be conceptualized to reside as part of the satellite. Within the signaling network context, the Virtual Tandem will be identified (addressed) by its own unique Point Code.

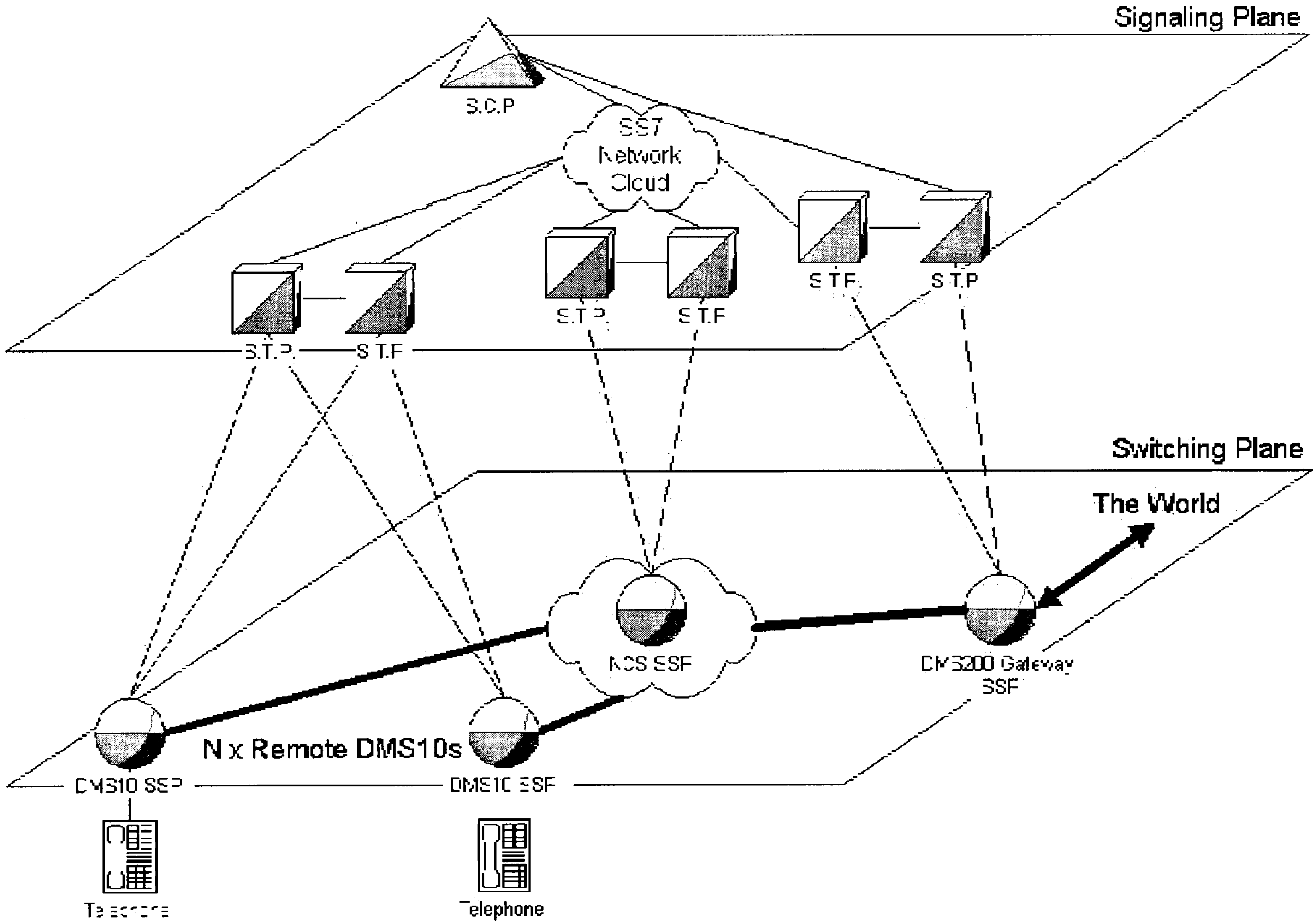


Figure II – High level architectural view of the SS7 network configuration

1273

The SS7 messages addressed to the Virtual tandem will be those Integrated Service User Parts (ISUP) messages associated with establishing and terminating the standard three phases of call control.

- Call set-up
- The data/conversation phase, and
- Call tear –down

The principle difference between the MF approach and SS7 is that the NCS will have to "connect" (tandem) calls through itself on a virtual basis as opposed to being a pure network broker (controller). In doing so, the Switching Transfer Points (STP's) will play a critical role in routing all signaling traffic to, from and within this sub-network.

Key abbreviation descriptions;

- ISUPISDN User part – SS7 protocol which provides the signaling

functions required to support basic bearer services and

supplementary services for voice and non-voice application.

- SSPService Switching Point – switching office that is equipped with the

hardware and software needed to handle trunk signaling as well as

database transaction services.

- STPSignal Transfer Point – packet switches that route SS7 messages

between nodes in the network.

- MFMultiple Frequency – R1 for North America channel associated

signaling.

- CCSCommon Channel Signaling, voice and signaling carried on separate

facilities.

- CASCircuit Associated Signaling, voice and signaling share the same path.

- SS7 Message types (discussed herein)

  - IAM Initial Address Message

  - ACM Address Complete Message

  - ANM Answer Message

  - REL Release Message

  - RCL Release Complete Message

SS7 Upgrade Challanges

The TES™ network deployed in 1995 was based on Phase II hardware. After initial discussions and research with the HNS software design team, it was quickly discovered that the processing power and other critical functionality of this hardware would not satisfy the expected demands of the new signaling system. This resulted in a complete retrofit of the Phase II channel units and card chassis to new hardware known as TES Quantum™. The hardware upgrade phase of the program has been completed.

The new hardware system employs an added component called the Primary Rate Access Card or PAC. This device was originally intended to become a digital interface module between the channel units and the switching device (i.e. replace the need for a Channel Bank). The SS7 realm necessitates modification requirements of the PAC so that it will take on additional signaling duties and "facilities monitoring" functionality.

SS7 utilizes out of band signaling or CCS which is substantially different from MF signaling or CAS. These signal messages or ISUP are carried on redundant A-links.

In terms of physical network design, this represents 9.6kb/s PAMA circuits connecting the remote end office (SSP) to the STP. The 9.6Kb/s link speed was determined by the following baseline assumptions*;

> A-links operating at 9.6Kb/s and 35% occupancy will carry 420 octets/sec. A site terminating 25 trunks will normally be expected to generate an average load of 9 octets/sec. for standard ISUP traffic. On a more instantaneous basis, over 1 second, two 9.6Kb/s A-Links could readily serve 6 co-incident call attempts (TCAP queries for Calling Name plus ISUP messaging).

- *Based on traffic engineering rules established by Stentor Canadian Network Management (SCNM)*

The satellite based A-links have been sized to minimize overall bandwidth utilization while ensuring acceptable capacity to manage the expected message volume.

The terrestrial links between the STP and NCS will be network standard 56kb/s redundant links. This STP will bridge the SCP (database) and the NCS.

The major modification to the NCS not including the necessary upgraded code will be the incorporation of an SS7 Message Transfer Part (MTP) stack. This will be facilitated on a new SUN platform communicating through an Ethernet connection to the existing NCS redundant VAX computers.

Call Processing under SS7

With the MF architecture, an off-hook circuit seized the channel unit destined to carry traffic. The called number and ANI information then transferred as a call request to the NCS for processing. With conditions in acceptable format and the route determined, the NCS assigned frequency pairs through a return broadcast to the originating channel unit and the called channel unit. The destination phone was then rung. An elaborate check process was employed within the MF signaling and NCS channel unit signaling to confirm message reception, channel unit health and confirmation of call set-up/tear-down. Another important factor is the call set up time. Under normal conditions the above processing would occur with a very acceptable 2-4 seconds, however the caller would experience a 7-9 second post dial delay (PDD).

Under SS7 architecture, the out of band signaling nature combined with the DAMA satellite bandwidth access technique, pose a plethora of new criteria to manage. Time to complete a voice path, possibility of channel unit to channel unit path failure, impact of the failure and risk of glare are but a few examples. Conversely the digital SS7 protocol permits the opportunity for improvements such as reduced PDD and improved glare resolution.

The issue of when the IAM message should be issued during call processing is critical because of the risk of passing the message before the voice path is guaranteed Vs delay in call set up.

-

SS7 Features and possible effect on the community

The basic advantages of SS7 can be summarized as follows;

- Greater volume of signaling information available
- Reduced call set-up times
- More efficient trunk usage
- Fraud reduction due to separation of signaling and voice paths
- Faster implementation of new services

1279

The initial net result of the system upgrade to an SS7 platform creates an environment to offer supplementary telephony services to isolated villages. This provides a revenue opportunity for the Telephone Company and convenience for the users. The enhanced communication facility will partially assist the northern isolated villages by removing the stigma of a "lacking second class society". The local inhabitants who are primarily native Inuit or Cree will utilize the advanced network features to maximize the economic ventures already established and could ultimately attract 1280 investment due to successful growth.

SS7 supports Database services like 800/888, alternate billing (credit card and third party calling) along with Class ™ services such as; Calling number display, Calling number blocking, Calling name delivery, Distinctive Ringing/Call Waiting, Selective Call Forwarding, Selective Call Rejection and Selective Call Acceptance.

The network upgrade will also create a total digital environment from the DMS switch through the earth station. This creates the natural next step for introducing high-speed (64Kb/s) switched data services. These enhancements will support improved Internet connections and "Electronic Commerce" or e-com and video conferencing applications.

As approximately 20% of calls result in the end user busy SS7 response, the audible busy tone will be generated by the originating switch. This will release the satellite resources sooner when compared to MF. The result will be less demand on the DAMA bandwidth pool and therefore result in improved space segment utilization.

Conclusion

The main purpose for presenting this paper was to demonstrate perhaps a "model" for remote satellite based networks. Having been established for over twenty-five years, this network, through its continuous positive progression, has been an exceptional proving ground for technology and development of remote network management techniques.

As compared to other programs, which strive to offer basic POTS solutions for remote, isolated communities around the world, this network could definitely be labeled as being at the "high end of the scale". As a telecommunication professional who has traveled the world and seen first hand the "other end of the scale", I understand how truly lucky we are to be in a position to increase the capability of our remote networks and ultimately improve communications for the inhabitants.

It is not however purely an engineering exercise, Canada, through the leadership of our Federal Government has established a powerful vision with a baseline concept that connecting Canadians or "Connectedness" as it has been coined, will lead to a stronger Canada. Better infrastructure throughout the country is critical to this vision. Specifically, this concept expects the following results;

- Build a stronger dynamic Canadian economy
- Build a Canadian learning culture
- Build a more cohesive & united Canadian society
- Build a stronger democracy through direct citizenship participation

As I present this paper, the Telesat engineering team will have deployed all the necessary hardware and will be in the final stages of testing the initial software release from HNS at our lab facilities in Ottawa Ontario. Based on our past experience in dealing with complex programs of this nature I do anticipate some challenges, however, I am totally confident the skills of our personnel will overcome them as usual. With the support of HNS and Bell Canada, the network will be fully functional and providing improved services to Canada's remote territories by the 2nd quarter of this year (1999).

Acknowledgements:

- Bell Canada
- Hughes Network Systems
- Stentor SRCI

Return to Top   View Full-screen

Roaming between Satellite and Terrestrial Systems -- New Concepts and New Commercial Issues

Michael E. Davis

Ward & Partners Lawyers, Australia

ABSTRACT

The age of global mobile personal communication by satellite is upon us. The satellite system operators are anxiously awaiting an economic return on the vast amounts invested. An essential part of the marketing of the new satellite services is the business relationship the satellite operators need to develop with terrestrial carriers. A key to this relationship is the ability of users of satellite terminals to roam onto terrestrial mobile networks.

The international telecommunications industry is only beginning to appreciate that satellite roaming involves new commercial considerations. This paper examines those considerations and explains why agreements for satellite roaming are different in concept from terrestrial roaming agreement models.

View Full Text

Roaming between Satellite and Terrestrial Systems - New Concepts and New Commercial Issues

I. INTRODUCTION

The global satellite services industry is one of the fastest growing sectors of the world's economy, both as a percentage of the total telecommunications services market (from 2.5% to 1995 to 5% in 2000) and in absolute terms (from US$14 billion in 1995 to US$37 billion in 2000).

With the commencement of commercial service by Iridium, the age of global mobile personal communications by satellite is a commercial reality. However, GMPCS systems will meet only a tiny proportion of the communications needs of the estimated 3 billion people who do not have access to terrestrial telecommunications services. In the next 12 years the number of GMPCS subscribers is estimated to be between 10 million and 27 million. This represents only a small percentage of the world mobile telecommunications market.

II. GMPCS SYSTEMS

Proponents of GMPCS services point out that they can serve the needs of users that are not covered by terrestrial networks (described as *primary* services) as well as the needs of users who are travelling around the world (described as *supplementary* services). GMPCS operators assert that they do not compete with terrestrial services, but rather complement cellular networks "so as to increase the value of the aggregate service to the customer on a global basis".

While it is true that GMPCS systems will never supplant terrestrial wireless systems, it is clear that the *supplementary* services and the customers they will attract will constitute an important market for GMPCS operators and their distributors. According to Ms Leslie Taylor, at least 700 million are expected annually to travel beyond the borders of their own country by the year 2000. Of the total number traveling internationally, almost one-fifth do so on business, resulting in a total addressable market for mobile satellite communications, in the year 2000, of some 119 million travelers.

Roaming between terrestrial wireless systems is restricted because of the fact that these systems are based upon a number of different technical standards. GMPCS services are promoted on their ability to complement cellular networks by providing subscribers handsets that will operate globally in various modes. For example Motorola's Iridium telephone allows the user to insert a radio cassette into the telephone that is compatible with different local cellular networks. Kyocera's Iridium phone is designed for use with GSM, CDMA, AMPS and PDC cellular networks and docks with a terminal cradle when satellite service is necessary.

III. ROAMING

Inter-carrier roaming is a well-known concept. It can be defined as the ability for a customer of one network (the home network) to access service from another network (the host network) using the same handset. Roaming can take various forms.

In the case of the GSM system, manual roaming can be achieved through the use of a removable module (called the SIM card) which identifies the subscriber separately from the handset. By removing and replacing a SIM card, a user can access a different network using the same handset.

Roaming depends upon the establishment of a commercial relationship between carriers or service providers on behalf of their customers. It allows customers to make and receive calls simply by turning on their handsets when inside a new network coverage area. To achieve this the two operators must have an agreement covering a number of commercial and technical issues.

The GSM MoU Association plays a major role in creating a standard agreement which includes but is not limited to revenue sharing, the delivery, timing, accuracy and other procedures before inter-carrier charging records, fraud management and control and service availability.

IV. INTERNATIONAL ROAMING

International roaming is a form of automatic roaming. In Europe, where cellular systems from each country overlap to some extent along border areas, GSM systems have been modified in phase 2 standard to provide a facility to revert to the home network at every opportunity.

The GSM MoU Association has a Satellite Steering Committee that is involved in developing dual mode operation standards for roaming between terrestrial and mobile satellite systems based on the GSM platform. It has a total of 293 members from 120 territories. Membership is open to licensed mobile network operators committed to building and implementing GSM based systems and government regulators and administrators who issue commercial mobile telecommunications licenses.

The GSM MoU Association has established certain general requirements. These requirements are that dual mode equipment shall as a minimum provide manual GSM/mobile satellite service mode selection in which the user explicitly selects the GSM/MSS mode. Dual mode equipment may also provide automatic GSM/MSS mode selection, which, at a minimum, provides the following options:

- GSM preferred
- MSS preferred

In addition it *may* provide the following options: -

- MSS preferred if home public land mobile network not available
- MSS preferred if home public land mobile network and preferred public land mobile networks not available

The GSM MoU Association's Satellite-GSM Roaming Guide states: -

> *"Once service from GSM is selected, the dual satellite GSM telephone will automatically search for any of the preferred networks specified within your SIM card, in the order of preference stored in the SIM card. Failing that, the GSM telephone may select the most suitable alternative network offering service... The preferred GSM network list contained within the SIM card can be programmed by the Network Operator or the Service Provider or by you as the satellite subscriber using the keypad of the phone - please refer to your manufacturer's handbook for the programming procedure."*

The concept of international roaming between terrestrial networks is easily understood - a subscriber provided with services in one country by one network operator can also gain access to the services of the networks of other operators in other countries. The concept of satellite roaming is quite different because of the geographical overlap between the satellite network's coverage (which is either global or nearly global) and the coverage of the terrestrial network.

Standard international GSM roaming occurs in physical circumstances which are easily defined, i.e. when a customer of the home network leaves his or her home country and is within coverage of another GSM network. International roaming is therefore based upon the customer's geographical location. On the other hand, the availability of satellite roaming does not depend upon the customer's geographical location but only upon the availability of satellite network coverage. Therefore, at all times, selections made by users of dual or multi-mode mobile terminals will be the sole determining criterion for the network selection by subscribers.

Unlike under other domestic and international roaming agreements, roaming onto satellite networks by customers of terrestrial cellular networks with dual mode terminals will be possible even when their customers are within the coverage of their own network.

V. CONCLUSIONS

Professor Rob Frieden has pointed out that mobile satellite service operators owe the spectrum allocation success achieved at the ITU to promises that the satellite networks will not bypass incumbent carrier facilities or otherwise reduce existing revenue streams. Will satellite roaming detract from the revenue streams of terrestrial network operators?

The standard roaming concept for terrestrial network operators does not adversely affect the revenue of the home network because the customers of the home network normally do not have a choice of networks while in the geographical coverage of the home network.

On the other hand, the user of a dual-mode handset who has access to satellite roaming has no obligation to use the home network in preference to the satellite network. While it will probably be more expensive for a user to use satellite roaming when the same call can be made through a home cellular network, it seems likely that there will be situations in which the user will elect to use satellite roaming rather than the home network. In fact the standard roaming requirements of the GSM MoU Association make allowance for such an election.

The extent to which terrestrial network operators have factored this possible loss of revenue into their business calculations is not clear. Although access to GMPCS services is clearly a value-added benefit that terrestrial operators will wish to offer their customers, there are risks inherent in satellite roaming agreements of which they should be aware. In particular they should not overlook the fact that by entering roaming agreements they are, in effect, agreeing to compete with the GMPCS networks in the provision of mobile services within the geographic coverage of their own networks. This may be a benefit to consumers because of the increased incentive to ensure that the technical performance of terrestrial mobile networks and service levels are of a high standard.

GMPCS operators and their distributors are clearly dependent on the commercial relationships they are developing with terrestrial network operators. The evolution of these relationships and the benefits both sides will derive could be a key to the commercial success of the new GMPCS systems.

- The global satellite services industry is one of the fastest growing sectors ...5% to 1995 to 5% in 2000) and in absolute terms (from US$14 billion in 1995 t

Return to Top View Full-screen

Market Prospects In Asia For Satellite Mobile Services

Bruce S. Middleton

Asia Pacific Aerospace Consultants, Australia

ABSTRACT

Four regional satellite systems and at least five global systems plan to address the Asia Pacific market for mobile personal communications by satellite. The regional systems are Asia Cellular Satellite System (*ACeS,* to commence service late in 1999), Asia Pacific Mobile Telecommunications (*APMT,* to commence service in the second quarter of 2000), *Thuraya* (to commence service in September 2000) and *Agrani* (to commence service in the third quarter of 2001). Of the global systems, Iridium is now operational, Globalstar will probably commence service in late 1999, and ICO in mid 2000. Ellipso plans to commence service in the fourth quarter of 2000 and ECCO in late 2001.

Indications are that the market for these services, both global and regional, will be large. Iridium is already in service, and others will follow starting in 1999. The regional (GEO) services will offer cheaper airtime charges and better performance in certain areas, but the global (MEO and LEO) systems offer simpler global roaming. The one region where all of them will compete is the Indian subcontinent.

The Asian economic downturn and the increasingly widespread availability of terrestrial cellular roaming indicate that modified approaches will be necessary for this market. The business plans for all these systems should be reviewed with respect to the Asian region. Capital expenditure needs to be minimised, early cashflow established and additional markets and services explored. Pricing, especially for airtime, should be reviewed: it will generally be better to build markets and secure market share, even at the cost of some early profits, than hold firmly to price points calculated in better times.

View Full Text

Market Prospects In Asia For Satellite Mobile Services

I. INTRODUCTION

Global mobile personal communication by satellite (GMPCS) is now a reality. Iridium came into commercial service last November, Globalstar and ICO are following close behind, and others are coming within a few years.

Asia's strong acceptance of terrestrial cellular mobile communications indicates that it will be a successful market for mobile personal communications by satellite. Not surprisingly, it is here that the global systems will meet competition from regional systems using geostationary satellites.

Asia however is not the same market it was when these systems were conceived. Terrestrial cellular systems are widespread, many of them offering roaming on a regional scale. Asian economies are suffering a slowdown, and currencies have been devalued. These and other factors change the picture against which the satellite business plans were developed.

This paper reviews the mobile personal communication services to be offered by satellite operators in Asia using the global and regional systems. It discusses prospects in the new circumstances, and offers suggestions on directions for revision of business plans.

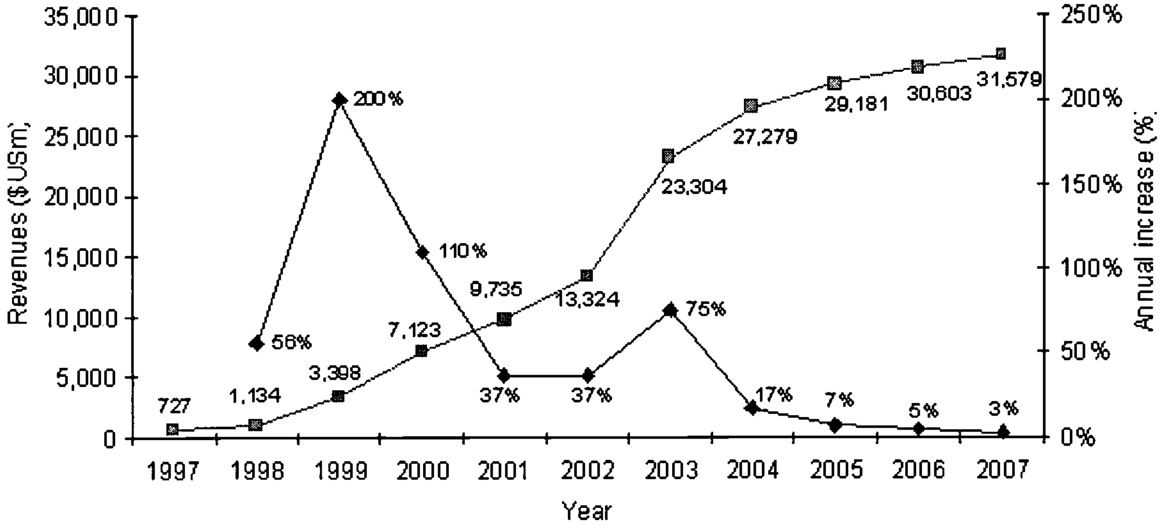
II. THE GLOBAL MARKET

1. *Global Trends*

Revenues from the global market for satellite mobile services are expected to grow strongly over the next decade. Global revenues from satellite-based mobile telephone services will rise from $727m in 1997 to $31b in 2007, according to a report released in April 1998 by Merrill Lynch, Pierce, Fenner & Smith.

The Merrill Lynch projections are shown graphically in Figure 1.

Figure 1: Global Revenues for Satellite Mobile Services, 1997-2007



Source: Merrill Lynch, Pierce, Fenner & Smith, 1998

Other studies of the satellite mobile market support the trend projected by Merrill Lynch. Frost & Sullivan predicted in 1997 that there would be 450,000 global mobile subscribers in 1999, but more than seven million in 2004. In October 1998 Ovum predicted 11 million subscribers by 2007.

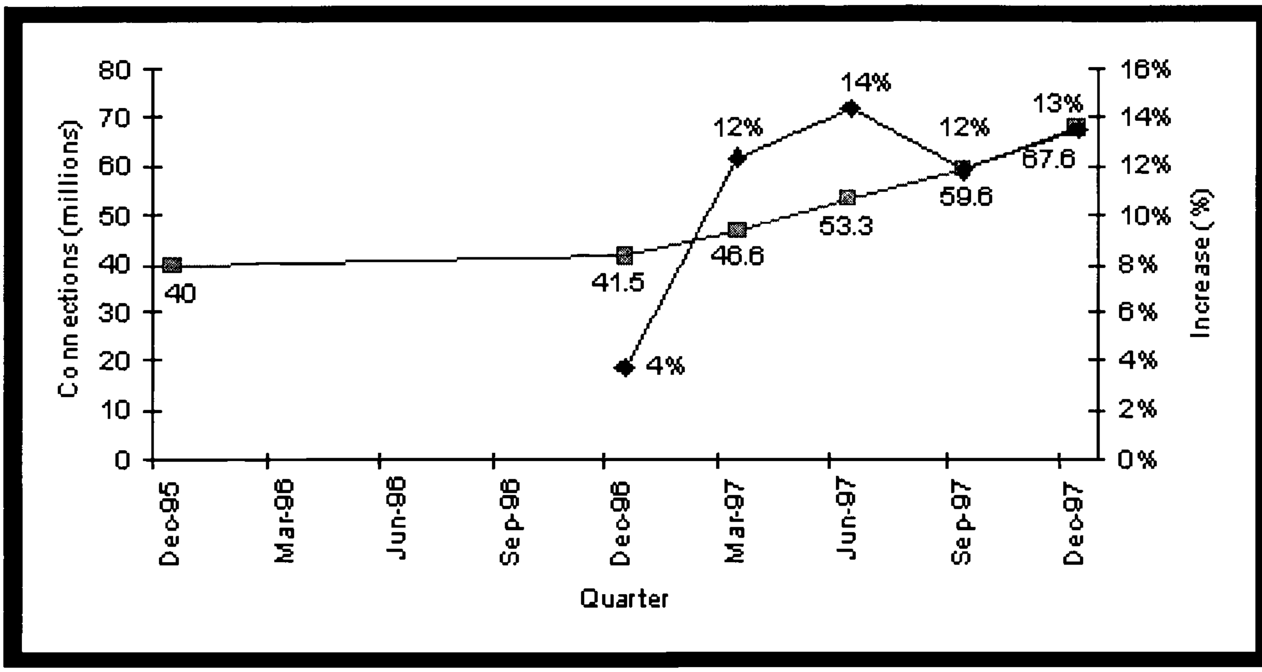
These predictions parallel growth projections for terrestrial mobile subscribers. Globally there were nearly 210 million subscribers to cellular and PCS services at the end of 1997, but in 1998 the Strategis Group predicted this number would grow to over 650 million worldwide by 2003

2. *The Asia Pacific Market*

Personal (terrestrial) mobile communications are already big business in Asia, and growing fast. At the end of 1997 there were 67.6 million handsets connected to terrestrial mobile systems (a 62.9% increase over one year earlier). The Asia-Pacific cellular and PCS subscriber base surpassed the North American subscriber base in 1997 for the first time. China and Japan together added 18 million subscribers in 1996 and almost 19 million in 1997. The Strategis Group projected in 1997 that the Asia-Pacific would account for nearly 40% of worldwide cellular and PCS subscribers in 2003.

The scale and increasing rate of takeup of terrestrial mobile services in Asia are shown in Figure 2.

Figure 2: Terrestrial Mobile Connections in Asia



Source: "Asian Communications" (ICOM Publications)

Since more than 70 million subscribers already use terrestrial personal mobile communications in Asia, it is likely that the region will comprise a substantial portion of the global market for satellite mobile services as it develops over coming years.

3. *Market Segments*

The global satellite systems for mobile personal communications – Iridium, Globalstar, ICO, Ellipso and ECCO - will generally offer the following services:

- Mobile communications via satellite beyond the coverage area of any terrestrial cellular service
- Terrestrial cellular roaming through dual-mode and multi-mode handsets
- Basic fixed services in regions beyond the reach of the terrestrial public telephone service
- Value-added services including position location, short messaging, paging, call forwarding, call waiting, third party conferencing, call blocking, voice mail, data, Internet services and fax.

These services are targetted at four primary market segments:

- Current cellular customers roaming outside the coverage area of their service provider;
- International business travellers
- International leisure travellers, and
- Potential users located in areas of the world that are not served by public telephone services

The global systems differ in their relative focus on each of these four basic market segments. However all plan to offer fixed services in remote areas. Iridium, which is targetting government employees in areas that are not served by public telephone services, is also offering to disadvantaged countries its NOMAD program (a share in ownership, some telephone sets and discounted airtime minutes). Globalstar will offer a "village phone booth" for residents in isolated areas. ICO, Ellipso and ECCO will all offer services to areas not currently served by a public telephone system.

III. GLOBAL SYSTEMS

At least five more-or-less global satellite systems plan to offer mobile personal communications in Asia: Iridium, Globalstar, ICO, Ellipso and ECCO. Iridium is now operational, Globalstar will probably commence service in late 1999, and ICO in mid 2000. Ellipso plans to commence service in the fourth quarter of 2000 and ECCO in late 2001.

All will work on the GSM standard and offer interoperability with some terrestrial cellular systems using dual-mode handphones. Except for Iridium with its inter-satellite links, all will provide satellite coverage only within the area seen by a satellite in contact with the nearest ground station. All will have some difficulty penetrating buildings, and each has one or more features to alert the user to an attempted call in a situation of signal path obstruction.

The discussion that follows relates to the *satellite* services offered by the global operators. It does not canvass the terrestrial cellular services their subscribers will be able to access as an adjunct to satellite services.

1. *Iridium*

Iridium is a low earth orbit (LEO) system offering global telecommunications via the satellites and access to the cellular network of any cooperating carrier around the world. The service is operational though still debugging.

Iridium addresses the call dropout risk through a high link margin (at 16 dB) and path diversity through the number of satellites. Offsetting this, a handset stays on the one satellite for an average of only six minutes. Iridium has a powerful paging signal to ensure that a satellite user located within a building becomes aware of a call attempted, and/or receives a paging message.

Iridium handsets, using 2,400 bps for voice and data, provide lower voice quality than current cellular phones. The handsets are larger and heavier than current cellphones, and use a protocol transformer (called a "cassette") to access cellular systems. Their retail cost is $3,000 and up, and each cassette required to access a terrestrial cellular system costs $400, plus $700 for a pager. Airtime charges are $2 to $3 per minute, and monthly access fees around $50.

2. *Globalstar*

Globalstar will be the second LEO system when first operational, probably in late 1999. Theoretically it will provide global coverage, but in practice coverage will depend on the availability of a ground station within range of the required coverage area. Globalstar will offer handsets that utilise Globalstar service only, work on both Globalstar and GSM systems, and switch automatically from terrestrial cellular (analogue or digital) to the Globalstar satellite network.

The Globalstar service should have good clarity, with several technical features designed to minimise both congestion and call dropouts. It too will have path diversity, plus an ability to add power as needed to compensate for shadowing and interference.

Handsets will retail at $1,100 and up. Monthly access fees will be around $20 and airtime charges in the range $1 to $1.50 per minute. Globalstar is to provide telephone access from areas of the world that are not served by public telephone services through fixed terminals.

3. *ICO*

ICO is to be a mid earth orbit (MEO) constellation designed to offer complete overlapping coverage of the surface of the entire earth. Service commencement is expected in mid-2000. ICO dual mode handphones will operate both globally on ICO's satellite network and on established terrestrial cellular digital networks. ICO will target current cellular customers roaming outside the coverage area of their service provider, and international business and leisure travellers, as well as remote villages and households unserved by public telephone services.

ICO is expected to provide voice quality similar to digital cellular systems. Dropout risk will be reduced through the handset staying on one satellite for an average of 50 minutes, a smaller number of slower-moving satellites (meaning less handovers), path diversity, relatively high elevation angles and good link margins. ICO will be able to increase and switch capacity within a beam to support peak traffic capabilities.

ICO will offer data services at up to 38,400 bps, higher than the other satellite systems. Handsets are expected to cost $750 to $1,000, airtime in the range $1.50 to $2.50 per minute, and monthly access fees around $40.

4. *Ellipso*

Ellipso, another MEO system, will have a unique orbital architecture designed to maximise service from minimal investment by concentrating resources on the largest demand. The system will comprise two satellite constellations, of which one (named *Concordia*) will be tailored to provide coverage to 47° south and the other (named *Borealis*) the northern temperate latitudes. It will have an initial southern hemisphere operational capability in the fourth quarter of 2000 and full capability in 2002. Although not a global system, it will cover all of Asia.

Ellipso should have acceptable voice clarity, and will use advanced coding and modulation techniques to provide a robust signal that is resistant to impairment. Most handsets will be capable of accessing terrestrial cellular systems where this is the most cost-effective route for the call. The system will feature an alerting channel capable of ten times more blockage penetration than the normal voice channel.

Ellipso handsets will cost $1,100 and up, monthly access fees are expected to be $35 and airtime charges around $0.50 per minute.

5. *ECCO*

ECCO (for Equatorial Constellation Communications, also called Constellation) is another MEO system, to commence in late 2001 initially serving regions between 23° north and 23° south latitude. This will effectively omit those countries of Asia lying north of the latitude of Hong Kong.

Like its competitors, ECCO handsets will be dual-mode to provide universal coverage, using both cellular where it is available and satellite where it is not. ECCO will offer data and fax services at 2,400 bps. It too will offer rural telephony with fixed terminals in public phone booths designed for countries with remote villages and low-density populations spread though vast geographic areas.

IV. REGIONAL SYSTEMS

Development of the technology to provide mobile personal communications using a GEO satellite has opened a window for regional services. Four GEO systems for the Asian region are in development. They are Asia Cellular Satellite System (*ACeS*) based in Jakarta, Asia Pacific Mobile Telecommunications (*APMT*) based in Singapore, *Thuraya* based in Abu Dhabi, and the *Agrani* program of ASC Enterprises based in New Delhi. In addition Mitsubishi Electric of Japan has made known its ambitions for a three-satellite GEO constellation to provide mobile voice and data services in Australia, the western Pacific rim, Japan and eastern China.

The GEO systems will have several advantages over LEO systems, and to some extent also over the MEO systems. The lower number of satellites and their longer life will translate into reduced capital and replenishment costs. They will offer relatively high look angles from virtually anywhere within the footprint (due to their altitude and the boundaries of their service areas), reducing the likelihood of obstruction to the signal transmission path. Dropout risk will also be reduced because there is no requirement for handovers between satellites and a mobile terminal will stay connected to the same satellite throughout the duration of a call.

On the other hand the laws of physics impose the quarter-second propagation delay associated with two-way transmissions via a platform at that altitude.

All four GEO systems will operate on the GSM standard and offer typical GSM services in addition to voice. All will offer access to cooperating terrestrial cellular systems where these are available.

1. *ACeS*

ACeS will be the first regional service into operation later in 1999, following satellite launch currently scheduled for May. Pasifik Satelit Nusantara (PSN) developed the ACeS concept in 1993 and is a key investor, along with the Philippine Long Distance Telephone Company (PLDT) and Jasmine International of Thailand. The ACeS satellite, named *Garuda*, will have a footprint ranging from Indonesia and Papua New Guinea in the south to China and Japan in the north and Pakistan in the west.

ACeS will minimise obstruction of the signal through use of an interference mitigation algorithm. This will first seek another basic voice circuit without interference, and if unsuccessful it will switch to Robust Mode with double the information rate. ACeS will also have a powerful paging and call alerting signal for use when the satellite user is located within a building or in an obstructed location.

ACeS users will be able to access either satellite or cellular (either GSM or AMPS) systems automatically or under user control. Initially the standard GSM services will be offered, with optional value-added services being added later. A handset will cost approximately $1,000 and the retail airtime rate will be about $1 per minute.

ACeS is not targetted at rural and remote areas, for which PSN has its Xpress Connection service.

2. *APMT*

The APMT system is running about a year behind ACeS (service launch is expected in the second quarter of 2000), and will have a similar footprint covering 22 countries and territories ranging from Pakistan to Japan and from China to Indonesia. APMT was established in 1995 by entities in Singapore and China, and a contract was let in early 1996 for two spacecraft. The project languished for a time, but was re-energised in 1998 with a small change in ownership. Some 51% of APMT shares are held by Chinese government entities, suggesting one advantage over its competitors, namely preferred access to the Chinese market.

The APMT gateways will initially be located in China, Singapore and Thailand, with two additional

Chinese gateways planned within two years of startup. APMT terminals will be handheld, vehicular and fixed-site. The system will offer fax and data at up to 9,600 bps initially.

APMT handphones will feature a GPS receiver and will be configurable to seek a terrestrial cellular GSM service first. There will be a High Penetration Alert service to warn users of an attempted incoming call when the terminal is in an obstructed location.

Handphones are expected to cost less than $1,000, and the retail airtime rate is expected to be less than $1 per minute. APMT plans to offer fixed services in remote areas as well as mobile communications applications.

3. *Thuraya*

In June 1996 the United Arab Emirates' telco, Etilsalat, announced plans to build the Thuraya system. The footprint will cover the Middle East, Turkey, Iran, the Indian subcontinent, Central Asian Republics, Northern and Central Africa, and Eastern Europe. Thuraya's battle with ACeS and APMT for mobile customers will be on the Indian subcontinent, where Agrani (see below) will also be active. The first Thuraya satellite is scheduled to be launched in May 2000 with commercial service commencing in September.

Thuraya's investor list includes Arabsat and telecom organisations from Qatar, Egypt, Libya, Tunisia, Morocco, Bahrain and Kuwait. It will initially have a primary gateway located in Sharjah in the United Arab Emirates, with national gateways in several other countries. Markets to be targetted include residents of rural areas where it is uneconomic to install cellular services.

Thuraya will offer handphones costing around $600 and airtime at around $0.50 per minute. It will also offer vehicular and marine installations and fixed phone booths, with all applicable GSM user features. The Thuraya system will also offer high power paging.

4. *Agrani*

Agrani was established in 1994 by Afro-Asian Satellite Communications (ASC), but the project languished for several years. It re-emerged in April 1998 under ASC Enterprises of New Delhi, owned by the Essel group, VSNL, Lockheed Martin and other non-Indian investors. ASC plans to provide hand-held mobile communications services in the Indian subcontinental region, with service commencement in the third quarter of 2001.

The Agrani satellite will not be dedicated only to mobile communications, but will also carry DTH television and will support rural telephony via VSATs and wireless local loop networks. For its mobile service ASC is targetting both business executives who travel in the coverage area, and rural villages. There will be five gateway stations initially, mainly in India.

In areas where the satellite service overlaps with accessible terrestrial cellular, the Agrani user will be able to select either GSM or satellite mode. The Agrani system will incorporate several techniques for improved signal robustness and to mitigate interference. These include switching to higher basic speech rate, changing frequency and time-slot allocation, and dynamic power control. The network will provide High Penetration Alerting for paging in difficult environments. Dual-mode handphones are expected to cost $400-600 each, and an international call will cost about $2 per minute.

V. MARKET PROSPECTS

Asia is the core market for these four regional systems. It will also be important to the global systems for, as noted earlier, the Asia-Pacific terrestrial cellular and PCS subscriber base surpassed the North American subscriber base in 1997. This Chapter reviews the implications of recent developments relevant to this market.

1. *Regional Economic Developments*

The economic outlook in the Asia Pacific has changed substantially in the last 18 months. Early in the crisis it was hoped that the effects would be limited and recovery swift, but this was not the case. In the first quarter of 1998 severe devaluations were experienced in many Asian countries, rising to over 80% in the worst case, Indonesia. Since then exchange rates have stabilised, and many have recovered significantly from their low points.

The economic downturn, especially in the crisis countries (Korea, Thailand and Indonesia), has also been worse than was initially expected. The weakness of the largest economy in the region, Japan's, has added to the pressure on other Asian economies. As a result the aggregate rate of real GDP growth in Asia in 1998 was assessed by the IMF in October at 1.8%, with selected countries performing as in Table 1.

Table 1: Real GDP Growth in Asian Countries, 1998

Country	Growth, 1998 (%)
China	5.5
Taiwan	4.0
Vietnam	4.0
Australia	3.5
Singapore	0.0
Philippines	-0.6
Hong Kong SAR	-5.0
Malaysia	-6.4
Korea	-7.0
Thailand	-8.0
Indonesia	-15.0

Source: International Monetary Fund, October 1998

Projections for 1999 are even more modest. Current expectations for economic growth in selected countries in the region in 1999 are shown in Table 2.

Table 2: Projected Real GDP Growth Rates in 1999

Country	Growth, 1999 (%)
Taiwan	3.9
Australia	2.0
Japan	0.5
Singapore	0.2
Hong Kong SAR	0.0
Korea	-1.0

Source: International Monetary Fund, October 1998

However expectations are that, subject to government policies, the crisis should bottom out in most economies in the region during the first half of 1999, and positive growth should return in the second half of the year. Fundamental economic, financial, and institutional reforms will however be needed for strong growth to resume in the crisis countries on a sustained basis, a process that could take up to three years. These reforms include the adoption of stricter prudential rules and ensuring their enforcement, the strengthening of corporate governance, and combatting the relationship-based financial and business practices that played a large role in the imprudent lending and borrowing that characterized the buildup to the crisis. If these challenges are met, the IMF expects the crisis countries to achieve quite rapid rates of economic growth in the future as the region resumes the process of catching up with the mature industrial countries.

The currency devaluations also are part of the business environment for the satellite mobile operators. Without exception these satellite systems have been funded through financing arrangements that include large borrowings in US dollars. Servicing these loans forms part of the cost base for the services, and is translated into subscription charges and airtime rates.

Devalued local currencies mean the capacity for local subscribers to pay for those services has declined correspondingly. Table 3 shows that even after a partial recovery in exchange rates relative to the US dollar, in October many currencies in the region were still heavily devalued.

Table 3: Devaluations Relative to US Dollar, July 97 to October 98

Country	Devaluation (%)
Singapore	9
Taiwan	13
Thailand	15
Vietnam	16
Australia	17
Malaysia	30

Philippines	30
Korea	32
Indonesia	65

Source: Calculated from rates derived from Olsen & Associates Information System data

2. *Implications from the Regional Economic Downturn*

There are two primary influences flowing from the regional economic events of the past 18 months that should be taken into account by the companies offering mobile personal communications by satellite (MPCS). One is the general slowdown, the other the devaluations.

The general economic slowdown in what is potentially the largest regional market for the MPCS systems is bound to influence early market penetration and cashflow. Businesses in the region are finding it hard to raise funds for growth following the flight of capital. Company managements have a tight control on costs – including communications costs. MPCS business plans need to be adjusted to limit expenditure and maximise cashflow. Questions that should be addressed in determining appropriate adjustments include the following.

- Can capital expenditure be reduced, in the space segment and/or ground segment?
- Are there other ways of sharing the capital expenditure amongst the stakeholders?
- Can some services be launched early using leased capacity, to build cashflow before completing system rollout?
- Can services be introduced on a staged basis, to build cashflow before completing the full capital investment?
- Are there additional market segments that might be addressed to increase cashflow?
- Are there additional, cheaper services that can be offered for the same objective?

The currency devaluations also impact on the capacity to pay. Handphones, monthly subscriptions and airtime rates calculated in US dollars have become significantly more expensive. Every MPCS business, global and regional, should be reviewing its prices with a view to meeting the market in these more difficult times. Most of the operators have good margins built into their advertised airtime prices, giving them a capability to adjust to current circumstances. It will generally be better to build markets and secure market share, even at the cost of some early profits, than hold firmly to price points calculated in better times.

3. *Threats to MPCS*

The concept of global mobile personal communications by satellite was developed in the 1980s when cellular availability was limited and the incompatible technologies then being used made roaming a nightmare. At that time new markets were opening up, for example in developing countries in and the former Soviet Union, where the existing telecommunications infrastructure was quite inadequate for business requirements and local factors made improvement unlikely in the foreseeable future.

Much of this has changed. Political developments have enabled the introduction of cellular and fixed services in important markets. The former Soviet Union is no longer a difficult communications environment. Developing countries have embarked on massive telecommunications infrastructure investments, with cellular high on their lists.

GSM technology is becoming widely available, permitting roaming on a scale unheard of a decade ago. GSM roaming is now available in most countries in the Asia Pacific region (with the notable exception of Japan and Korea). At the end of October 1997 there were 46 GSM networks in the Asia-Pacific region with around 11 million GSM subscribers, a number the GSM MoU Association expects to increase to 60-75 million by the turn of the century. Even in the US there are now licenses issued for GSM systems that will cover 90% of the population. Many analysts see the spread of GSM as a primary threat to the success of MPCS.

The development of Iridium's cassettes to enable handphones to access virtually any terrestrial cellular system foreshadows another threat to MPCS. From the end of 1999 we will see the introduction of the WorldPhone, enabling subscribers to roam freely between GSM, AMPS and D-AMPS networks. Since these technologies encompass more than 80% of terrestrial cellular systems, global roaming on terrestrial networks will become a practical reality within a few years, at prices generally lower than the satellite operators will offer. Given the choice, roaming subscribers will always prefer cellular on the grounds of cost, in-building access and call interference potential.

The growing trend of voice networks to move across to packet-switched operation will pose another threat. The ability to offer high data rates will become more important, especially as GSM moves to 64 kbps in 2000. Initially at least the satellite systems will not offer comparable rates. Iridium will offer fax and data at 2,400 bps from April, and ECCO currently plans the same rate. Globalstar will offer between 2,400 and 9,600 and Ellipso between 300 and 9,600. Only ICO will offer up to 38,400.

4. *Market Segments*

Chapter 3 listed the four market segments being addressed by the MPCS systems. Each has it own characteristics, but they are not equally prospective.

5. *Current Cellular Customers*

Cellular users in Asia are many and growing rapidly in number. Many international business travellers in the region are already cellular customers. So too are some leisure travellers, who, having embraced cellular access in working habits and lifestyle, are likely also to want access while on travel. As Asian cellular usage continues to grow, the demand for international roaming is bound to increase. The recovery of Asian economies, as that occurs progressively, will further increase that demand.

6. *International Business Travellers*

The business traveller in Asia is most likely to operate in or near cities and, where surface travel is required, to travel on major routes where cellular services can be found. When travelling outside the area of cellular coverage, business travellers will still want access to telephone services. This represents a potential market for satellite mobile services. So too do business operations in remote sites, for example in mining and oil and gas exploration. However the growth and wide availability of GSM services, and the coming advent of the WorldPhone, suggests the potential demand for satellite roaming by business travellers may actually be decreasing.

7. *International Leisure Travellers*

Cellular/PCS phones are fast becoming a lifestyle accessory, and they are increasingly regarded as a necessity. Decreasing prices for hardware and services have contributed to this change. Leisure travellers are therefore increasingly likely to expect access to mobile phone services. Leisure travellers are also more likely to roam further afield and beyond cellular coverage. While an increasing proportion of them will be potential customers for satellite mobile services, they are also likely to be price-sensitive customers.

8. *Potential Users in Unserved Areas - the "Village Phone Booth" Market*

A substantial potential demand exists for basic telephone services in areas that currently have no services at all. The penetration of basic telephone services is very low in some countries in Asia, which has less than 20% of the world's telephones for half the world's population. The ITU reports the latest teledensity in Indonesia is 2.47%, in Vietnam 2.07% and in Burma 0.46%, whereas in developed countries the figure is 50% and higher. Many of these countries are experiencing difficulty meeting the growing demand from business for new and additional services, while attempting to extend basic services to new areas. Difficult topography (such as Indonesia's 17,508 islands), dispersed populations and small economies add to the problem of meeting demand.

The capital cost of access to telephone services provided via satellite can be substantially less than for a terrestrial installation. The cost of a single circuit to a remote area or rural village can be as high as $10,000, four times and more the cost of a satellite terminal. The developers of the GMPCS systems saw a further market opportunity here. With appropriate spectrum allocated, national regulatory approvals and commercial agreements with local service providers, the satellites could readily provide services where no terrestrial system, fixed or mobile, was likely to be installed in the foreseeable future.

Globalstar is targetted to this market, amongst others. It plans to offer fixed site telephones using public telephone booths costing between $1,000 and $2,500, depending on the desired capacity and number of units sharing a fixed antenna. ICO, Ellipso and ECCO will offer similar services using what are variously described as public fixed unit terminals, rural phone booths and community telephones.

The issue for rural users however will be less the capital cost, than whether monthly fees and airtime charges are affordable. What these potential customers in less-developed countries want is a basic service, of adequate reliability and quality, at an affordable price. These are residents, not travellers, and their income level is generally low. Eighteen months ago, and before the more recent devaluations, the *per-capita* GDP in Indonesia was $1,146. In Vietnam it was $310 and in Burma $2,632. Currency devaluations since that time mean that the average GDP per head of population in Indonesia is now close to $400, and in Vietnam around $260.

Not surprisingly, there is a general correlation between GDP per-capita and teledensity, as shown in Table 4.

Table 4: Per-Capita GDP and Teledensity in Asia, 1997

COUNTRY	GDP per CAPITA	TELEDENSITY
Japan	$36,546	48.80%
Australia	$21,348	50.30%
Hong Kong	$24,578	56.08%
Taiwan	$12,240	46.62%
Korea	$10,639	44.40%

Malaysia	$4,701	19.55%
Thailand	$2,820	7.95%
Philippines	$1,146	2.83%
Indonesia	$1,131	2.47%
China	$566	5.58%
Vietnam	$310	2.07%

Source: ITU

Those countries in Asia where there is the greatest requirement for basic telephone services, such as Vietnam, China, Indonesia, the Philippines and Thailand, are also the countries with the lowest average per-capita incomes. Monthly access fees of $20 and up may be affordable by a village, but airtime charges ranging upwards from $0.50 will not be affordable by many individuals. A rural resident in Vietnam making a three-minute call at $0.50 per minute would face a call charge, after the devaluation, equal to 30% of average weekly per-capita GDP. After the devaluation in Indonesia the same call would take 20% of average weekly per-capita GDP.

This is not to deny that there exist in these countries substantial populations with incomes high enough to qualify them as part of the market for GMPCS systems. These people however do not live in unserviced rural villages, but in urban areas well-served by cellular systems.

The inability of rural residents to pay to use the GMPCS systems for basic phone services has been recognised by companies in Asia. Pasifik Satelit Nusantara (PSN) of Jakarta has been a leader in this regard. In response, PSN developed its Xpress Connection service, using VSAT terminals connected to the public switched telephone network (PSTN) to provide economical communal telephone services to rural areas in Indonesia and elsewhere in Asia. Indonesia has 35,000 villages that comprise the potential market, and demand has been substantially more than planners expected.

PSN went on to develop the concept of a dedicated a dedicated satellite system delivering consumer telecommunications services to individual homes, as an adjunct to the PSTN. Its Multimedia Asia (M^2A) system was designed to provide multimedia digital communications and broadcast services to homes throughout the Asia Pacific region. Connected to the PSTN, M^2A was to offer cheaper and readily available telecommunications services to areas not currently served by terrestrial systems. M^2A had approval to offer telephone services within Indonesia for 10c per minute, independent of distance. Regrettably the economic crisis in Indonesia has resulted in cancellation of the satellite being built for the M^2A service, at least for the time being.

In my judgement PSN gauged the rural telephony market more accurately than the owners of the GMPCS systems have. I expect the global systems to struggle to capture business in that market segment.

VI. CONCLUSION

When ACeS and Globalstar are launched later in 1999, APMT, Thuraya, ICO and perhaps Ellipso will be only a year or two behind. There will be special interest in Asia in the relative performance and competitiveness of the global and regional systems. It will be an absorbing tussle. On the one hand the GEOs will offer advantages in system cost (which can be expected to reflect in airtime charges) and performance in areas like call dropout. On the other hand the global systems will offer simpler global roaming. There has been talk of linking the GEO systems so subscribers to one could roam onto another.

If this is achieved the potential exists for global services through the GEOs as well as the MEOs and LEOs.

The toughest market battle for mobile customers will be the Indian subcontinent. Here all four regional GEOs will compete with the global systems.

The increasingly widespread availability of roaming on terrestrial cellular systems will put pressure on all the satellite mobile systems. Cost and performance advantages will always make terrestrial cellular the preferred network where there is that choice.

The Asian regional economic downturn poses a particular challenge to both global and regional MPCS systems. Business plans will need to be revised to accommodate the lower level of economic activity, the tighter control being applied to corporate costs, and the reduced capacity to pay the prices being advertised.

The timing and rate of economic recovery in the region will be important, particularly for the regional systems. Current prospects are for recovery to start in the second half of 1999, about the time ACeS and Globalstar are commencing service. Should recovery be delayed significantly from this year, all the satellite mobile systems could experience disappointing progress in the regional market. For the global systems, disappointment in Asia in the early years might be offset in other markets. The regional systems would feel more pain if economic recovery should be delayed.

I do not expect the global systems will find much business in the unserviced rural and remote villages of less developed areas, due largely to the level of airtime charges. It will be interesting to see whether the regional GEOs can get their retail airtime charges down sufficiently to be affordable in less-developed areas.

The regional GEOs have a cultural advantage. The Asian business culture takes account of personal relationships and commitment more than is common in Europe and North America. The strong position of regional investors in the regional systems may, all things being equal, translate into a preference to do business with these companies. Like shrewd investors everywhere, some have also hedged their bets by investing in global services, just as some local service providers have signed up with more than one satellite mobile service. Nonetheless I would not be surprised to see preference given to regional services.

VII. *REFERENCES*

1. Merrill Lynch, Pierce, Fenner & Smith, *Global Satellite Marketplace 98*, 1998

2. Frost & Sullivan, *Wireless Communications and Big LEOs and MEOs: Are they Complementary, or Will Satellite Technology Take Over?*, March 1998

3. Ovum Inc, *LEOs, MEOs and GEOs: The Market Opportunity for Mobile Satellite Services*, October 1998

4. Strategis Group, *World Cellular and PCS Markets: 1998*, 1998

5. Strategis Group, *Asia Pacific Cellular and PCS Markets 1997*

6. ITU, *Telecommunications Indicators Online*, June 1997

Return to Top View Full-screen

Increasing Ku Band Availability Through Buffering

Larry Levy, Richard Warren

GTE Information Systems Division, U.S.A

ABSTRACT

Increasing the availability of Ku-Ban satellite communications systems is a worthwhile design goal, with many diverse applications. We have developed a method for increasing the availability of satellite communication systems through the use of input data buffering. The benefits of this technique are directly related to the distribution of heavy rainfall in the area of transmission. The technique described in this paper is appropriate for implementation at the hub Earth Station of a satellite broadcast system. Propagation anomalies that occur at the receive-only remote Earth Stations and cause local outages are not directly influenced by our technique and are not addressed here.

View Full Text

Increasing Ku Band Broadcast Satellite System Availability

by the use of Dynamic, Adaptive Input Data Buffering

Introduction

One of the principal problems with Ku Band satellite communications is the potential for total system outages due to atmospheric attenuation of the transmitted signal caused by adverse weather conditions (i.e. heavy precipitation). This problem becomes particularly onerous when time-critical information is being transmitted via one way point-to-multipoint broadcast systems. In a two-way network, a receiver can request that lost data be retransmitted, but this is usually not possible in a broadcast system. An outage of the link between the hub Earth Station and the satellite will result in a total system breakdown. Consequently, reduced system availability is often a limiting factor in potential applications for Ku-Band satellite communications. This situation is exacerbated in many developing countries, which often have more frequent and heavier rainfall than industrialized nations. Thus, increasing the availability of Ku-Band satellite communications systems is a worthwhile design goal, with many diverse applications.

We have developed a method for increasing the availability of satellite communication systems through the use of input data buffering. When input data which is available for transmission cannot be transmitted over the uplink due to propagation anomalies caused by weather conditions, the data is buffered and saved until conditions improve. If this improvement occurs before the data becomes obsolete, it can be transmitted at that time, thereby allowing the transfer of data which otherwise would have been lost.

The benefits of this technique are directly related to the distribution of heavy rainfall in the area of transmission. (Although satellite propagation anomalies are caused by a variety of phenomena, we have chosen to focus this effort on the most common and most easily discernable condition, heavy rainfall.) For this technique to be of most value, short, frequent bursts of heavy rainfall are preferable, since data would not have to be buffered for long periods. However, if heavy rainfall tends to be concentrated in a few long bursts, most of the data can become obsolete before it can be retransmitted. Therefore, it is essential to determine the rainfall behavior in the hub Earth Station's geographic area.

The technique described in this paper is appropriate for implementation at the hub Earth Station of a satellite broadcast system. Propagation anomalies that occur at the receive-only remote Earth Stations and cause local outages are not directly influenced by our technique and are not addressed here.

The next section of this paper describes the data buffering system for increasing the availability of the satellite uplink. The remainder of the paper details our efforts to determine the distribution of rain rates over time and provides some information on our actual implementation of the concept. These elaborations includes a description of the data and where it was obtained, the methods used to interpret the data, the algorithm used to calculate link availability, the analysis results, and a note about the applicability of the results.

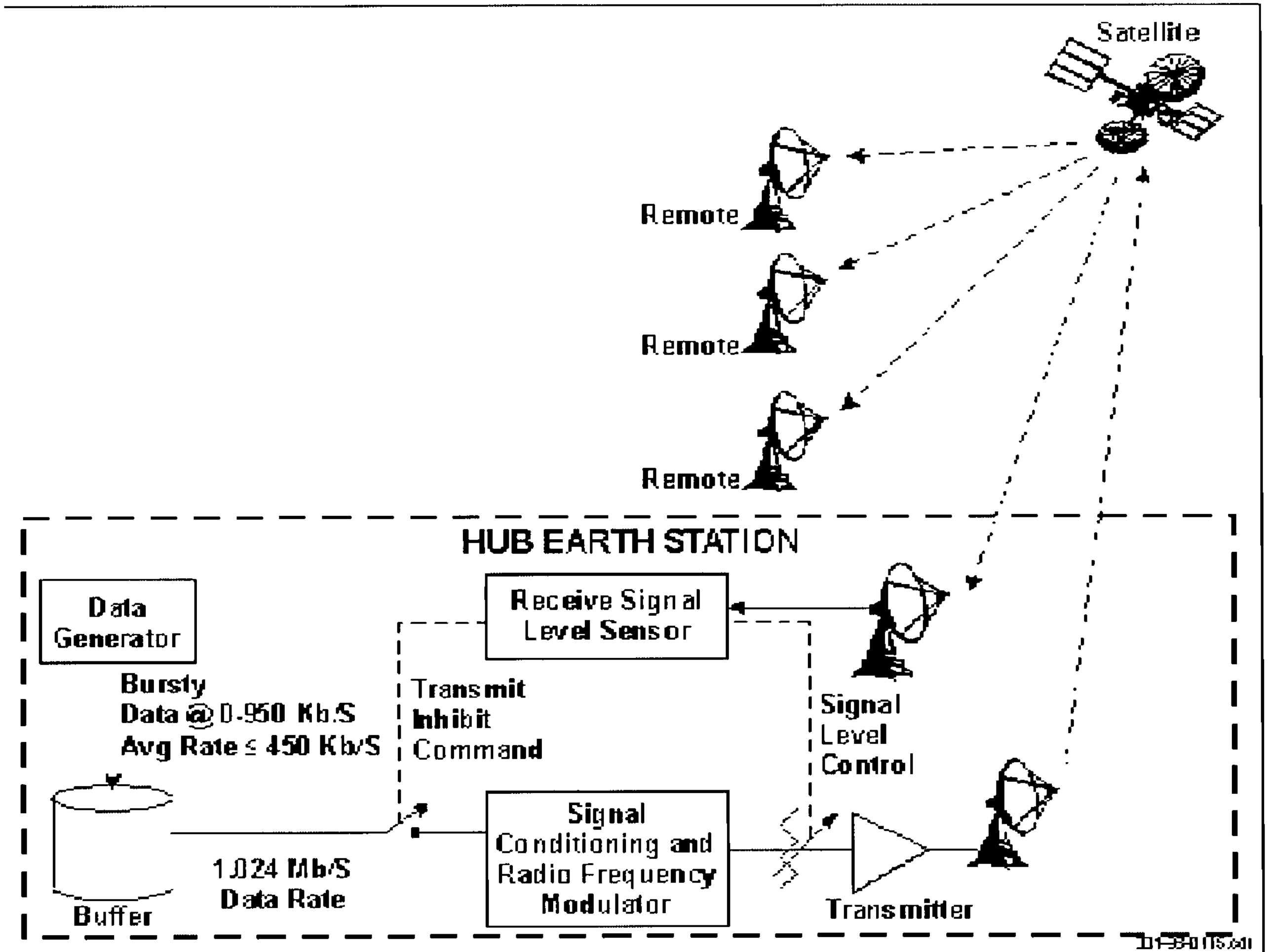
The Earth Station Data Buffering Technique

A block diagram of our implementation of the data buffering system is given in Figure 1. As the diagram shows, this technique requires the communication system to possess the ability to continuously monitor the condition of the link between the hub Earth Station and the satellite. Under normal conditions, the transmitted signal level is adjusted to compensate for clouds and/or light precipitation. However, only a finite amount of power is available from the Earth Station's transmitter to compensate for the atmospheric attenuation. When the link monitoring equipment senses that atmospheric attenuation exceeds the transmitter's power capacity, an inhibit command is sent to the transmitter. The input data is stored in a buffer for subsequent transmission.

We are investigating this technique because other straightforward methods of increasing availability for our particular application have already been implemented. Any increase in uplink transmission power would result in the FCC's maximum allowable power limit being exceeded on the downlinks of the network. In addition, we already use the most robust error correction code rate allowable within the Digital Video Broadcast (DVB) standard. The data buffering technique represents the next logical means to increase the availability of the uplink.

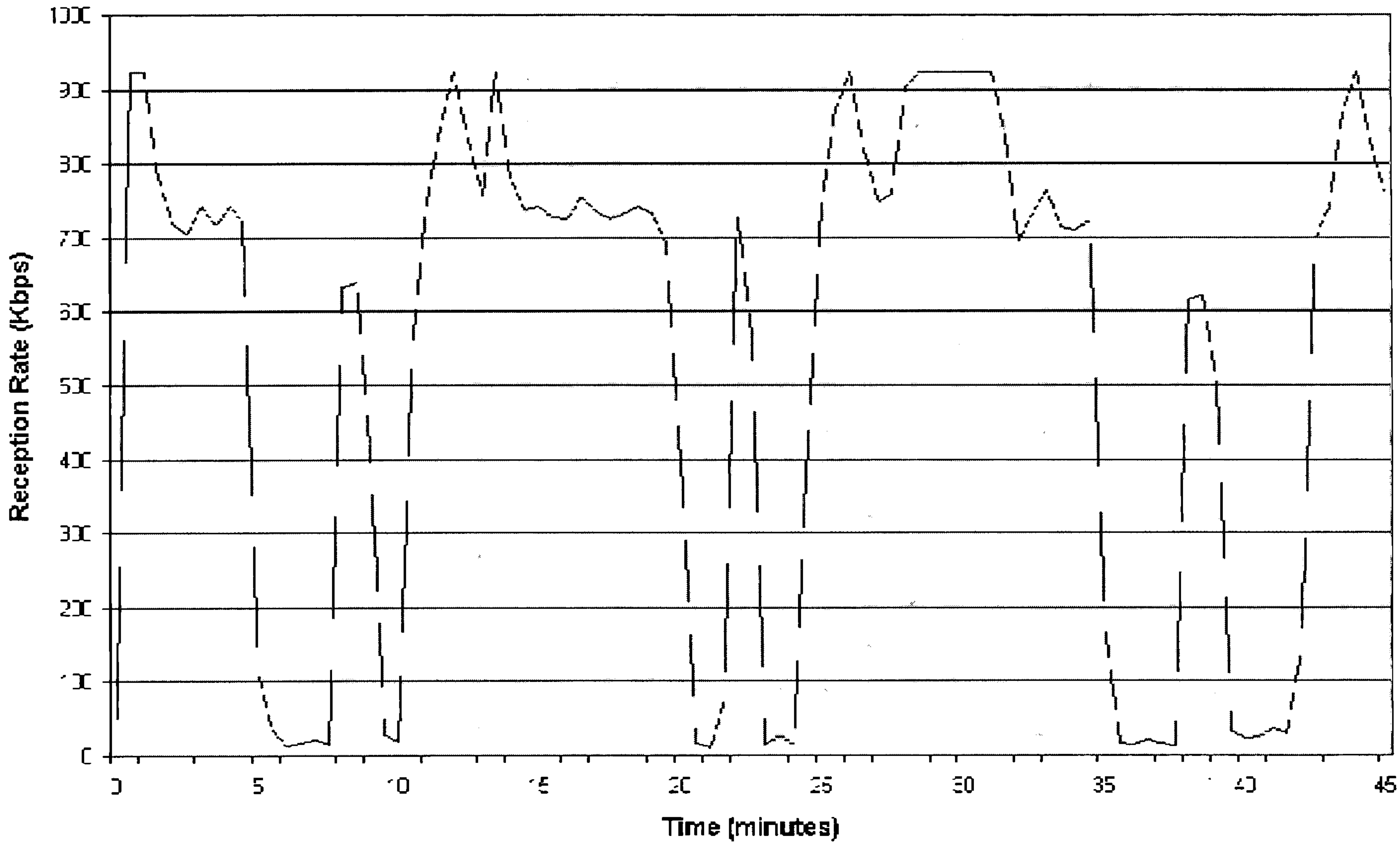
There are a couple of system prerequisites required before a data buffering system such as described above can be implemented. First, the transmission rate of the broadcast must be greater than the mean reception data rate. One reason this might occur is a bursty reception data stream. As Figure 1 shows, the maximum reception rate of our data is about 950 Kbps and the average reception rate is about 450 Kbps. The bursty nature of this data is presented in Figure 2. The reason our transmission rate is more than twice the average reception rate is to be able to service this maximum reception rate. Without this excess transmission capability, the data buffering technique would obviously not be effective.

Figure 1: Transmission System Block Diagram



In addition, for this data buffering system to be used effectively, the transmitted data should be packetized with a unique packet identifier. Without packetization and some data identification technique, remote receiving equipment would have no way of knowing where to pick up a data stream after it had been interrupted. The receivers must also be able to distinguish between the packets of different messages and be able to reconstruct a message's packets even if they are not received in the order they are transmitted. Without this latter capability, a system in which data from two different times and possibly two different messages are transmitted simultaneously would lead to totally garbled receptions.

Figure 2: Reception Rate vs. Time



1314

Source Data

1315

NASA, through its Tropical Rainfall Measuring Mission (TRMM), has been collecting rainfall data at Wallops Island, VA, and other sites throughout the world for almost a decade. Rainfall measurements are taken once a second from multiple optical rain gauges (at different times, as few as 5 and as many as 16 gauges are operating simultaneously). The gauges measure the "instantaneous" rainfall rate in units of millimeters of rain per hour. TRMM's long period of continuous data collection and the short period between its measurements make this set of data very attractive for our analysis. Unfortunately, the concurrent rain measurements from the different optical rain gauges often vary dramatically. In extreme cases, the value of the highest measurement can be ten or twenty times that of the value of the lowest measurement. Usually, over a twenty minute period (which is the length of time covered by a single TRMM record), there are differences in measurement of at least 50 percent; differences of a factor of two or three are not that unusual. This phenomena seems to be a consequence of varying equipment sensitivities and the differing physical locations of the gauges. Even a small difference in position can significantly affect readings, particularly if wind is altering the rain pattern. Given the discrepancy of the data, it also seems likely that different individual optical gauges at Wallops Island will give different readings in identical conditions, although not necessarily in a predictable fashion. In any event, before the effect of buffering upon satellite link availability could be determined, it was necessary to analyze these varied measurements to come up with an accurate estimate of rainfall rates.

In addition to the optical rain gauges, the TRMM data includes stick gauge measurements which indicate the total rainfall over a period of time. As the name implies, a stick gauge uses a calibrated rod and a collection cup to determine the amount of rain that falls in a given time period. This is a well established method for determining rainfall over a period of at least an hour. The periods between the TRMM stick gauge measurements can be as short as several hours or as long as several days, depending upon the amount of rainfall. We defined a *session* to be the time period covered by a single stick gauge measurement. Based on our discussions with the TRMM technical staff, we have assumed that the stick gauge measurement of rainfall during a session is an accurate figure.

Interpreting the Data

We wish to determine which of the optical gauges are taking accurate measurements and use the data only from these gauges. We will define the accuracy of an optical gauge by its performance over a session, since we already have an accurate measurement over those periods. The "accurate" gauges were identified using the following procedure. First, the total rainfall measured by each optical gauge over an entire session was calculated. We then compared this with the stick measurement for that session. Any optical gauge with a total rainfall of between 90% and 110% of the stick measurement was defined to be an *accurate gauge* for that session. Only the data from accurate gauges are included in the analysis.

Occasionally, none of the optical gauges had a total rainfall within 10% of the stick measurement. In these cases, the gauges with rainfall totals closest to the stick measurements were considered accurate. This rule resulted in one, two, or three accurate gauges, depending upon how closely bunched the total rainfall figures were.

In order to calculate the effect of buffering upon link availability, we need to know if the instantaneous rain rate is greater than a given threshold. The threshold is the minimum amount of rain that will interrupt satellite transmission. For our situation, the threshold, based on our uplink power control and link budget margins, was chosen to be 50 mm/hr. Naturally, this value will vary with the unique characteristics of the transmission system components and the size of the satellite dish.

We defined a period of rainfall in excess of the threshold as *heavy rain*. Each second of time covered by the analysis was evaluated by using the following rule: if at least half of the accurate gauges had a rain rate greater than the threshold, then it was a second of heavy rain. The one exception to this rule was if there were exactly two accurate gauges. In this case, both of the gauges had to show a rain rate in excess of the threshold in order for it to be a period of heavy rain.

Our objective was to find where the data showed consecutive periods of heavy rain. We called these consecutive periods *rainbursts*. The following additional rules were used to define rainbursts. Rainbursts must be at least five seconds in duration. (Periods of heavy rain less than five seconds are ignored for the reasons described below.) In addition, if two periods of heavy rain are separated by less than five seconds, the entire sequence, including the separation, is considered to be one rainburst.

There are several reasons behind the five second rules. Initially, it was thought that rain rates would fluctuate quite a bit over several seconds. One of the reasons for requiring five seconds of continuous rain to define a rainburst was to ensure that what was being measured was not some random fluctuation caused by wind or equipment sensitivity, but actual heavy rain that would interrupt satellite transmissions. However, rain rate variations proved to be quite smooth, with typically a gradual buildup prior to a period of heavy rain, followed by a damping down period. When less than five seconds of heavy rain was observed, it was usually a case of the rain rate maintaining values near the threshold. Often these short periods would occur at the beginning or end of a long rainburst.

Another consideration for requiring at least a five second separation between rainbursts was to allow time for remote satellite receivers to reacquire the interrupted satellite transmitted signal. In retrospect, the five second rules were probably not necessary. However, observation seems to indicate that they had very little effect upon the results of the analysis.

In addition to rainbursts, we are also interested in the duration of the time between two rainbursts. We refer to these periods as *gaps*. Gaps are important because they represent the time during which buffered data can be retransmitted. Using the rules just defined, we are therefore able to use the Wallops Island data to divide the period of the analysis into rainbursts and gaps and to determine the length of each of these periods.

Calculating Link Availability

The steps necessary to calculate the effect of buffering upon link availability are given below:

1. Determine the threshold rain rate at which data transmission is interrupted. As noted above, in our analysis the threshold was 50 mm/hr.
2. Determine the ratio of the maximum data transmission rate to its reception rate. In order for this technique to work, it is necessary that data can be transmitted at a faster rate than it is received. This enables the broadcaster to transmit the buffered data at the same time that the regularly scheduled data is transmitted. Without this faster transmission speed, it would not be possible to "catch up" on the backlog of buffered data. In our analysis, the transmission rate was assumed to be exactly twice the reception rate.
3. Determine how long data can be stored before it is too dated to be of use. This can vary with the type of transmission, although non-uniform limits will complicate the analysis by requiring either a schedule of transmissions or a simulation. In our analysis, we made the simplifying assumption that all data had a uniform maximum time limit before it became obsolete. This maximum time limit for retransmission was a parameter of our analysis.
4. Determine how large of a storage buffer is required. In our analysis, the buffer size was assumed to be equal to the number of bytes which could be transmitted during a period of time equal to the maximum time limit. The rationale for this assumption was that the delay in retransmitting stored data is the critical factor in maximizing link availability, not the size of the buffer. Within limits, the buffer size can always

be increased to match the maximum time limit. Since there is no point in storing data beyond the time limit, there is no need to have a buffer size larger than can be stored during the time limit. Therefore, the size of the buffer was strictly determined by the retransmission maximum time limit.

5. To emphasize the previous point, the size of the buffer will be stated in terms of the amount of time it takes to transmit its contents concurrently with the regularly scheduled data. For example, suppose that data is received at 1 megabit per second (Mbps) and that the maximum transmission rate is 2 Mbps (allowing buffered data to be transmitted concurrently with regularly scheduled data at its 1 Mbps rate). If the buffer can store 50 megabits of data, then we would say that we have a buffer size of 50 seconds.
6. Determine in what manner data is stored in the buffer. In our analysis, we assumed that the software operating the buffer was sufficiently intelligent to function in an optimal fashion. The simplest way to describe this optimal operation is to give an example. Suppose that the uniform time limit for retransmissions (and therefore, the buffer size) is 60 seconds. We have a rainburst of 70 seconds, followed by a 20 second gap, followed by a burst of 15 seconds, and finally followed by a gap of 80 seconds. As the first rainburst hits, the data is recorded into the buffer. After 60 seconds of data has been recorded, the buffer is full. At this point, the first pieces of data which were recorded are about to become obsolete, since their time limit is about to expire. Therefore, beginning at the 60 second mark of the rainburst, the received data will overwrite the data received at the beginning of the rainburst. This takes place for 10 seconds, until the burst is over. We can now begin transmitting the stored data. The most efficient data to transmit is the data we started recording at the 10 second mark of the burst. In other words, the data we were just getting ready to overwrite. We transmit data until the gap ends. This takes us to the 30 second mark. We now overwrite the next 15 seconds of data (i.e., the data received from the 30 second mark to the 45 second mark of the original rainburst). The next gap is sufficiently long to transmit the entire contents of the buffer. This includes the last 25 seconds of the first rainburst as well as the entire 15 seconds recorded during the second rainburst. The amount of data in the buffer over time in this example is displayed in Figure 3 below.

Figure 3: Buffer Contents vs. Time--An Example

7. Calculate how many seconds of data have been transmitted over the time period of the analysis. Include data transmitted at its regularly scheduled time as well as retransmitted data. To illustrate, in the example given in Step 6, 20 seconds of regularly scheduled data was transmitted during the first gap, as well as 20 seconds of data retransmitted from the first rainburst. During the second gap, 80 seconds of regularly scheduled data was transmitted, along with 25 seconds of retransmitted data from the first rainburst and 15 seconds of retransmitted data from the second rainburst. This makes up a total of 20 + 20 +80 + 25 + 15 = 160 seconds of data transmitted.
8. Use the value obtained in Step 7 and the total time of the analysis to calculate the link availability adjusted for buffering. Use the following formula:

(Seconds of Transmitted and Retransmitted Data)

Link Availability (w/buff.) = --

(Total Analysis Time [in seconds])

Compare this to the unadjusted link availability, which is based upon the seconds of transmitted data. This figure is simply equal to the sum of the gaps during the analysis. The following formula is used to calculate the unadjusted link availability:

(Seconds of Transmitted Data)

Link Availability (unadj.) = --

(Total Analysis Time [in seconds])

To complete the example given in Step 6, since the total time period in the example is 70 + 20 + 15 + 80 = 185 seconds, the link availability adjusted for buffering is (160 ÷ 185), or 86.5 percent. Without buffering, the link availability would have been (100 ÷ 185), or 54.1 percent.

Analysis Results

To conduct our analysis, we used data gathered at Wallops Island from January, 1994 through November, 1996, a period of 35 months. This represents a total analysis time of 91,980,000 seconds. Using the procedure outlined above, we calculated what the link availability would be with different maximum time limits for retransmission. We analyzed 13 instances, varying the time limits by 30 seconds from zero minutes (i.e., no buffering) to six minutes. Keep in mind that the maximum time limit for retransmissions determines the size of the buffer. The results of the calculations are given below in Table 1.

Table 1: Analysis Results for Varying Retransmission Time Limits

Max. Time Limit for Retransmissions (min.)	Downtime (seconds)	Downtime (min/year)	Link Availability
0.0	17,451	99.7	0.999810
0.5	13,254	75.7	0.999856
1.0	10,895	62.3	0.999882
1.5	9,386	53.6	0.999898
2.0	8,161	46.6	0.999911
2.5	7,151	40.9	0.999922
3.0	6,275	35.9	0.999932
3.5	5,378	30.7	0.999942
4.0	4,653	26.6	0.999949
4.5	4,081	23.3	0.999956
5.0	3,610	20.6	0.999961
5.5	3,257	18.6	0.999965

6.0	2,929	16.7	0.999968

As the table shows, with a retransmission time limit of two minutes, the unavailability of the link due to rain is cut in half by buffering. Even with a 30 second time limit, link unavailability is reduced by about 25 percent. And with a 6 minute time limit, the link unavailability is reduced by a factor of six.

Figure 4 presented below shows the relationship of link availability to the maximum time limit for retransmissions. Annual downtime is shown on the right for reference. Notice that the curve flattens as the time limit increases, showing that the increase in link availability lessens as the time limit grows larger.

Applicability of Results

We believe that the methodology for predicting the effect of input data buffering upon link availability has wide applicability to a variety of situations and to almost any geographic area. However, we feel we should state some caveats about the specific conclusions reached on the TRMM data.

First, the rain data from Wallops Island produced quite a bit more heavy rain than is predicted. Wallops Island is located in the D2 region of the Crane global rain model. The model predicts an unadjusted link availability of 0.9999 if a threshold of 50 mm/hr is used. As the above table shows, the actual unadjusted link availability for the 35 months modeled was 0.99981, which represents almost twice as much heavy rain as predicted by the Crane model for that region. Moreover, we have collected rain data ourselves using a specially modified optical rain gauge at our location in Chantilly, VA. (The gauge was modified by the manufacturer to reduce the measurement integration time to 5 seconds – this was as close to "instantaneous" as he was able to achieve). Chantilly is also in the D2 rain region and is not far from Wallops Island. The unadjusted link availability calculated from the Chantilly data is 0.99992. The Chantilly data is for only 8.5 months, is non-continuous, and uses only a single rain gauge, so it is not nearly as reliable as the Wallops Island data. It does, however, support the contention that during the time of the study, Wallops Island received an unusually large amount of heavy rain for a D2 location.

There are several possible reasons for this apparent discrepancy in actual versus predicted rainfall. First, the Wallops Island TRMM data is measured on an island. The personnel at Wallops believe that their total annual rainfall is typical for a D2 site, but given the proximity to the ocean, it would not be surprising if heavy rain is more common than it would be for an inland D2 location. In addition, the summer of 1996 saw the effect of Hurricane Fran on the East Coast of the United States. This is reflected in the unadjusted link availabilities from Wallops for each of the three
1328 model years. These availabilities are shown in Table 2 presented below. As the table shows, 1996 seems to have been an anomalous year for

heavy rain which may have skewed the overall results. On the other hand, major hurricanes are not uncommon for the East Coast, so this may simply be another indication that Wallops Island receives more heavy rain than a typical D2 location.

Table 2: Unadjusted Link Availability per Model Year

Year	Unadjusted Link Availability
1994	0.99990
1995	0.99983
1996	0.99969

The second point we wish to emphasize is that while we believe our analysis clearly shows that buffering will increase link availability, the precise effects will vary , sometimes dramatically, with time and place. For example, the conclusion that a retransmission time limit of two minutes reduces link unavailability by a factor of two is valid for our data but may not be applicable to other D2 locations or for every year. To see the variability of the effect of buffering, we present Table 3, which shows the annual downtime for the Wallops Island data in the three model years for the different retransmission time limits.

Table 3: Downtime per Year for Different Retransmission Time Limits

Max. Time Limit for	Downtime (min/year) for		
Retransmissions (min.)	1994	1995	1996
0.0	51.6	89.5	163.4
0.5	29.7	72.6	129.4

1.0	19.0	63.7	107.9
1.5	14.2	57.0	93.0
2.0	10.6	51.0	81.2
2.5	7.5	45.9	71.8
3.0	5.1	41.5	63.3
3.5	2.6	36.7	55.0
4.0	1.2	32.1	48.3
4.5	0.5	27.8	43.3
5.0	0.0	24.3	39.1
5.5	0.0	22.3	34.9
6.0	0.0	20.7	30.7

As the table shows, buffering had a tremendous effect in 1994. A two minute transmission delay limit reduced the link unavailability by almost a factor of five. In 1995, however, even with a two and a half minute delay limit, the link unavailability is reduced by less than a factor of two. The 1996 data falls in between these extremes, with a two minute delay limit resulting in link unavailability being cut in half.

Conclusion

Based upon the data that we have collected, the technique of dynamic, adaptive buffering of input data for subsequent transmission significantly improves the availability of a Ku-Band satellite transmission system. In our example, the unavailability of the satellite link was cut in half for transmissions that could be delayed by two minutes. Our data shows the link availability improvement lessening as the retransmission time limit increases.

Return to Top   View Full-screen

New Standards and Solutions

for Satellite Communication Modulation and Error Correction

Eric Jacobsen

EF Data Corp, U.S.A

ABSTRACT

As technology advances and satellite distribution and services evolve, there is a natural evolution in Satellite Communications equipment that is driven by these forces. Some of the most notable changes are happening in the closely related areas of Modulation and Error Correction. Several new standards developed for satellite digital video distribution have recently appeared which are driving product development with higher order modulation formats and new Error Correction schemes. These new standards using 8PSK and 16QAM have resulted in developments of new Trellis Coding and Error Correction systems which differ from existing standards for various reasons. Additionally, new advances in Error Correction have led to the exploration and development of a new class of codes known as Turbo Codes. Turbo Codes are suitable for Satellite Communications for both power and bandwidth reduction. A survey of available and developing modulation formats and error correction systems demonstrates the uses and advantages of the various methods and the tradeoffs involved in their selection. Maximization of channel bandwidth efficiency or power efficiency can be facilitated by understanding the relationships of the various modulation methods and error correction capabilities. The role of Turbo Codes in allowing further tradeoffs for power or bandwidth management is also examined, as well as probable future capabilities based on current research.

View Full Text

New Standards and Solutions

for Satellite Communication Modulation and Error Correction

Introduction

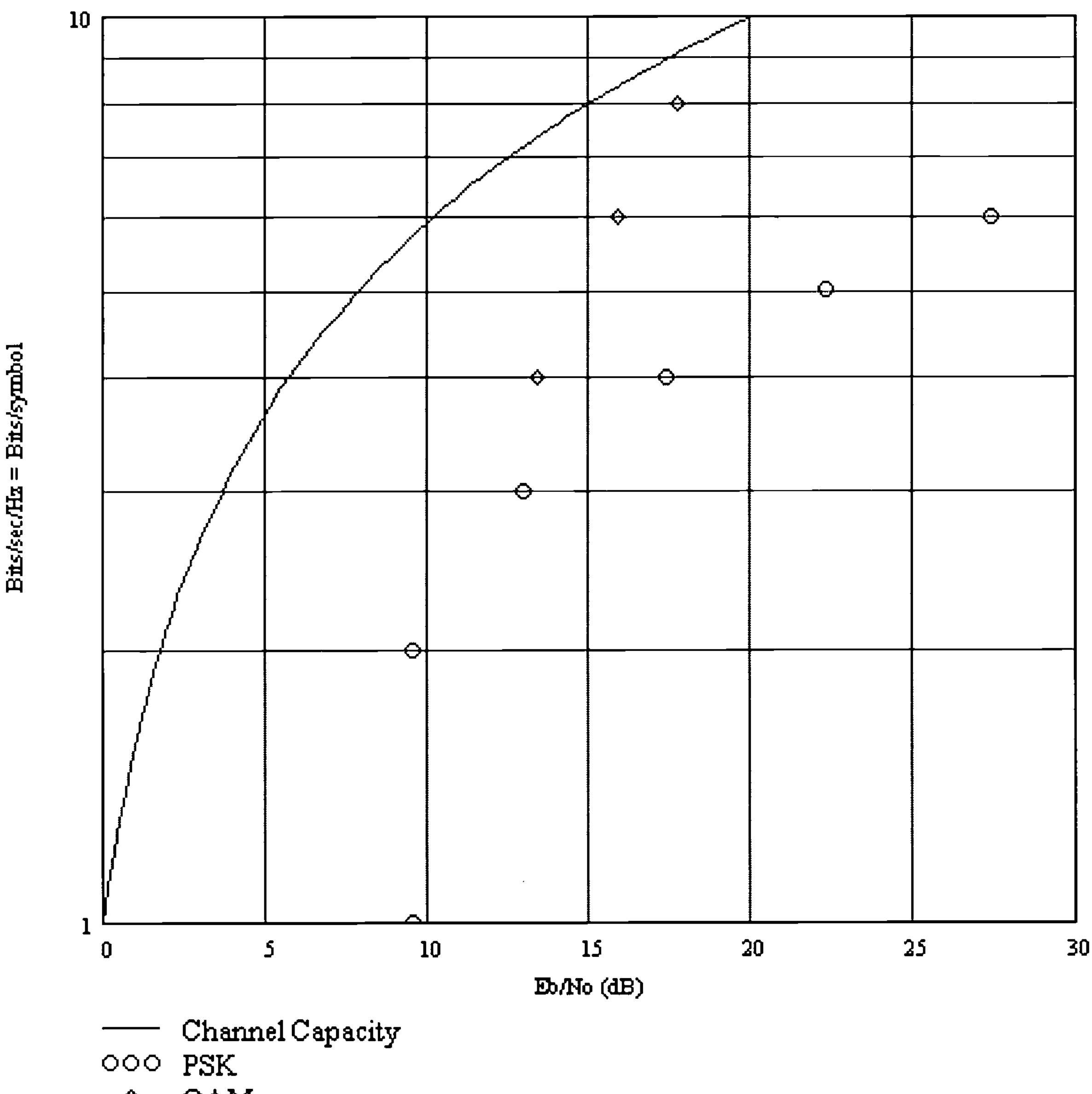
Tradeoffs in most transmission media between transmitted power, occupied bandwidth, error correction systems, and information bit error rate present users with a sometimes daunting array of possible link and system configurations. Formal Industry Standards facilitate common compatible implementations of specific solutions that allow interoperability of equipment and other potential advantages to users. Evolutionary forces are moving the industry towards more bandwidth efficient modulation schemes which have spawned more new formal standards. It is useful to the user to understand the differences between the standards since many of them are incompatible with each other.

One of the primary evolutionary forces driving changes in satellite communications is the need to improve bandwidth efficiency. Of the many parameters that affect the capacity of a system or network, bandwidth efficiency offers the most dramatic potential for improvement. There are two primary means to achieve improved bandwidth efficiency: higher order modulation schemes (such as 8PSK and 16QAM) and Forward Error Correction systems with reduced overhead (i.e., higher rate codes). Both of these avenues involve tradeoffs that must be understood in order to make intelligent decisions in system management.

Modulation Formats

The general idea of higher-order modulation schemes is to transmit increasing numbers of bits per transmitted symbol. This results in a higher transmitted bit rate within a given bandwidth at the expense of some noise or distortion immunity. Currently the most common modulation scheme for satellite communications is QPSK. The next obvious step in improving bandwidth efficiency with modulation is 8PSK, and 16QAM is the next step after that.

Figure 1 shows a bandwidth-efficiency plot of various modulation methods and how they compare in bandwidth and power efficiency. The vertical axis is bandwidth efficiency in bits/sec/Hz, which for PSK and QAM is equivalent to the number of bits per symbol, and the horizontal axis is Eb/No. The points indicated are the operating points for uncoded (i.e., no FEC) operation of each indicated modulation type at a Bit Error Rate of 10^{-5}. BPSK and QPSK fall on a vertical line which reflects the characteristic that both formats have identical power efficiency. The vertical separation between the two indicates that QPSK has twice the bandwidth efficiency of BPSK, which is a result of transmitting two bits per symbol in QPSK rather than one for BPSK. The next step up in bandwidth efficiency is 8PSK, which is taken with a penalty in power efficiency. This means that an 8PSK signal can handle one and a half times as much raw data as a QPSK signal of the same bandwidth, but it also requires ~3.4dB more transmit power to maintain the same error rate. The next step up from 8PSK in bandwidth efficiency is 16QAM. It is evident that 16QAM is chosen over 16PSK since 16PSK requires more power to achieve the same performance with the same bandwidth efficiency as 16QAM. Modulation formats that are higher order than 16-ary are not suitable for satellite communications with current technologies, but it is clear from the plot that QAM is superior to PSK for 16-ary signaling and higher.



◇ QAM

Figure 1. Bandwidth-Efficiency plane for M-ary PSK and QAM signaling at $P_e = 10^{-5}$.

The performance issues shown in Figure 1 compare only the fundamental modulation formats and do not consider other factors such as FEC utilization, phase noise performance, etc. For a practical application the final system performance is paramount, so the effects of FEC and channel impairments must be considered.

PSK modulation carries information in the signal phase, and as the order of the modulation increases the susceptibility to phase noise also increases. Since BPSK and QPSK have the same power efficiency (as illustrated in Figure 1), and QPSK has twice the bandwidth efficiency as BPSK, the primary advantage of BPSK is increased immunity to phase noise and related channel impairments. Not surprisingly, 8PSK is more susceptible to phase noise than QPSK. A link operating at the limit of Intelsat phase noise specifications will exhibit some degradation with 8PSK modulation. If the close-in phase noise is kept approximately 3-6dB better than the Intelsat specification 8PSK will operate at E1 rates with little or no degradation with a carefully engineered carrier recovery loop. Modern quality phase-locked LNBs generally exhibit low enough phase noise and adequate stability to handle 8PSK without significant degradation or cycle slips. The power penalty from QPSK to 8PSK indicated in Figure 1 is approximately 3.4dB, and with suitable LNBs the transition from QPSK to 8PSK to realize a 50% increase in bandwidth efficiency is easily within reach. As equipment continues to improve this transition should become even less of an issue.

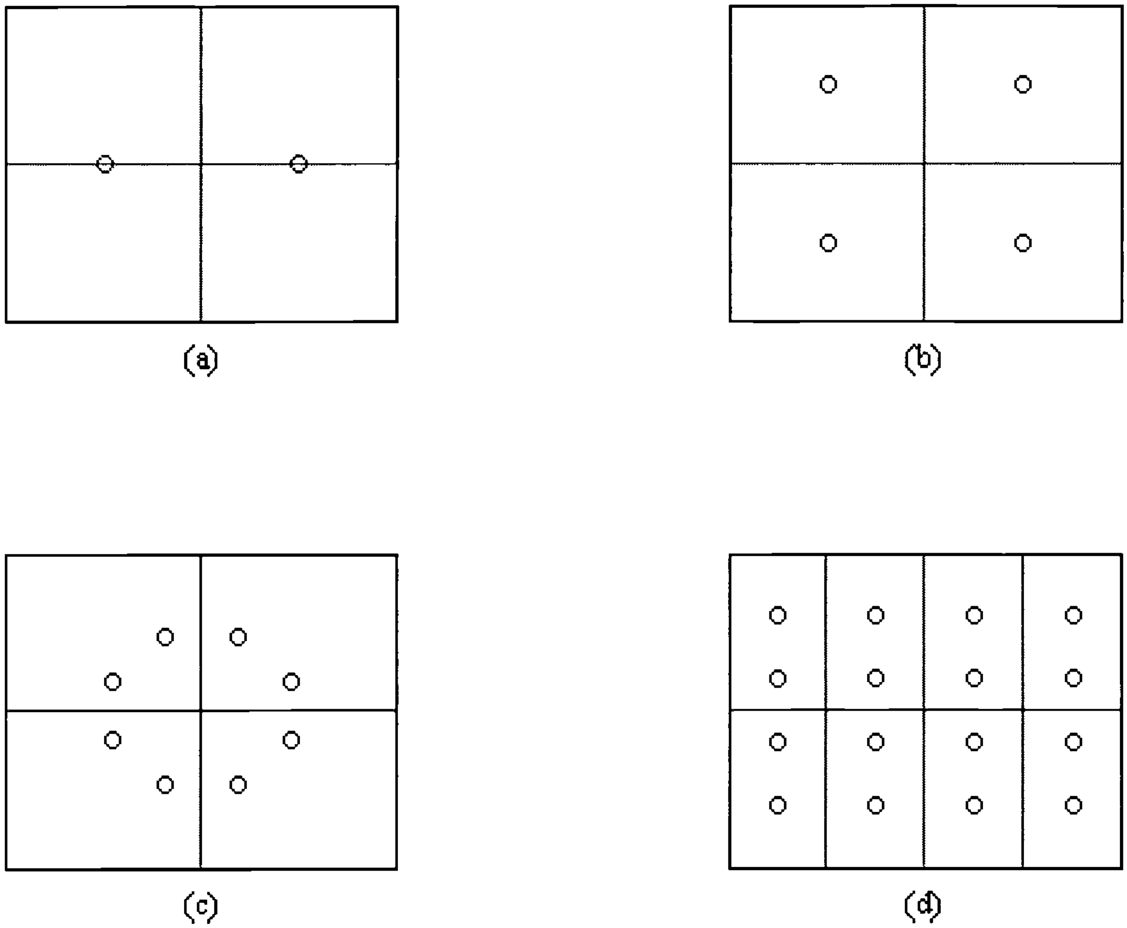


Figure 2. Common constellations for satellite communications. The dots represent all of the possible symbols for each modulation method. (a) BPSK, (b) QPSK, (c) 8PSK, (d) 16QAM.

The transition from PSK to 16QAM is not insignificant when considering practical operating requirements. From Figure 1 it can be seen that 16QAM offers a 33% increase in bandwidth efficiency over 8PSK with a power penalty of less than 1dB. While this is true in a theoretical sense, the practical application of 16QAM in satellite communications requires careful attention to subtle details. All PSK modulation schemes share the trait that since only the signal phase is used to carry the modulation, the symbol magnitudes are constant. Figure 2 shows constellation diagrams of some common signaling methods. With QAM, the signal amplitude carries information as well as the phase. This has several important consequences. The most obvious consequence is that QAM signals require a predominantly linear channel in order to avoid degradation due to distortion. It is necessary that the power amplifiers in a channel utilizing QAM be operated with enough backoff to ensure sufficient linearity to prevent the distortion. PSK systems are much more tolerant to channel nonlinearity since the symbol magnitudes do not change.

A second less obvious consideration with QAM is the distinction between peak and average Eb/No. With PSK modulation the peak and average symbol power levels are the same, but with

16QAM there is an approximately 3dB difference between the peak and average symbol power level. Since BER performance curves are typically shown against average Eb/No rather than peak, 16QAM requires an additional backoff of at least 3dB in order to maintain linearity if the link analysis is performed using average Eb/No figures.

Many satellite transponders use signal filters with significant phase deviation near the edges of the transponder bandwidth. These phase deviations are much more detrimental to 16QAM than to PSK, and narrow carriers operating in or near these phase deviations may experience significant degradation. A properly designed adaptive equalizer will generally be able to restore most or all of the degradation caused by the channel phase distortion.

Forward Error Correction

The relative efficiencies indicated in Figure 1 do not consider the use of FEC. While Figure 1 is useful for comparison of modulation schemes, a practical satellite link is nearly unusable without some form of FEC in the system. Many satellite users require Quasi-Error-Free performance which is generally taken to mean BER performance of $P_e = 10^{-10}$ or better. Obtaining this level of performance from a satellite link mandates the use of extremely powerful FEC solutions. The most common FEC systems used in satellite communications utilize either Viterbi decoding or Viterbi decoding concatenated with a Reed-Solomon block code. Figure 3 shows the performance curves of these FEC systems at code rates of R = ½, ¾, and 7/8.

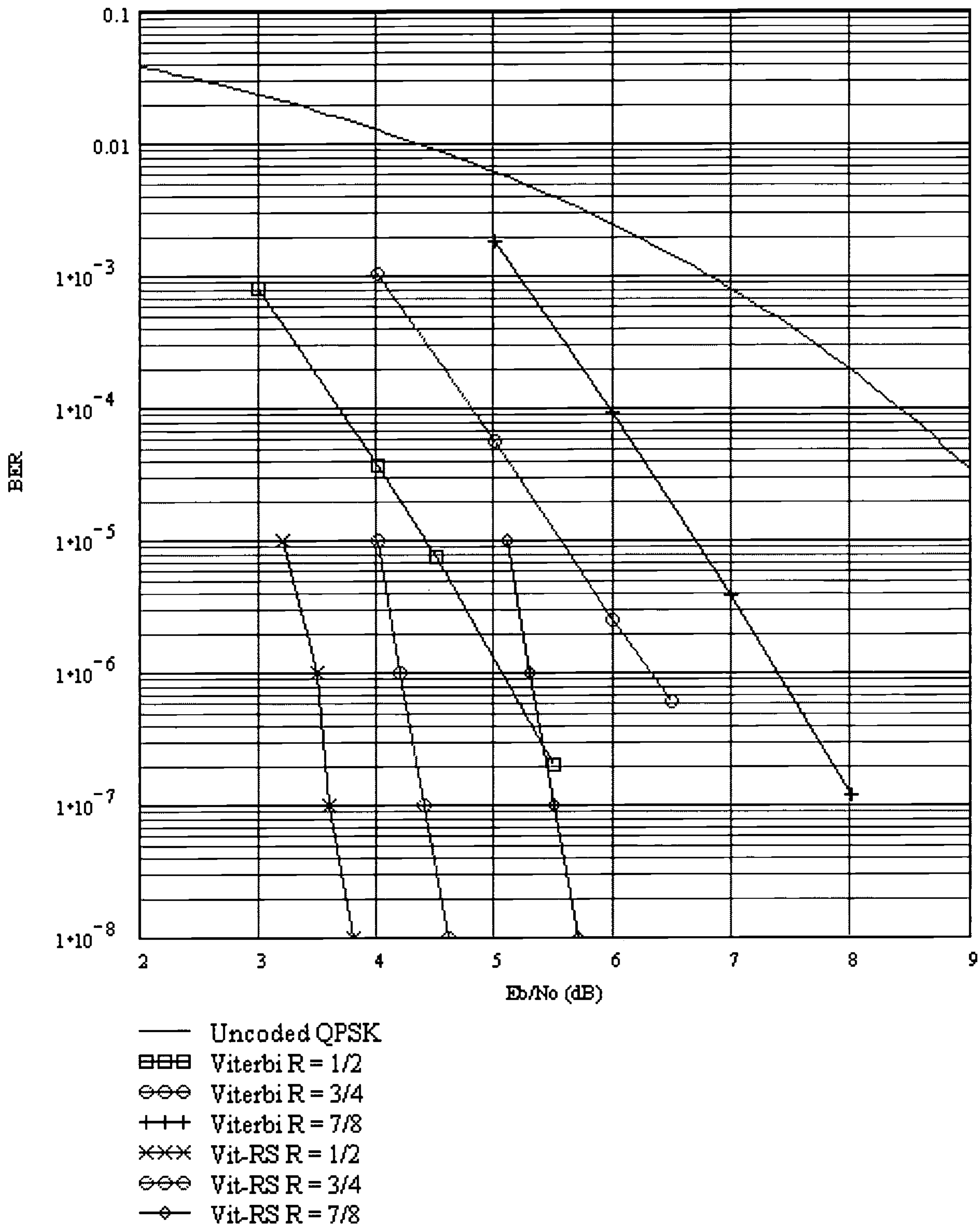


Figure 3. Performance of Viterbi and concatenated Viterbi-RS Forward Error Correction for QPSK modulation.

The distance from the indicated FEC performance curves to the uncoded curve for a given BER is referred to as the coding gain. As the amount of redundancy transmitted increases (i.e., the code rate decreases) the performance of the decoder improves. For a Rate = ½ code half of the required bandwidth is utilized by the code overhead. A Rate = 7/8 code uses only 1/8 of the occupied bandwidth for code overhead. Choosing an appropriate code rate for an application involves a compromise between the bandwidth increase due to the code and the power benefit (i.e., coding gain) that it provides.

Utilization of a Reed-Solomon code in conjunction with the Viterbi decoder offers a significant increase in coding gain with a small additional increase in occupied bandwidth. While the concatenated codes are typically referenced only by the Viterbi code rate, the Reed-Solomon code does add additional overhead. The net code rate for a concatenated R = ½ Viterbi and R = 188/204 Reed-Solomon code is R = 188/408 or just under ½. Figure 3 indicates that the small increase in bandwidth due to the Reed-Solomon overhead yields a performance increase of more than 2dB at a BER of 10^{-7}. Since the slope of the concatenated Viterbi-RS curve is steeper than the Viterbi performance curve, the benefits of the Viterbi-RS system increase as Eb/No increases.

Standards

Several organizations have developed standards for satellite communications equipment that serve, in part, to ensure equipment interoperability. The solutions specified in standards from different organizations tend to differ for various reasons, not all of which are technically driven. Intelsat has been one of the leading organizations in setting equipment standards for satellite communications. The Intelsat IESS-308 standard helped define configurations for utilization of concatenated Viterbi-RS FEC in satellite modems. Since IESS-308 was one of the first standards published for this technology it was developed in the context of the technology at the time. For data rates over 10Mbps IESS-308 specified the use of three independent Viterbi decoders in parallel. This was done in order to utilize economically available Viterbi decoder chips which were data rate limited at the time. IESS-308 also specified different overhead rates in the Reed-Solomon outer code for various data rates and configurations. While this allowed a good deal of flexibility and also allowed the codes to be somewhat optimized for the corresponding configurations, it also forced the selection of a specific vendor for the Reed-Solomon decoder.

As it became clear that LNBs and other components in satellite communication links were improving to the point where higher-order modulations were practical, Intelsat published IESS-310 for the use of 8PSK. Although only one FEC rate of R = 2/3 was considered, it did pave the way for the next logical step up from QPSK and maintained some of the basic Viterbi-RS components from IESS-308. Recently the DVB-DSNG standard was established which also includes specifications for concatenated Viterbi-RS and 8PSK modulation. DVB-DSNG borrowed some components from DVB-S, which had also established standards for concatenated Viterbi-RS for QPSK. By the time these standards were being developed new Reed-Solomon decoders were available which, although less flexible, were less expensive than those required for IESS applications. DVB also specified a longer interleaver between the Viterbi and Reed-Solomon decoders. The longer interleaver provides a small performance increase and slight steepening of the curve at the expense of data latency. DVB-DSNG introduced new standards for two additional code rates for 8PSK, R = 5/6 and R = 8/9, as well as R = ¾ and 7/8 for 16QAM, all with concatenated Viterbi-RS FEC.

The differences between the existing standards, as well as some under development, provide an array of choices to the user community. Since the Intelsat and DVB standards specify different Reed-Solomon decoders, interleavers, and Viterbi decoder configurations for high data rates, equipment built for one standard is not compatible with the other. As new standards develop for various applications the compatibility issue must always be addressed. Standards committees generally examine technology issues in the context of what is available at the time, so technical advances often contribute to incompatibilities with previous standards.

Recent Developments

One notable recent development that is just starting to affect the communications industry is the development of a new class of FEC codes known as Turbo Codes. These codes utilize a different structure and architecture than commonly used codes and achieve error correction performance that is in some instances very close to channel capacity, which is the theoretical limit. The fundamental innovation in Turbo Codes is the implementation of an iterative decoding process where two separate convolutional codes are separated by an interleaving process. This requires the decoder for each code to output soft decision metrics for the next iteration rather than the hard decision information generated by most common decoders. The optimal decoder for convolutional Turbo Codes is an A Posteriori Probability decoder (also known as a Maximum A Posteriori decoder) which is approximately double the complexity of a Viterbi decoder. The additional complexity of the APP plus the requirement for several APPs and associated interleavers to perform the iterations amounts to an FEC solution that is of much higher hardware complexity than the common Viterbi-RS concatenated codes.

Figure 4 shows the performance of an example Turbo Code currently under development. In this case the code is a parallel architecture with an interleaver of length 8192 performing six iterations at E1 rates. It can be seen that this code significantly outperforms the Intelsat concatenated Viterbi-RS codes at the same overhead rates. The indicated Turbo Code performance is from system simulations that do not include an additional outer Reed-Solomon code, and results are not shown below a BER of approximately 10^{-7} because of simulation limitations.

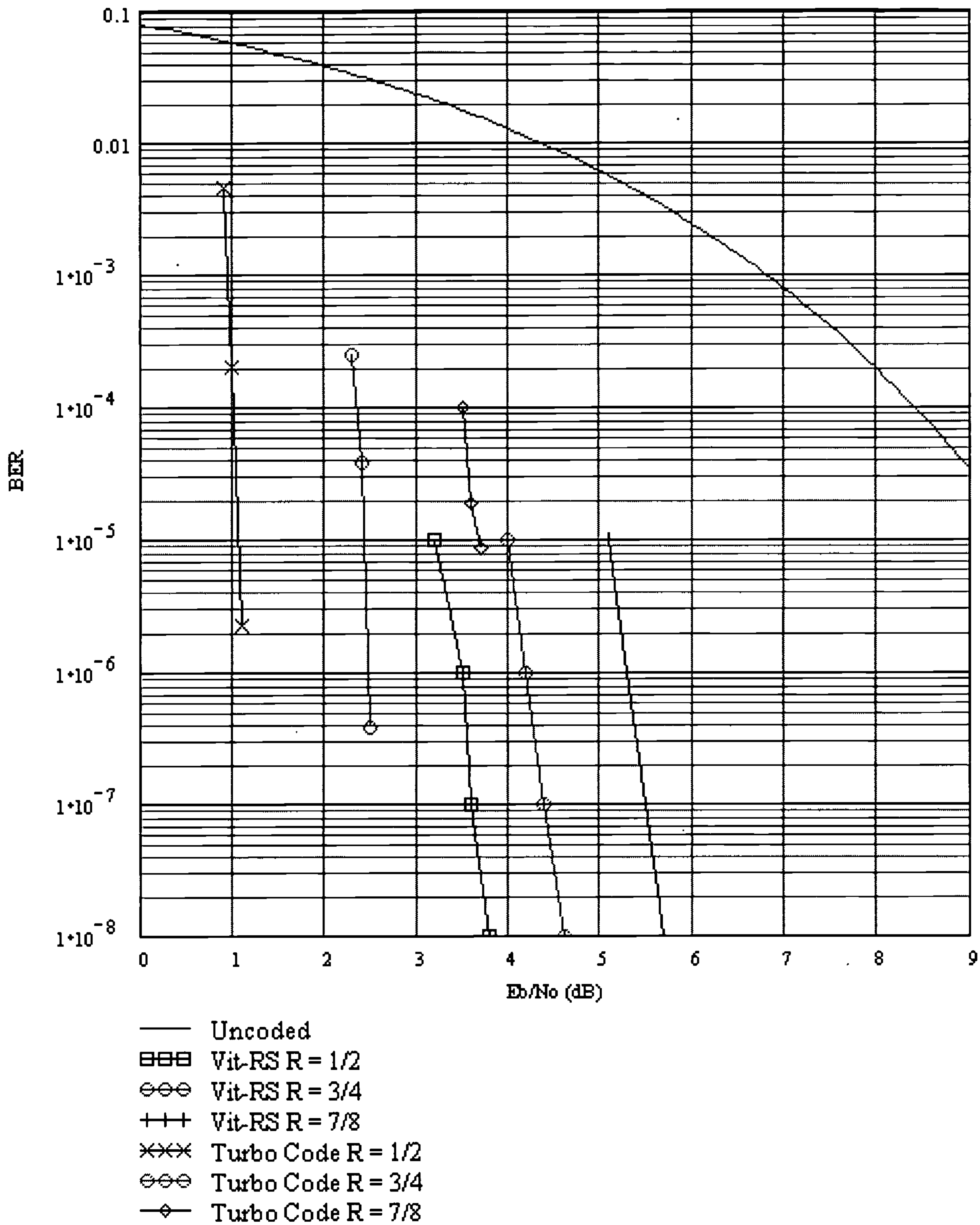


Figure 4. Results of Turbo Code simulations compared to typical Intelsat concatenated Viterbi-RS performance. Performance is for six iterations of a parallel architecture Turbo Code with an interleaver depth of 8192. QPSK modulation is assumed.

The most obvious benefit of a Turbo Code with the indicated performance is in Eb/No or required power. An R = ½ Turbo Code could save approximately 2.5dB over an R = ½ Viterbi-RS at a BER of 10^{-8}. This raises the question of the ability of the modem to maintain signal lock at an Eb/No of 2dB or less. While it is certainly possible to design a modem to maintain lock in this region, it may be more beneficial to many users to exploit Turbo Codes for bandwidth reduction rather than power efficiency. Extrapolating the performance of the R = 7/8 Turbo code to a BER of 10^{-8} gives an Eb/No within ~0.5dB of the R = ½ Viterbi-RS system with a bandwidth reduction of nearly 43 percent. The R = ¾ Turbo Code would require approximately 1dB less power and provide a 25 percent reduction in bandwidth. In this case the modem would be operating at or near the same signal to noise ratio as with the Viterbi-RS code so many existing modems could be used without modification as a Turbo Code platform.

Conclusion

The availability of stable phase locked LNBs and other improvements in satellite link components has helped pave the way for the use of higher order modulation formats in satellite communications. Recent standards such as IESS-310 and DVB-DSNG provide specifications for equipment that utilize 8PSK and 16QAM and include Viterbi-RS FEC.

Equipment built to these standards offer users the opportunity to realize bandwidth savings over existing QPSK solutions. Figure 5 shows a bandwidth-efficiency plot of specified performance of practical satellite modems at a BER of 10^{-10} with concatenated Viterbi-RS FEC and QPSK, 8PSK, and 16QAM modulation. It is apparent that R = 2/3 8PSK is more efficient than R = 7/8 QPSK in both bandwidth and power. The expected specification performance of the Turbo Code from Figure 4 is also shown with the addition of an R = 245/255 Reed-Solomon outer code, indicating significant advantages in power and bandwidth over the Viterbi-RS QPSK systems.

As satellite link components continue to improve, utilization of higher order modulation formats will become more and more common for satellite communications. Increasing user acceptance and the continuing evolution of the industry will likely result in more standards to take advantage of improved technology for new applications. New developments in FEC, equalization, antennas, power amplifiers or additional high-order modulation formats could drive new standards from a technology standpoint. As applications and systems evolve, new standards could also emerge from user requirements such as multi-user, multiple-access, user isolation or security, etc. Currently these forces are generally pushing in the direction of improved bandwidth efficiency which can be obtained by exploiting high-order modulation as well as FEC solutions.

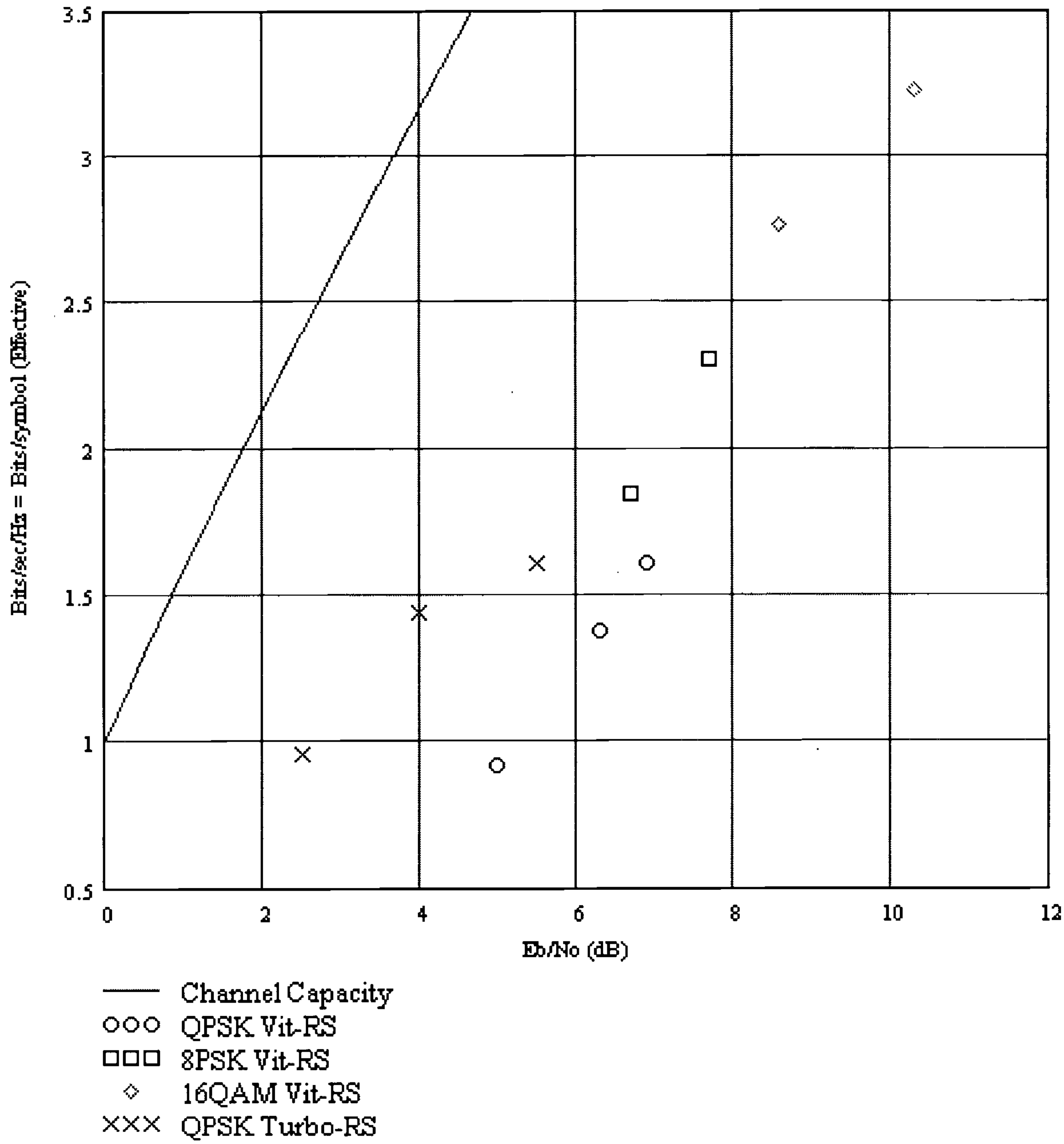


Figure 5. Bandwidth-Efficiency plane for practical QPSK, 8PSK, and 16QAM systems with Viterbi-RS and Turbo Codes at BER = 10^{-10}. The indicated Eb/No levels are from modem specifications and may be 0.3-1.0dB worse than typical performance. FEC overhead and modulation efficiency has been included. The vertical axis has been changed to a linear scale to improve readability.

References

1. Stewart, H., Cannon, R. "Advanced Modulation Techniques for Digital Satellite Modems," Proceedings of PTC '96, Vol I, P. 105

2. "Testing of EFData Developed 16-QAM Modem for EFData," Comsat Laboratories Internal Report, August 1994.
3. Stewart, H. "16-QAM Modems in Satellites," Communications Systems Design, July 1996.

Return to Top View Full-screen

NGSO/GSO Satellite Spectrum Sharing Issues

Michael T. N. Fitch

Vice President

Regulatory Affairs and Spectrum Management

USA

Abstract:

Not available

View Full-text

NGSO/GSO Satellite Spectrum Sharing Issues

At the 1997 World Radiocommunication Conference (WRC-97) of the International Telecommunication Union (ITU), one of the most contentious issues was whether NGSO satellite systems should be permitted to share frequencies already used for operating and planned GSO satellite systems. Operators of GSO systems, including Hughes Electronics, had serious reservations about the ability of proposed NGSO operations to avoid undue interference to GSO systems.

WRC-97 considered proposals to permit NGSO FSS operations on FSS and BSS spectrum at Ku band and FSS spectrum at Ka band. Advocates of NGSO interests put forth proposed power flux density (pfd) limits on NGSO systems, which they asserted would adequately protect GSO operations from interference. GSO and NGSO interests could not come to agreement on the validity of the proposed approach or specific pfd limits.

At the end of WRC-97, temporary measures were adopted, including "provisional" pfd limits, for both Ku and Ka bands. Recognizing that there was insufficient technical analysis of this approach, WRC-97 adopted Resolutions 130 and 538, which called for technical, operational and regulatory studies regarding these issues by ITU-R on an urgent basis between WRC-97 and WRC-00. WRC-97 provided for WRC-00 to set the final, appropriate pfd limits. WRC-97 also decided that all changes to the pfd limits made by WRC-00 will apply to all NGSO systems operating under these provisions, whether or not the systems were proposed or initiated before the WRC-00 decisions are finalized.

In addition to those important conditions, the United States delegation entered the following Declaration (No. 52) to the Final Acts of WRC-97 regarding this matter:

> The World Radiocommunication Conference (Geneva, 1997) has adopted provisional power limits regarding non-geostationary satellite systems providing fixed-satellite services. The United States of America is committed to protecting existing and planned geostationary satellite systems from unacceptable interference; therefore, the United States of America emphasizes that these power limits are provisional, and are subject to detailed technical study and review of ITU-R and to confirmation by the next competent world radiocommunication conference. Any entity proceeding with a non-geostationary satellite system will be obliged to conform to the final regulations adopted at the next competent world radiocommunication conference. The United States of America is committed to participating fully in the ITU-R study of power limits that protect existing and planned geostationary-satellite and terrestrial systems, while enabling new non-

geostationary fixed-satellite technologies to develop.

The work on this issue called for by WRC-97 was assigned to Joint Task Group 4-9-11, which has addressed procedures and methodologies for the work. The next meeting of JTG 4-9-11 will be held in Long Beach, California on Jan. 20-29, 1999. That meeting is tasked with recommending new pfd limits for the WRC-00 conference preparatory meeting process.

In preparation for the upcoming JTG meeting, Hughes and other companies have done extensive technical analysis regarding these issues. In this work, Hughes companies are seeking the appropriate balance between different satellite interests, since Hughes is involved in all of these different interests. As a satellite manufacturer, Hughes supports the most efficient use of the limited available spectrum for satellite services. Hughes Space and Communications builds both GSO and NGSO satellites. If NGSO satellites can share spectrum already used for GSO service without degrading existing and future GSO services, we support that expanded use. However, we believe it will not serve anyone's interests, including those of NGSO proponents, to make the foundation of a new service the unacceptable degradation of existing services upon which literally millions of people around the world rely today.

As a satellite operator, Hughes has very significant GSO interests, including DIRECTV, PanAmSat and the recently licensed Spaceway system. Based on the extensive technical analysis done by Hughes companies, we conclude that the provisional limits from WRC-97 are inadequate to prevent harmful interference to existing and planned GSO operations.

Adoption of the WRC-97 provisional limits could cause a serious degradation of existing GSO satellite services, which is certainly not in the public interest. Accordingly, Hughes has come up with alternative, more restrictive pfd limits which would permit shared NGSO-GSO operation without unacceptable adverse impact on GSO services. Those recommended limits are set out in papers being submitted to the upcoming JTG 4-9-11 meeting. The full text of the papers is available on the ITU Radiocommunication Sector web site (*www.itu.int/itudoc/itu-r/sg4/docs/tg4-9-11.html*).

There are very important differences between the WRC-97 provisional pfd limits and those we recommend. First of all, stricter limits are necessary to adequately protect the wide variety of GSO uses around the world. Some NGSO proponents argue that only specific, not all, links should be protected, but that would unfairly restrict options for future users of GSO services. Our proposed limits will allow GSO services to be provided globally to users. There are also new limits for more antenna sizes than WRC-97 addressed, as well as additional "not to exceed" percentages of time.

The proposed pfd limits are significantly more restrictive on NGSO operations than the WRC-97 provisional limits. That is consistent with the substantial equities that should exist for the existing operators, who have developed these bands up to this time, and their millions of users.

It is reasonable that higher burdens be placed upon the new, entering service. Hughes will share that burden. On January 8, 1999, we filed two Ku band NGSO applications that meet the pfd limits we propose. We have determined that an NGSO system can meet the proposed pfd limits and offer viable, attractive services.

Ultimately, the interests of the users must be foremost. As of 1997, seven percent of the one billion homes with television in the world received video services by satellite. Add to that another 25-45 percent that receive video service by cable providers, almost all of which rely on satellite feeds for much of their content. Impairment of satellite video distribution, most of which is done at Ku band, could affect 500,000,000 households around the world. Think of the number of people who watched the 1998 World Cup distributed over GSO satellites.

I hope this presentation will generate greater interest in the ITU process on this issue. The decisions that WRC-00 makes will affect people in every country in very significant ways. While the interested parties are conducting very detailed technical debates, there is no evidence of user awareness of the significance of this issue. However, if services that they now take for granted are impaired, millions of users will be extremely unhappy and very quickly make their voices heard.

Return to Top View Full-screen View Presentation

Study on High-speed FTP for Multimedia Interactive Satellite Communications System

Katsutoshi Nidaira, Shuichi Yoshino, Masayoshi Nakayama

NTT Wireless Systems Laboratories, Japan

ABSTRACT

NTT has developed an economical and high-speed multimedia computer network that combines satellite and terrestrial circuits. In this network, the propagation delay of satellite systems can degrade TCP throughput. This degradation can be reduced by expanding the size of the TCP window, but this prevents connection to traditional networks. The throughput of UDP, an alternative protocol, does not depend on round trip time, but UDP is not reliable. Therefore, this paper proposes a new protocol, High-speed FTP (HFTP) based on UDP. HFTP realizes highly reliable file transfer and minimizes the influence of satellite propagation delay. In HFTP, a user terminal does not transmit an ACK to the server upon packet reception but transmits a NAK to the server when packet loss is detected; this eliminates the effect of the satellite propagation delay. When the server receives a NAK, it retransmits the packets from the lost packet. According to HFTP experiments using a communications satellite (N-SATR), it is confirmed that the maximum throughput of HFTP is approximately 2 - 4 Mbit/s depending on the packet receiving performance of the user terminal.

View Full Text

Study on High-speed FTP For Multimedia Interactive Satellite Communications System

I. INTRODUCTION

It is now essential to transport large quantities of information over the Internet at increasingly faster speeds. To achieve this goal, NTT developed the Multimedia Interactive Satellite Communications System that combines satellite and terrestrial circuits [1], [2], [3]. Terrestrial circuits are used for forward links (user terminal -> server) and satellite circuits, which have high transmission speeds of 30 Mbit/s, are used for the backward links (server -> user terminal) in this system.

The configuration of this system is shown in Fig. 1. A satellite circuit-transmitting adapter (STA) that converts the terrestrial transmission interface into the satellite transmission interface is installed in the satellite central station. The end-to-end section between the server and user terminals uses TCP/IP and/or UDP/IP, but the satellite circuit section uses cell-based ATM to multiplex the information in the IP packet. The protocol stack of this system is shown in Fig. 2. Each user station comprises an approximately 50-cm antenna, a tuner, a satellite circuit-receiving adapter (SRA), and user terminals. To reduce the cost of the tuner, this system adopts the radio system developed for Digital Video Broadcasting (DVB). The employed error correction scheme in this system adopts concatenated coding with convolutional encoding (Viterbi decoding) as the inner coding and Reed-Solomon encoding (188/204) as the outer coding. The SRA incorporates functions for filtering the corresponding ATM cells, assembling the IP packets, sending them to the user terminals via 10 Base-T Ethernet, and accessing the terrestrial circuits using a modem or Terminal Adapter (TA). The SRA is designed to connect not only one user PC but also multiple user PCs over a LAN. The STA and SRA are newly developed.

This system provides three types of services.

1. Interactive communication services (Fig. 3a) e.g., web access, FTP, and e-mail.

2. Reliable multicast communication services (Fig. 3b) e.g., the distribution of newspapers, software, and catalogues.

3. Multicast transmission services (Fig. 3c) e.g., fashion shows, live sports, and movies.

FTP throughput is about 500 - 600 Kbit/s and HTTP throughput is about 600 - 800 Kbit/s in this system. These throughputs are approximately 30 times higher than the throughput of terrestrial circuits using an analog modem (28.8 Kbit/s). Realizing a protocol with a throughput in the Mbit/s range would allow 100-Mbyte files to be interactively accessed without wasting a lot of time.

However, existing TCP schemes (FTP and HTTP) cannot achieve this level of throughput. If the propagation delay is as long as it is in satellite circuits, TCP wastes too much time waiting to receive the acknowledgement (ACK) needed to continue transmission (Fig. 4). TCP with an expanded window size was proposed to eliminate the influence of satellite propagation delay [4]. Utilizing this scheme requires a special TCP with an expanded window size, so that connection to conventional network equipment and terminals is problematic. UDP can eliminate the satellite propagation delay and so it has a high throughput in the Mbit/s range, but its reliability is low because it does not offer packet retransmission. UDP is used to transfer animated pictures, but not data files. TFTP [5] is UDP with retransmission and thus it is reliable, but its throughput is low because each packet triggers a return ACK. NETBLT [6] and XTP [7] are protocols that minimize the influence of the propagation delay and have a high level of reliability. Unfortunately, as NETBLT and XTP lie in the transport layer, they have poor compatibility with conventional network equipment and PCs.

II. HIGH SPEED FTP

In order to transfer efficiently large quantities of information over satellite links, a new protocol, High-speed FTP (HFTP), is proposed. The HFTP provides unicast file transfer services such as CD-ROM data and animated pictures as quickly as possible.

The requirements for HFTP are as follows:

1. Compatibility with conventional networks

2. High reliability for file transfer

3. High throughput at Mbit/s rates in an environment with long delays such as a satellite circuit

4. Applicability with as many kinds of user terminals as possible

Regarding requirements (1) and (3), HFTP employs UDP/IP. However, it is well known that UDP/IP is capable of achieving fast data transmission without retransmission control. Therefore, HFTP also employs retransmission control in the upper layer for high reliability transmission (Requirement (2)). To achieve reliable high-throughput transmission, HFTP does not use an ACK when receiving data but uses negative acknowledgement (NAK) to the server in order to eliminate the influence of the propagation delay so far as it is possible. Moreover, it is assumed that the user terminal is a PC, so each user terminal has different specifications in CPU processing performance, memory capacity, hard disk accessing speed and so on. However, the HFTP server would not know what is the user terminal specification. Considering requirement (4), to accommodate even those user terminals with small memories, HFTP employs Go-back-N retransmission, because the Go-back-N retransmission scheme does not require a large receiving buffer in the user terminals and is very simple to implement. The details of the retransmission control scheme are described in the following. A sequence number is added to each packet to detect packet loss. When detecting packet loss at a user terminal, it sends a NAK to the server with the sequence number of a lost packet. When the server receives the NAK, it starts retransmission from the packet corresponding to the sequence number within the NAK with Go-Back-N. The HFTP behaves similarly to UDP as far as NAK was not generated, therefore it has a high throughput in the Mbit/s range. Because it is located on the UDP layer, there is no problem of compatibility with conventional network nodes and terminals at all.

The flows at the server and user terminal are described below. The basic flow of HFTP is shown in Fig. 5.

The HFTP server session at a server is processed as described below.

1. When the HFTP session starts, the server transmits a "notification of packet transmission" to the user terminal

2. The server begins packet transmission with a sequence number

3. The server stops packet transmission if it receives a NAK. Then it refers to the sequence number in the NAK and starts the retransmission on a Go-

Back-N basis from the packet that corresponds to the number

4. The server transmits "notification of packet transmission completed " *to the user terminal after it sends the final packet and then waits for "confirmation of notification of packet transmission completed.*"

5. When the server receives *"confirmation of notification of packet transmission completed"*, HFTP session finishes. The HFTP client session at a user terminal is processed as described below

6. The user terminal receives "notification of packet transmission" from the server and then prepares to receive the data packet

7. The user terminal receives packets and monitors the packet sequence numbers. If it finds a sequence number missing, it transmits a NAK with the sequence number of the lost packet to the server

8. When the user terminal receives a "notification of packet transmission completed", it transmits "confirmation of notification of packet transmission completed" to the server and completes the HFTP session

III. EXPERIMENTAL VERIFICATION OF HFTP

To evaluate HFTP performance, verification experiments are conducted using the communications satellite, N-STAR. The experimental configuration is shown in Fig. 6. In these experiments, the satellite circuit is error free. The transmitted file sizes to the user terminals are 4, 10, and 20 M bytes, and the maximum packet size is 1500 bytes. HFTP throughput is measured while varying the packet-transmission interval. Three user terminals that have different levels of packet receiving performance are prepared in order to confirm that HFTP can be used for all user terminals. The packet receiving performance of the user terminal mainly depends on the CPU's processing speed and the hard disk writing speed. For example, a high performance terminal is a PC that has the 200-MHz CPU and a hard disk with a 5-Mbit/s sustained writing speed. Medium and low performance terminals have specifications lower than the above specifications. The throughput of HFTP is calculated in the experiments in the following equation:

$$Throughput = transmitted\ file\ size / (Ta - Tb)$$

where Ta is the time required to receive "confirmation of notification of packet transmission completed" and Tb is the time required to transmit "notification of packet transmission".

The experimental results of HFTP throughput are shown in Fig. 7. The maximum throughput for the high performance user terminal is about 4 Mbit/s, that for the medium performance terminal it is about 3 Mbit/s, and that for the low performance terminal is about 2 Mbit/s. HFTP throughput is up to 7 times higher than that of FTP.

The throughputs of each user terminal are broken as shown on the left hand side of Fig. 7, because the HFTP session is incomplete due to a packet transmission interval that is too short. Under such conditions, the speed at which packets arrive is faster than that at which they can be received, so packet loss occurs frequently and then the HFTP session is almost stopped during packet transmission.

The packet transmission interval that has the maximum throughput is different for every user terminal (Fig. 7). Furthermore, when the packet transmission interval is too short, the HFTP session is mostly incomplete. When a server is connected to many kinds of user terminals, the aforementioned occurrences cause some problems because the server is unable to find the appropriate packet transmission interval for a user terminal. Therefore, HFTP must incorporate a mechanism to solve these problems.

IV. ADAPTIVE PACKET TRANSMISSION INTERVAL CONTROL

As discussed above, HFTP must have a mechanism to solve the problem concerning the packet transmission interval. There are three basic approaches to solve the problems.

1. The packet transmission interval is adjusted to suit the user terminal with the lowest packet receiving performance

2. The packet transmission interval is adjusted to suit each user terminal

3. A restriction is placed on the kind of user terminal

Approach (1) is simple but fails to fully utilize the terminals or down links. Approach (2) is effective but is unrealistic because it is difficult to know the appropriate packet transmission interval for each user terminal. Approach (3) is also simple but does not satisfy Requirement (4).

Therefore, an adaptive packet transmission interval control scheme is proposed. This scheme automatically calculates the most suitable packet transmission interval for each user terminal (Requirement (4)) from the NAK reception data. In this scheme, shown in Fig. 8, the initial packet transmission interval is a common value (small) for each user terminal and is increased by a constant value whenever the server receives a NAK. This increment mechanism of the packet transmission interval is repeated over a predetermined period.

Experiments involving HFTP and this scheme are conducted to confirm its effectiveness. The parameters are the initial packet transmission interval values (2.65, 2.90, and 3.15 msec) and the increment values for the packet transmission interval (0.25, 0.50, and 0.75 msec). Three user terminals are used in the experiments.

A predetermined period is determined and is described in the following. The packet transmission interval must be adjusted so that the speed that a received packet is processed by a user terminal's CPU is faster than that of the arriving packet. A user terminal stores the received packet data in its own buffer (2 Mbytes) before it writes the data to the hard disk. Therefore, the increment in the packet transmission interval is repeated until the buffer fills with packet data in the early stages of the HFTP session.

The relative throughput for each user terminal is shown in Table 1. The relative throughput is the measured throughput divided by the maximum throughput for each user terminal. The relative throughput for each user terminal exceeds 0.8 for the parameters listed in Table 1. It is confirmed that the adaptive packet transmission interval control is effective.

V. HFTP THROUGHPUT IN ENVIROMENT OF LOW C/N SATELLITE CIRCUIT

The HFTP throughput in an environment with a low C/N satellite circuit is measured to investigate the relationship between throughput and the packet error ratio (PER). The experimental configuration is shown in Fig. 9. HFTP with adaptive packet transmission interval control is used for the measurements. The PER is less than 3.05×10^{-1} in the experiments. The relative throughput is shown in Fig. 10. The relative throughput is the measured throughput in an environment of low C/N states divided by that of an error free state.

When the PER is in the order of 10^{-4}, the relative throughput almost equals 1, i.e., almost the same as the throughput in the error free link. The relative throughput is about 0.6 when the PER is in the order of 10^{-2}. The number of NAK increases steeply when the PER is higher than 10^{-1} (Fig. 10), but the throughput of HFTP is about 64 Kbit/s which is the same as that of the terrestrial circuit. We revealed that HFTP is effective in low C/N links.

VI. CONCLUSIONS

This paper proposed a new protocol HFTP that has a high throughput and high reliable protocol for the Multimedia Interactive Satellite Communications System. The achieved maximum throughput of HFTP is approximately 2 - 4 Mbit/s depending on the packet receiving performance of the user terminal. HFTP achieves high speed and high reliability file transfer even across circuits with significant propagation delay such as satellite circuits and allows the use of conventional network equipment and user terminals.

VII. ACKNOWLEDGMENTS

The authors wish to thank Dr. S. Samejima and Mr. H. Nakashima of NTT Satellite Communications, Dr. H. Mizuno of NTT Wireless Systems Laboratories, and Mr. T. Masamura of NTT Multimedia Business Department for their encouragement and helpful guidance.

VIII. REFERENCES

1. M. Nakayama, M. Nakagawa, Y. Hashimoto, K. Tanaka, and H. Nakashima, *A Satellite Communication System for Interactive Multimedia Networks*, January 1997, IEICE Transactions on Communications Vol. E80-B No. 1

2. M. Nakayama, K. Araki, M. Kobayashi, and H. Nakashima, *A Satellite Communication System using ATM multiplex scheme for Interactive Networks*, October 1997, IAF-97-M.2.10.

3. M. Kobayashi, K. Araki, M. Nakayama, K. Nidaira, and H. Nakashima, *Satellite*

Communication System for Interactive Multimedia Network and Its Performance, February 1998, AIAA-98-1290.

4. M. Allman and D. Glover. *Enhancing TCP Over Satellite Channels using Standard Mechanisms*, February 1998. Internet-Draft draft-ietf-tcpsat-stand-mech-03.txt (work in progress).

5. K. Sollins. *THE TFTP PROTOCOL (REVISION 2)*, Jury 1992. RFC 1350.

6. D. D. Clark, M. L. Lambert, and L. Zhang. *NETBLT: A Bulk Data Transfer Protocol*, March 1987, RFC 998.

7. *Xpress Transport Protocol Specification, XTP Revision 4.0*, XTP Forum, 1995.

Return to Top View Full-screen

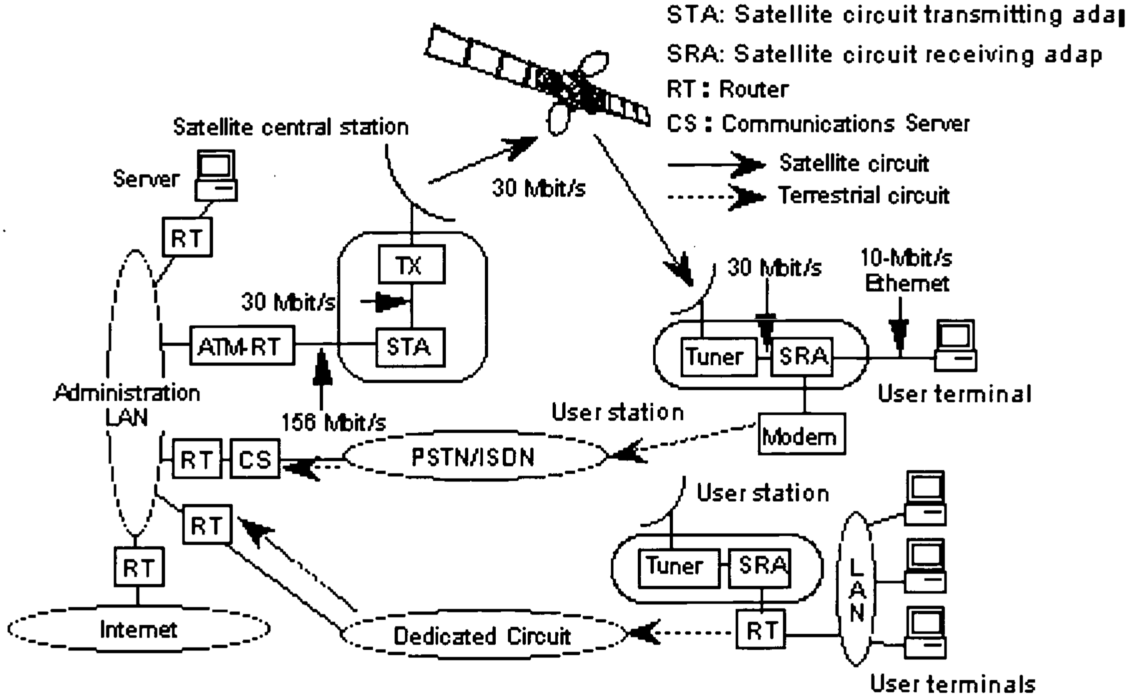


Fig. 1 System configuration

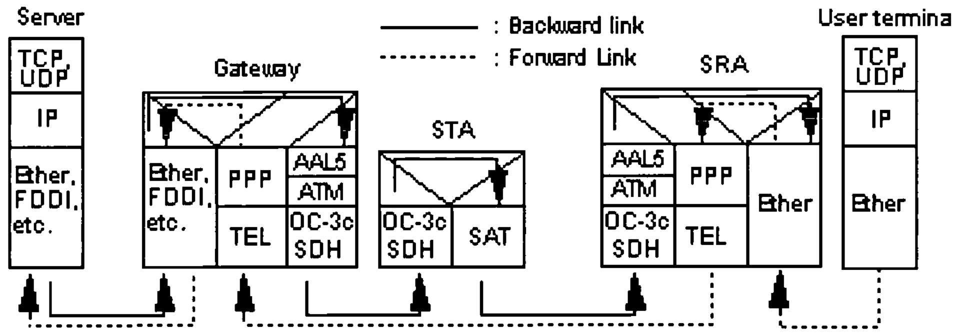
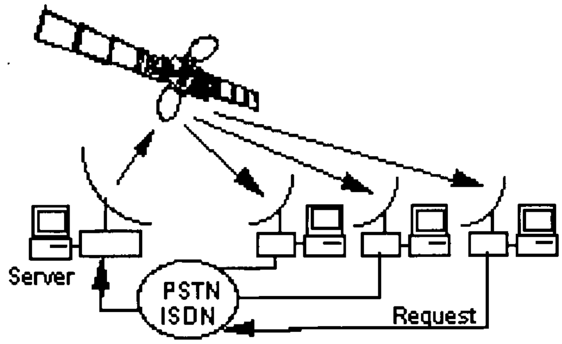
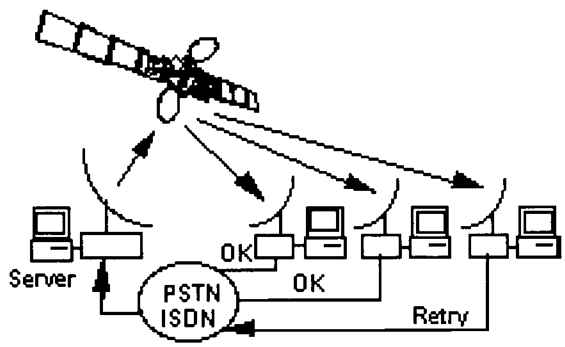


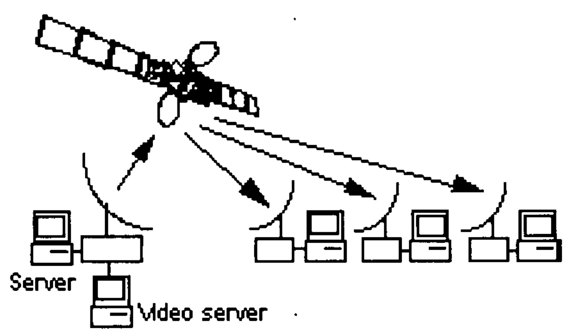
Fig. 2 Protocol stack



(a) Interactive communication servi



(b) Reliable multicast communication serv



(c) Multicast transmission service

Fig. 3 Service configurations

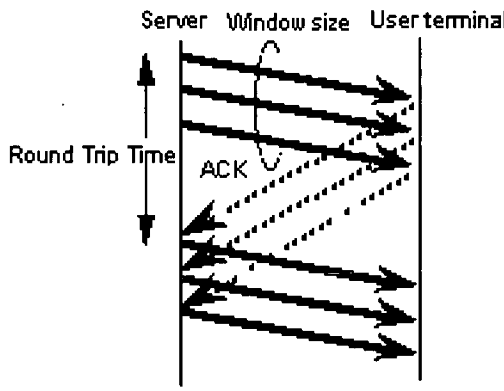


Fig. 4 TCP flow with a long propagation delay

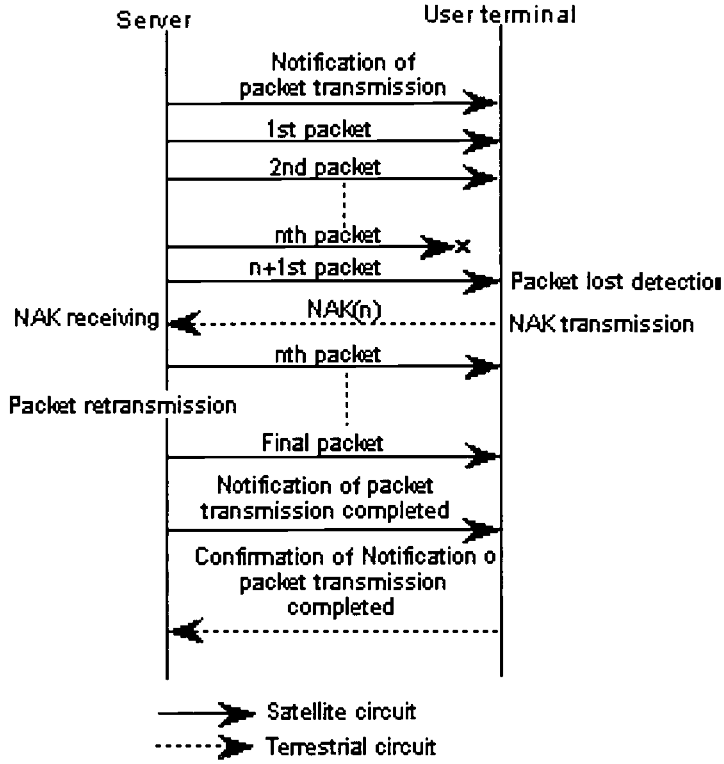


Fig. 5 HFTP flow

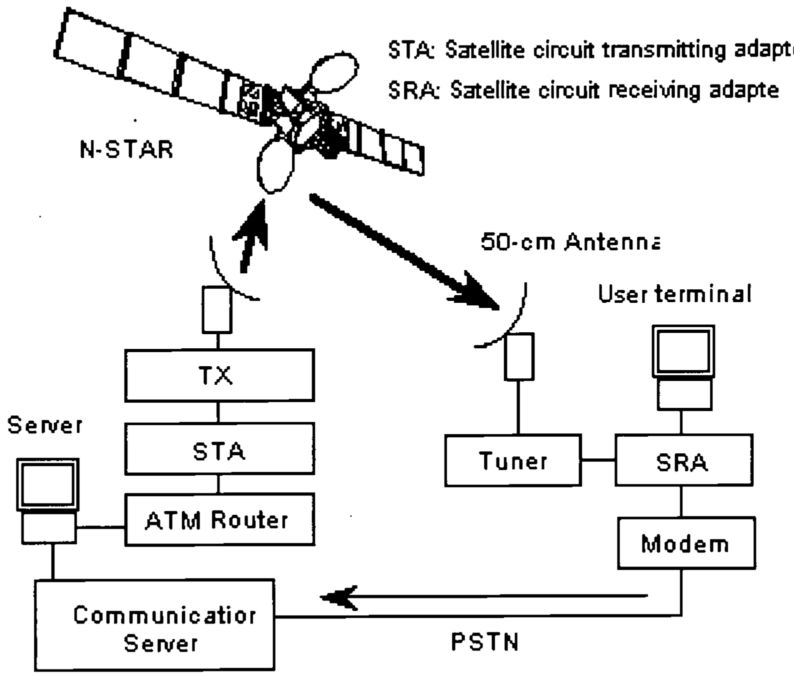


Fig. 6 Configuration of HFTP throughput measurement

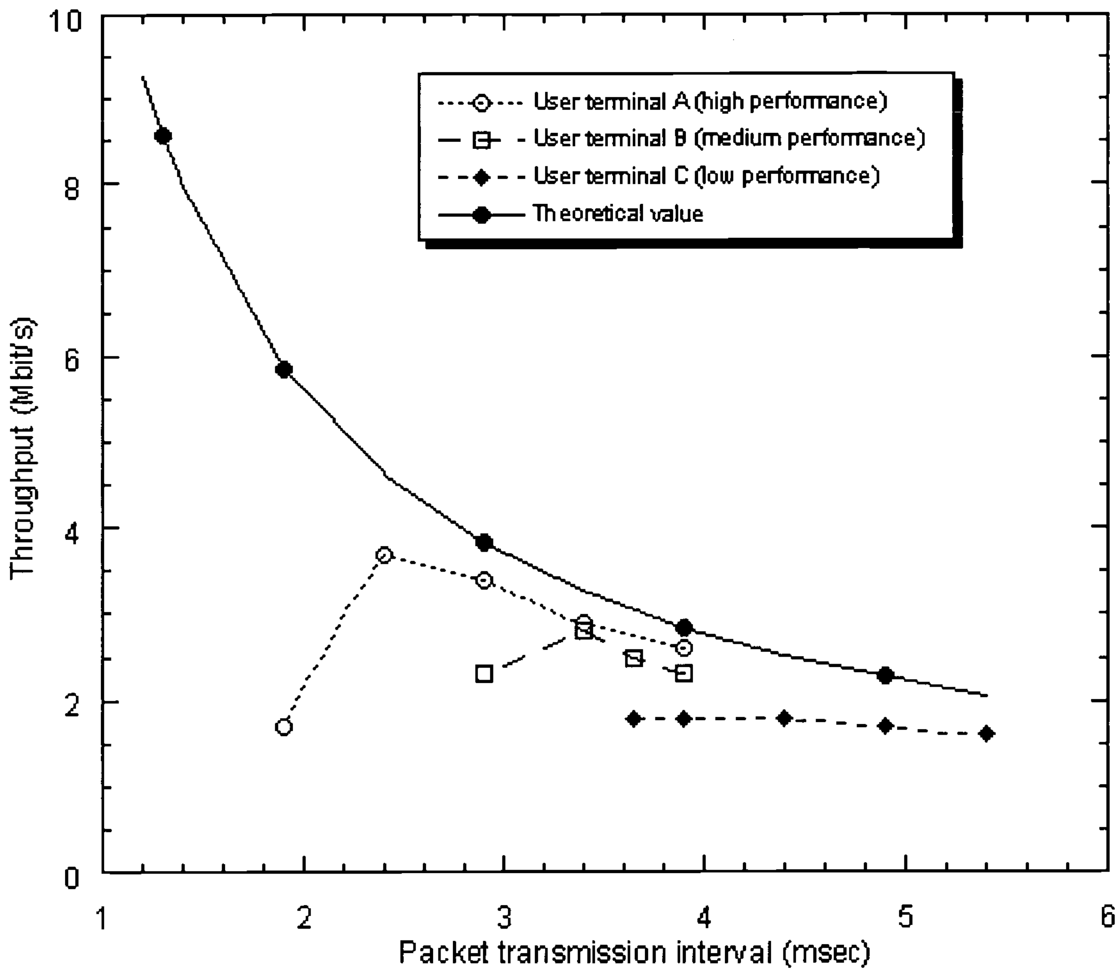


Fig. 7 Throughput of HFTP

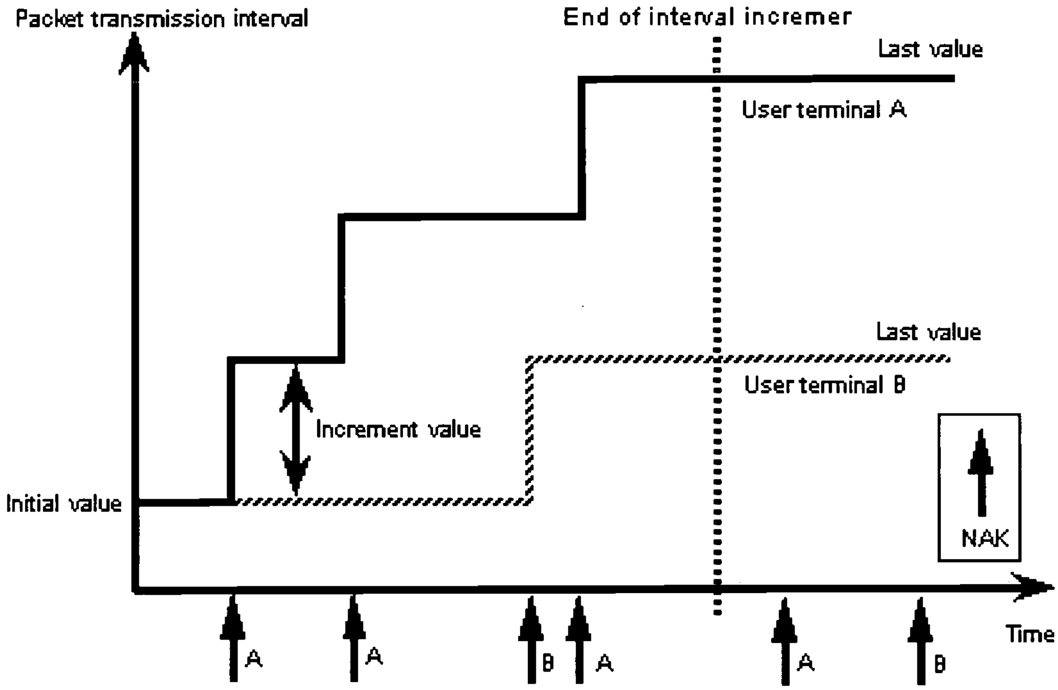


Fig. 8 Concept of the adaptive packet transmission interval contro

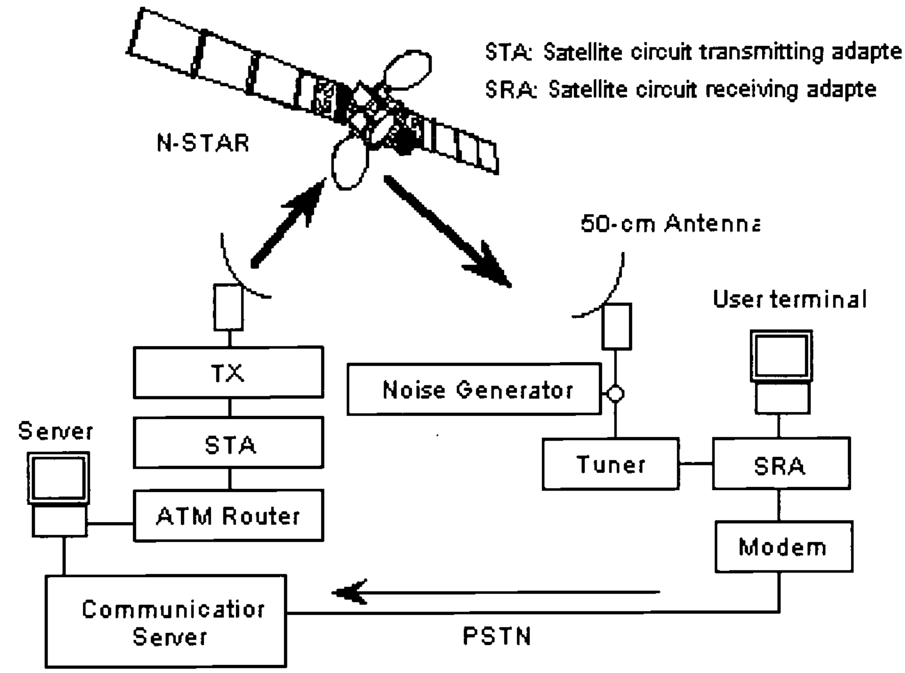


Fig. 9 Configuration of throughput measurements in low C/N satellite circ

Table 1. Packet Transmission Intervals and Relative Throughpu

User terminal A (high performance)

Initial value (msec)	Last value (msec)	Increment value (msec)	Relative throughput
2.65	2.65	0.75	0.97
2.90	2.90	0.50	0.89
3.15	3.15	0.25	0.87

User terminal B (medium performance

Initial value	Last value	Increment value	Relative throughput
2.65	3.40	0.75	0.82
2.90	3.40	0.50	1.00
3.15	3.40	0.25	0.96

User terminal C (low performance)

Initial value	Last value	Increment value	Relative throughput
2.65	3.65	0.75	1.00
2.90	3.90	0.50	0.94
3.15	4.15	0.25	0.94

Relative throughput is normalized by maximum throughput for each user termin

Trends in Satellite Based Applications

Roger Naff

Hughes Space and Communications International, Inc., U.S.A

ABSTRACT

This paper examines the current trends in the satellite industry focusing on business and end-user applications. Much of data presented is from the satellite service provider and end-user perspective. The information has been gathered from several sources:

- Satellite owners and operators
- Users of satellite services
- End users and subscribers of satellite services
- Consultants
- Secondary research findings

View Full Text

TRENDS IN SATELLITE BASED APPLICATIONS

I. GOVERNMENT AND INSTITUTIONAL INVESTORS VS PRIVATE OWNERSHIP

Until recently satellite systems were the domain of governments and institutions such as Intelsat. The applications were basic telephony, international interconnection (trunking) and social services such as telemedicine or distance learning. Governments used satellites (either their own or leased capacity) to implement or expand existing telephony infrastructure, and institutional providers (Intelsat, Inmarsat) provided lease capacity for the same applications.

It did not take long for private operators to enter the market and begin competing for market share. Today the trend is clearly established; private and quasi-private operators along with regional and global consortiums are competing directly with governmental provided systems and offer a wide choice of applications in addition to basic services and/or transponder leasing. These new applications include:

- Direct to Home Services
- Business Systems
- Mobile and Rural Telephony
- Internet Access
- Broadband Capabilities
- Wireless Data

The development of these new applications is a response to the industry shift from basic telephone trunking and transponder leasing to integrated services. As providers move "up the value chain" from manufacturing to leasing and to integrated services, profit margins should increase and the number of competitors decrease. While there is higher risk in these new business ventures, these new services allow enhanced differentiation and profitability to the service provider.

Responding to the private systems (and greater profitability), government and institutional owners/operators are now focusing on privatizing their systems and expanding their application base. This includes the privatization plans of Intelsat and Inmarsat.

Also the industry is witnessing deregulation within government owned telecom companies and pledges of "open sky" policies. No less than 69 countries representing over 90% of global telecommunications revenue have committed to the World Trade Organization to open their national telecommunications systems to privatization and competition.

It has become clear that end user demand for higher level services, the impact of more advanced and powerful satellites, continued privatization and more efficient use of spectrum are responses and enablers driving the marketplace. The WTO has called the privatization of telecommunications and the evolution to higher level services the "most important telecommunications development of the next century". Private ownership, global systems and regional consortiums are the future direction for satellite ownership and operators. Some will offer bandwidth, others will market end-to-end services, while some will offer a combination of ownership and service provider investor options.

This is not to say government owned satellite based systems will cease to exist. There are still regions of the world where governments will use satellites to provide basic infrastructure applications; Sub-Sahara Africa, parts of South East Asia and China are examples. Most likely these systems will co-exist with other regional or global systems offering an array of services.

-

II. TRENDS IN MARKET DRIVERS

In the past there was a commonly held notion that the more advanced a country or region's ground infrastructure was, the less likely would be the demand for satellite applications – except for TV broadcast or private VSAT systems. Much of this belief was based on the concept that fiber optics, with its superior bandwidth and data transmission characteristics, would spell the demise of satellites.

However, research shows that those countries or regions of the world with the highest penetration of fiber optics and ground infrastructure (USA, Western Europe, Japan) also have the highest levels of transponder coverage on a population basis. One explanation for this high level of satellite penetration is related to per capita income.

Higher levels of income result in more discretionary spending, creating higher demand for services in the marketplace. For example, fixed telephony alone is not sufficient for the business user or global traveler who demands constant voice, fax and data communications. This need for more applications is a driver for global and regional satellites providing telephony, fax and data. A second example is Direct to Home TV in the USA and Japan. Here satellites compete directly on with cable TV. Direct to Home satellites are now under construction for more than television and music. These new systems will offer combined broadcast, voice, Internet access and eventually real-time two-way interaction.

Time to market is also an important factor. As end users migrate to new applications and competition between providers increases; first to market becomes increasingly important. To the end user, schedule may mean a competitive business advantage. For the service provider, timing is critical in capturing end user marketshare. End-user demand, together with service providers drive to dominate a particular market, has impacted satellite manufacturing. Satellite suppliers are challenged with developing and manufacturing larger, more powerful satellites in shorter build cycles. The resulting trend is that schedule may be the dominant satellite purchase criteria when market timing is key to a business plan.

This brings us back to the differences between institutional services providers and the new entrepreneur. The entrepreneur is willing to accept, often demand, turnkey systems holding manufacturers to overall system performance and schedule. This allows the satellite provider to modify or alter manufacturing processes, once held sacred by the institutional or government customer, in order to meet schedule and end-to-end system performance. To many customers, performance and specifications aimed at meeting end user demands are more important than specifying exact construction processes. The challenge to the satellite manufacturer is to reduce schedule and cost without sacrificing quality.

Technology also remains important, however. In fact, technological breakthroughs in both space and ground segment capabilities will be a market driver. Some of these capabilities include:

- Larger, more powerful satellites allowing smaller receivers on the ground. Better allocation of bandwidth along with higher power will result in more efficient frequency use and increased capacity

- Increased use of onboard processing improving functionality

- Increased solar panel efficiency with the use of multiple junction gallium arsenside allows increased power

- Xenon-Ion Propulsion Systems (XIPS) dramatically improves onboard propulsion efficiency and saves weight, reduces launch costs and/or allows the addition of larger payloads

- Digital encoding and compression allows for increased number of channels per transponder

As the skies have become more congested for GEO satellites and global constellations are further developed, the industry will see growth in the LEO/MEO orbit planes. LEO's may dominate those applications where latency is an important end user factor. However, whether GEO, MEO or LEO, these systems will co-exist based on applications, user acceptance and cost performance. However, there are technological challenges associated with these new systems – on board processing, cross links, system signaling, software integration and billing/collection invoicing, to name a few.

III. END USER DEMAND

A key trend in satellite demand is linked to end user demand for applications. Users are more concerned today with what a particular technology brings to the marketplace. Taking our example of Direct to Home services, end users or consumers are becoming less concerned with "how" the applications are brought to market and more concerned with the "value" the application represents. This "value" can be translated into a number of attributes such as:

- Competitive advantage
- Price performance
- Convenience
- Creating unique market niche
- Financial performance

The marketplace asks "what will a service do" for my business or quality of life, rather than concern over "what is the technology". Satellites are an enabler like fiber optics, RF, or wireless systems. One is not inherently "better" than another. For example, mobile telephone coverage is more important than the technology of PCS, GSM or satellite services. The quality and quantity of broadband access is more important than how the service is delivered. The same can be said of DTH programming as the end-user discriminator, rather than the type of delivery system.

Concerning broadband and Internet applications, the demand and packaging of these services is beginning to unfold. In the United States, there are an estimated 25 to 35 million Internet users. As a result, ISPs and telephone companies are straining during peak hours to provide acceptable levels of service. Also, private networks world-wide are proliferating in order to meet Internet and upcoming broadband services.

Both GEO and non-GEO systems are being put into place in anticipation of Internet and broadband user demand – Teledesic, Spaceway, Cyberstar, etc. are examples.

IV. FINANCING

As financing plays a significant role in the future for satellite systems, we should make a few comments addressing this subject. Although financing of satellites is a complex issue and detailed evaluation is beyond the scope of our discussion, there are issues to consider. In the past, governments and institutions financed themselves. Today the use of third party, direct bank, IPO's and vendor financing dominate the market. A recent report stated that IPO or direct loans for satellite financing were $11B USD for systems from January 1997 through July 1998. Future fundraising will be complicated by stock market volatility (as we are witnessing today), regional economies and exchange rates. No doubt new entrants will look to a number of alternatives for financing. These include but are not limited to:

- Private financing
- Bank loans
- IPO
- Use of EXIM type fundS
- Vendor financing and participation
- Equity debt

The question of whether there will be sufficient public and private funds available for the number of satellite prospects proposed is a much debated topic.

-

V. CONCLUSIONS

Trends in the satellite industry have no absolutes, they are guide posts for planning and understanding applications. One element seems to be certain, that satellite based applications will continue to foster new business. These applications will be driven by end user demand, developments in technology and a variety of financing arrangements.

Return to Top View Full-screen

Link One: An Advanced Satellite Network Service

JOHN W. KOPINSKI

COMSAT World Systems, U.S.A

ABSTRACT

Market forces point to a need for satellite-based bandwidth-on-demand network service, which would functionally provide broadband virtual connections for voice, video, data, and multimedia applications. Such a system needs to have attributes which translate into savings for users, i.e. state of the art technology in its design, implementation, and recurrent use. In this case study, the satellite system network employs multi-frequency TDMA (time division multiple access) in order to achieve extremely high efficiency and flexibility in satellite bandwidth management, and utilizes existing off-the shelf, commercially available earth stations including low-cost, compact VSAT-like terminals. However, unlike traditional VSATs, this new network system offers high data rates (up to 2 Mbps/VSAT and up to 32 Mbps at a single site with gateway-sized antenna), full-mesh, single hop connectivity, and high speed local area network interconnection services.

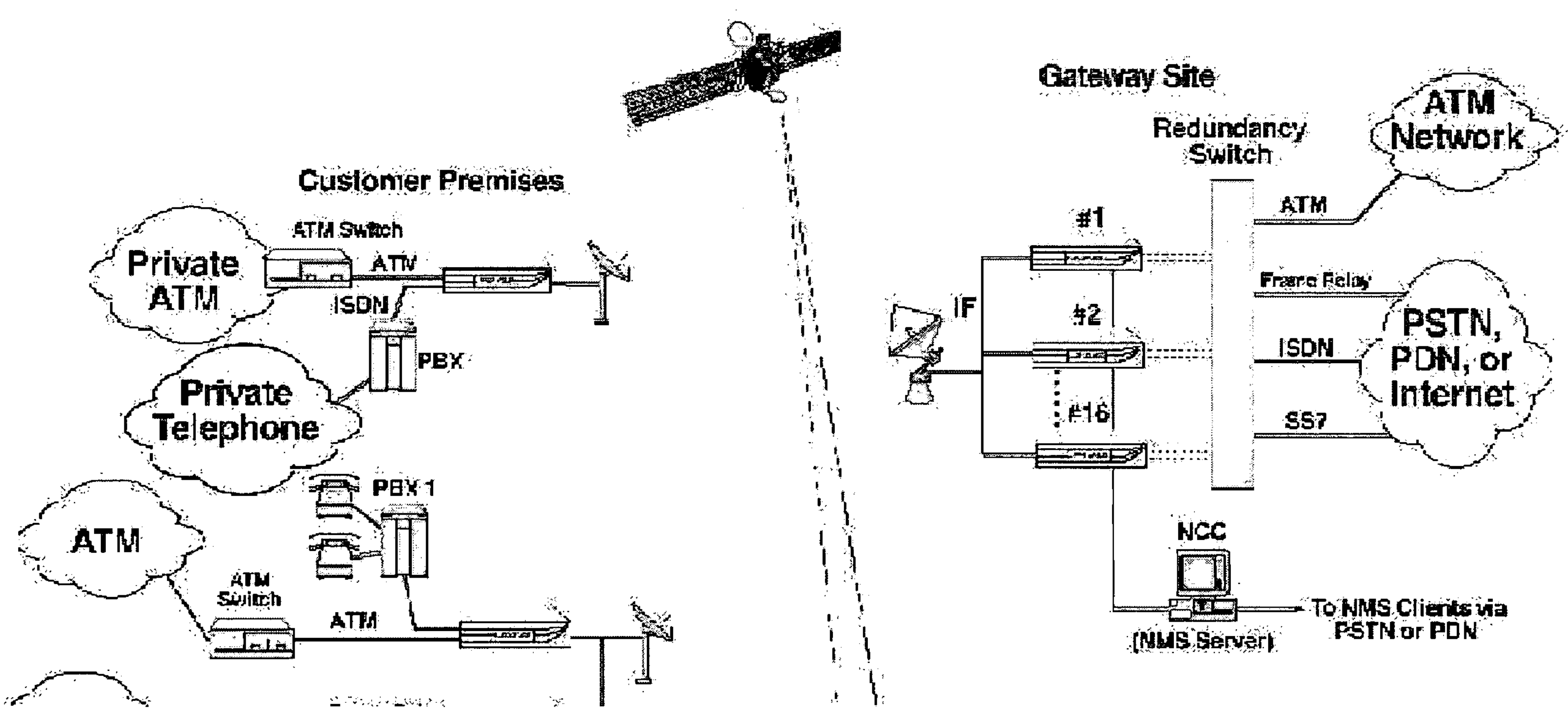
View Full Text

Link One: An Advanced Satellite Network Service

I. INTRODUCTION

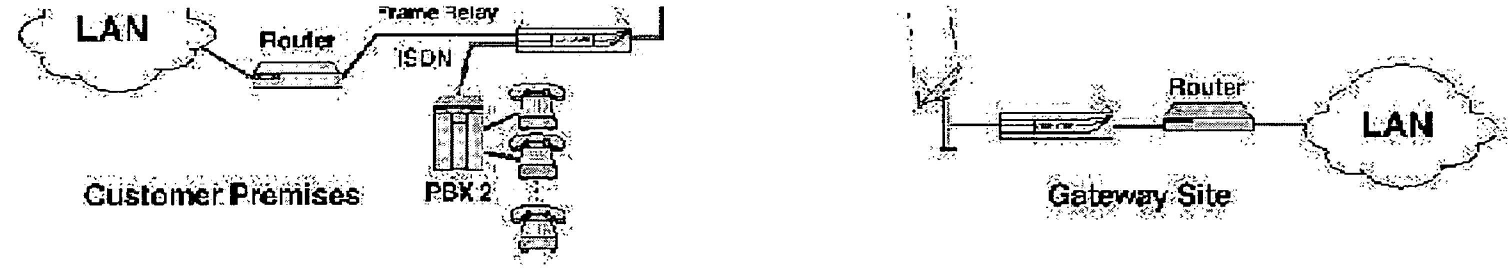
Market forces point to a need for a satellite-based bandwidth on demand network service which would functionally provide broadband virtual connections for voice, video, data, and multimedia applications. Such a system needs to have attributes which translate into savings for users, i.e. state of the art technology in its design, implementation, and recurrent use. In this case study, the satellite system network employs multi-frequency TDMA (time division multiple access) in order to achieve extremely high efficiency and flexibility in satellite bandwidth management, and utilizes existing off the shelf, commercially available earth stations including low-cost, compact VSAT-like terminals. However, unlike traditional VSATs, this new network system offers high data rates (up to 2 Mbps/VSAT and up to 32 Mbps at a single site with gateway-sized antenna), full-mesh, single hop connectivity, and high speed local area network interconnection services.

Figure 1 - Network Diagram



1378

1379



II. MARKET ROLE

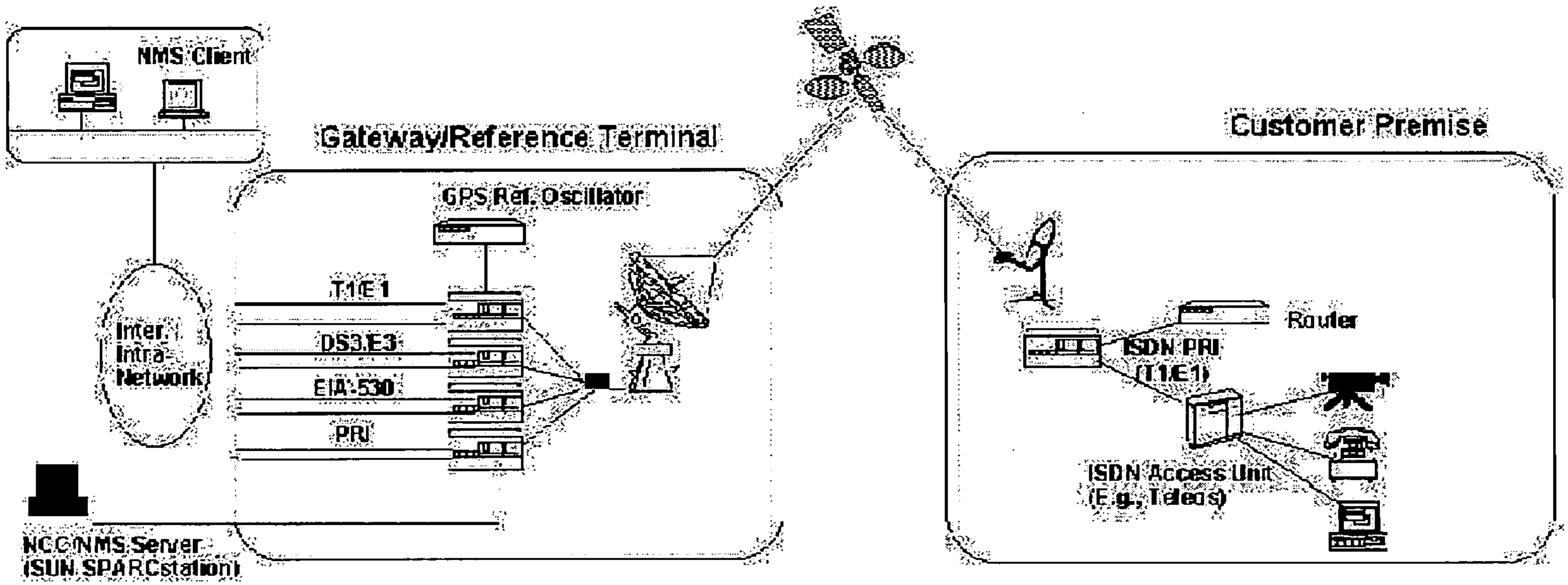
A satellite-based broadband, on-demand network provides instant infrastructure to all points illuminated by the satellite footprint. Low cost outdoor units (ODUs) consisting of antenna and radio frequency terminals (RFTs), and network indoor units (IDUs) operating in a full-mesh hubless design has the potential to bring advanced communications to large multinational corporations, or to provide international service carriers with the means to offer virtual private network services worldwide. To this end, LAN-LAN interconnection applications, Internet, and remote telephony are typical applications over Frame Relay (FR), Asynchronous Transfer Mode (ATM), Integrated Services Digital Network (ISDN) and Signaling System 7 (SS7) networks.

III. CAPABILITIES

Functionally, the advanced network design allows for multiple sites, multiple users and dynamic bandwidth allocation. It provides integrated circuit-switched and packet services over a single hop, TDMA satellite architecture. Service features include full-mesh connectivity between any user device to any user device connected by the network, via standard signaling based, switched connections for a virtually unlimited number of users at multiple sites. The network terminal devices developed by COMSAT, are called Linkway-2000™ units, and service utilizing the proprietary Linkway 2000™ technology will be marketed by COMSAT as Link One℠.

Link One uses primarily industry-standard interfaces for user access. Circuit services for telephony, video and digital applications are accessed through a T1/E1 ISDN primary rate interface (PRI). Link One includes full support for ISDN Q.931/Q.921-based signaling, thereby enabling establishment of n x 64 kbps/digital circuits. Frame relay packet data services are accessed via standard EIA-530 serial synchronous ports. An ATM capability is also incorporated, with cell loss, throughput and jitter performance requirements being met by innovative error correction and bandwidth management techniques. ATM services are accessed via standard E3 or DS3 ATM ports.

Figure 2 - Typical Frame Relay Service Architecture



NCC Features	NMS Features:
Capacity/Bandwidth/Configuration Management	Access NCC using JAVA aware Web Browsers
Alarm/Performance/Security Management	GUI for Network Operations, restricted access/ view to customer NMS clients
Web-based NMS server for JAVA Browser clients	Upgrade path to Standards based Customer NMS
Accounting: Call Detail Records in flat files for each service	

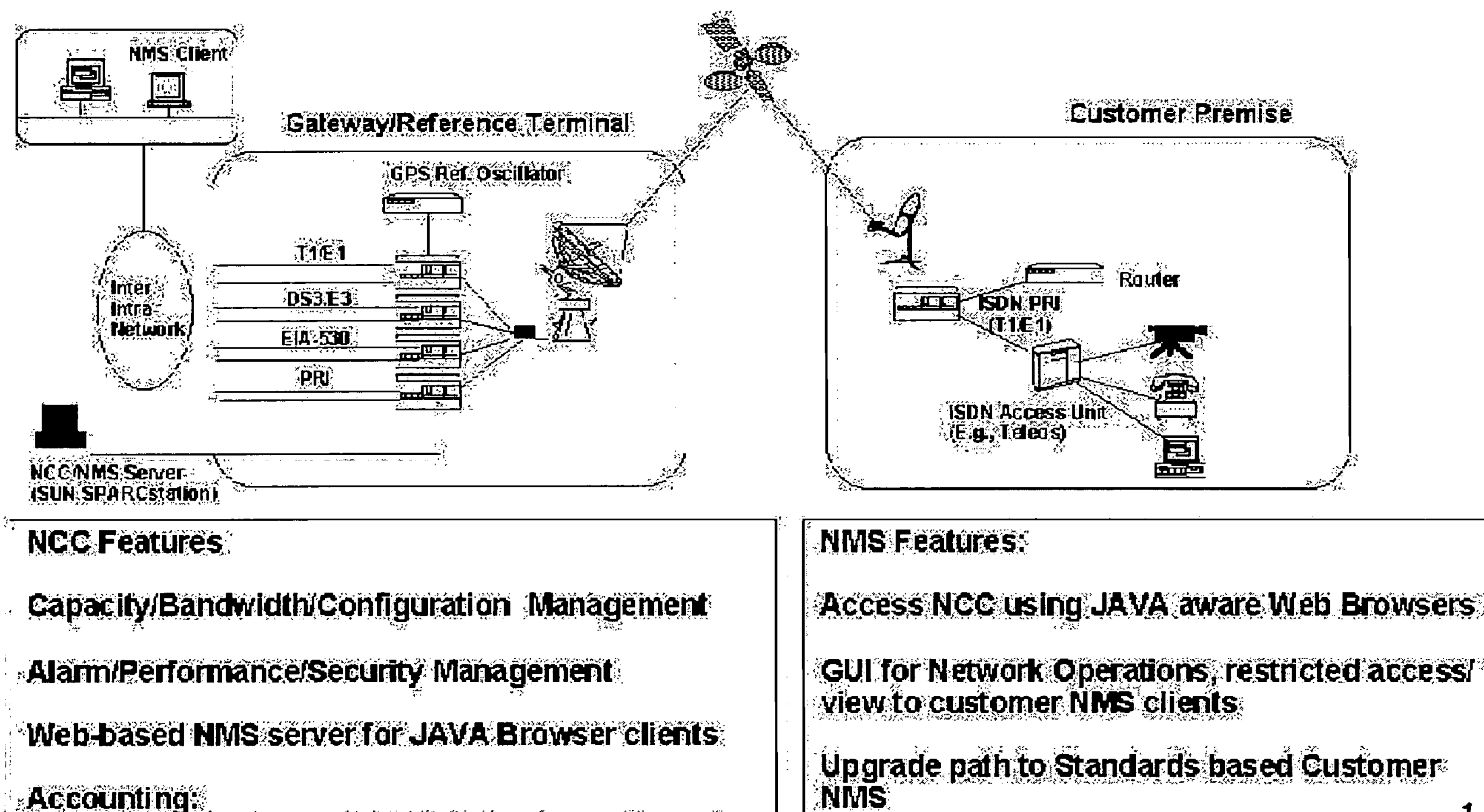
1382

1383

BEST COPY AVAILABLE

A basic terminal contains any two of four interfaces: **ATM, Frame Relay, ISDN, or SS7,** in addition to a standard ethernet interface on each unit. All electronics, including the satellite modem, are housed on a single board in a low profile chassis. User information rates from fractional-T1 through 8 Mbps can be supported by the network, allowing both low-rate, low-cost customer premise terminals and higher rate gateway hub terminals to be mixed in the same network.

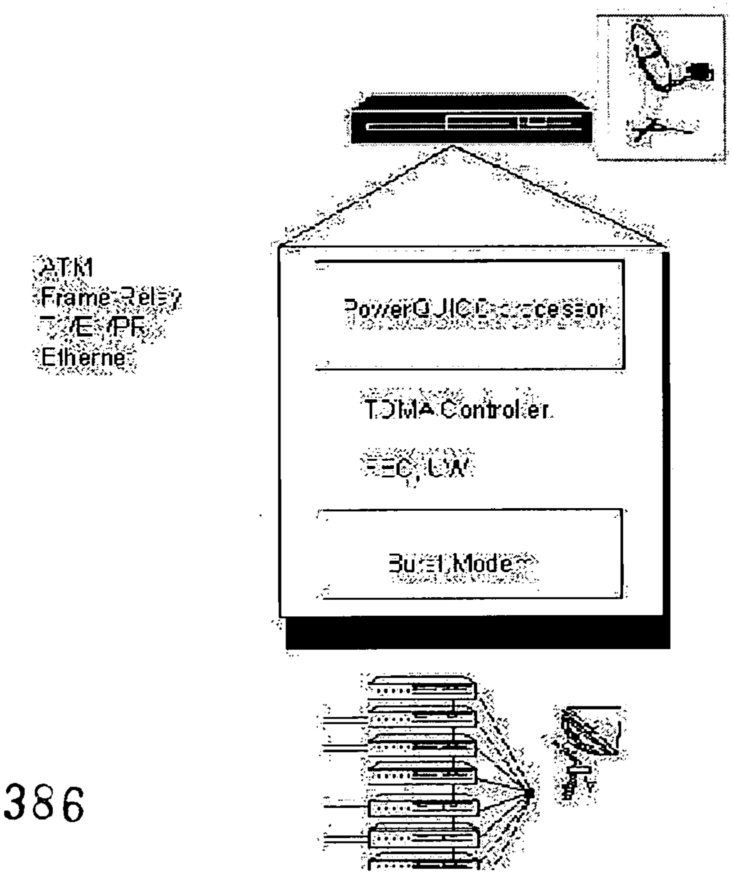
Figure 3 - Terminal Hardware Architecture



1384

1385

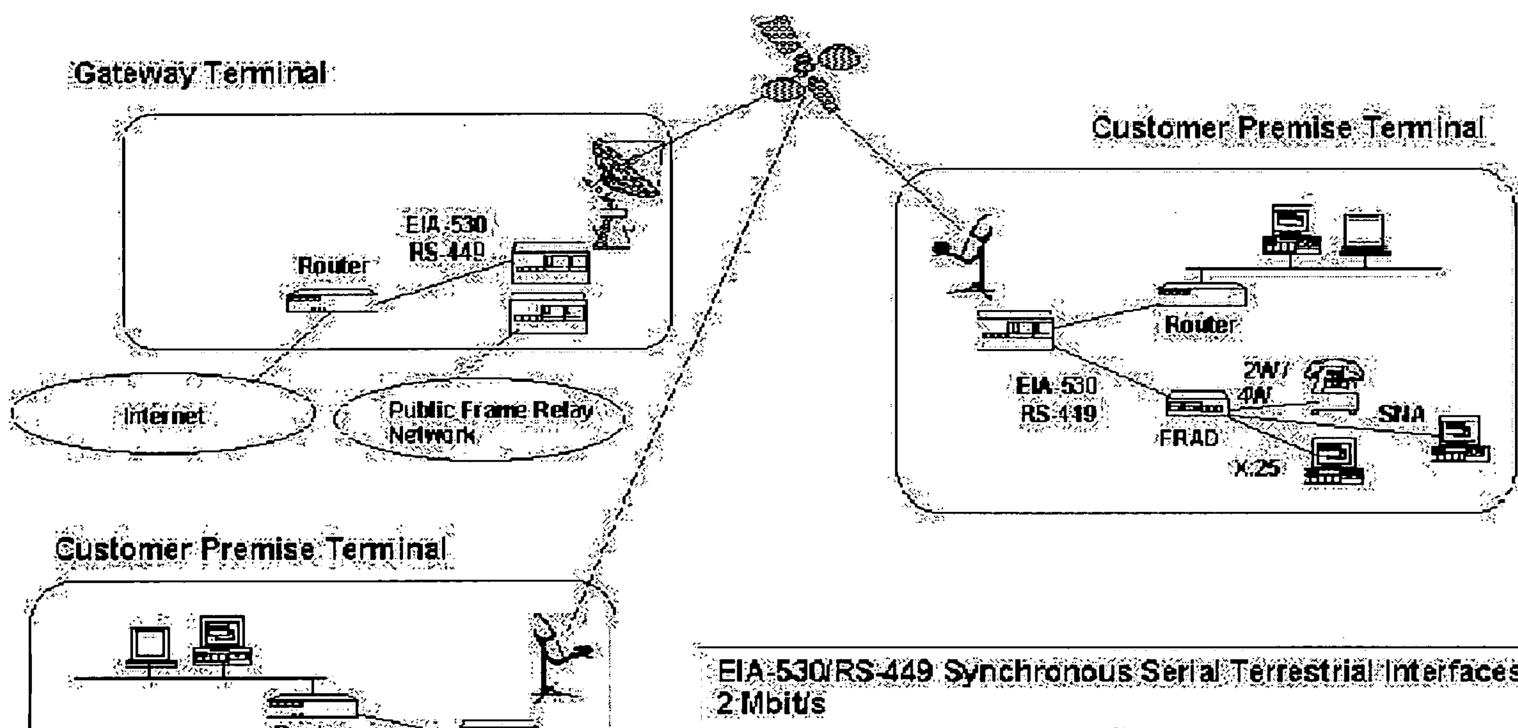
Call Detail Records in flat files for each service

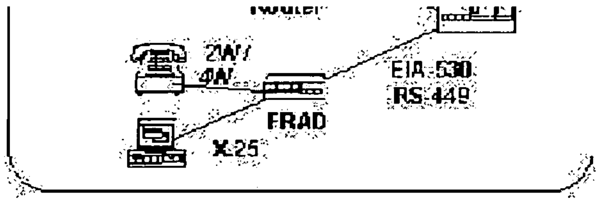


- Allows for 2.4m Ku and 3.7m C-band antennas in a fully meshed ground network up to Std A/C INTELSAT stations
- IDU supports any 2 of 4 industry standard interfaces, with a single modem per chassis, capable of carrying 2 Mbit/s user data
- Stackable architecture allows for greater data rates at larger stations
- All operating software and configuration parameters downloaded by NMS
- Supports future product enhancements

The Link One network consists of a Network Control Center (NCC) and a number of traffic terminals. One traffic terminal is designated as the Master Reference Terminal (MRT) to provide TDMA timing. A Supporting Reference Terminal (SRT) is used in networks not having loopback beam connectivity. The system is controlled dynamically by a full-featured NCC, hosted on a Sun Workstation/Server, that runs the Network Management System (NMS) Server and performs the bandwidth management function. The NCC provides centralized management, monitoring, control, configuration, accounting, and bandwidth management functions. The NMS is a web-based platform - independent Java application, which provides central network management functionality. Any standard commercial web browser can be used to access the NMS server in a user friendly fashion . The user retrieves data from and delivers information to the NCC servers via TCP/IP sockets following a well-defined protocol.

Figure 4 - NCC/NMS





ITU Q.922/ANSI 617, LMI/Annex D Core Standard Support

PVC service with QOS subscription

Interfaces with Frame Relay Routers, Access Devices and Switches

IV.

CIRCUIT LEVEL OPTIONS

Each interface carries one or more virtual circuits. Typically, up to 1024 circuits can be supported by each interface. Each packet application type requires certain parameters to be specified to define a virtual circuit; contract parameters which define how packets are processed by the terminal, and subscription parameters which specify terrestrial circuit identification and access side interface parameters. ATM services are divided into four types: Constant Bit Rate (CBR), Variable Bit Rate - Real Time (VBR-RT), Variable Bit Rate -Non-real Time (VBR-NRT) and Unspecified Bit Rate (UBR). A CBR service contract is defined by the peak cell rate (PCR). VBR-RT and VBR-NRT services are defined by Peak Cell rate (PCR) and Sustained Cell Rate (SCR). UBR service is defined by PCR. A Frame Relay service contract is defined by the Committed Information Rate (CIR), Committed Burst Size (Bc) and Excess Burst Size (Be).

Link One reserves bandwidth according to the virtual circuit contract parameters. When virtual circuits become active or inactive, allocations are made or removed. Allocations are also made for non-guaranteed traffic when capacity is available.

For ATM applications the following space segment capacity guarantees are provided:

Service Category	Guaranteed
Constant Bit Rate	Peak Cell Rate
Variable Bit Rate - real-time	Sustained Cell Rate
Variable Bit Rate - Non-real-time	Sustained Cell Rate
Unspecified Bit Rate	None

ATM user information rates from fractional T-1 through 8 Mbps can be supported by the network, allowing both low-rate, low-cost customer premise terminals and higher rate gateway hub terminals to be mixed in the same network.

For Frame Relay applications the following guarantees are provided:

BEST COPY AVAILABLE

Category	Guaranteed

Committed Information Rate	Committed Information Rate
Committed Information Rate = 0	None

For circuit-switched traffic, bandwidth is allocated on a call by call basis. ISDN service is connection-oriented digital circuit service that allows transmission of ISDN traffic at speeds from 64 kbps to 2.048 Mbps using 64 kbps bearer channels. Full ISDN signaling support is provided in accordance with ITU-T Q.921 standards. For SS7 services, basic call setup/teardown features are supported including call progress, seizure and release, and messaging. Link One acts as a Common Channel Signaling (CCS) switching office with Service Switching Point (SSP) functionality. The SS7 service feature supports ITU Message Transfer Part (MTP) /ISDN User Part (ISUP) enabling SS7 to ISDN interworking with unique point code.

V. BETA TESTING

Following successful alpha testing of the Link One system, in which operational compliance to system design specifications were verified, beta testing was conducted. Initially, COMSAT and COMSAT Argentina, a domestic service provider in Argentina with the approval of Telintar, the Argentine international service provider, worked together on developing the different service configurations and applications used for beta test of the Link One system, in which services representative of a typical commercial deployment of a Link One network were validated for performance and functionality.

In order to conduct the beta test of Frame Relay and ATM services, COMSAT Argentina (CI) installed a 3.8 meter C-Band antenna at Telintar facilities in downtown Buenos Aires. After coordination with COMSAT, Telintar and Intelsat, CI set up an international link between that antenna and two traffic antennas in Clarksburg, Maryland.

The following applications and verification tests were conducted under the beta test program:

A. Service Performance:

- ATM and Frame Relay performance tests

B. Intranet Applications:

- E-mail
- STP/Telnet
- Web Browsing
- MPEG Video Streaming
- Desktop Video conferencing (H323)

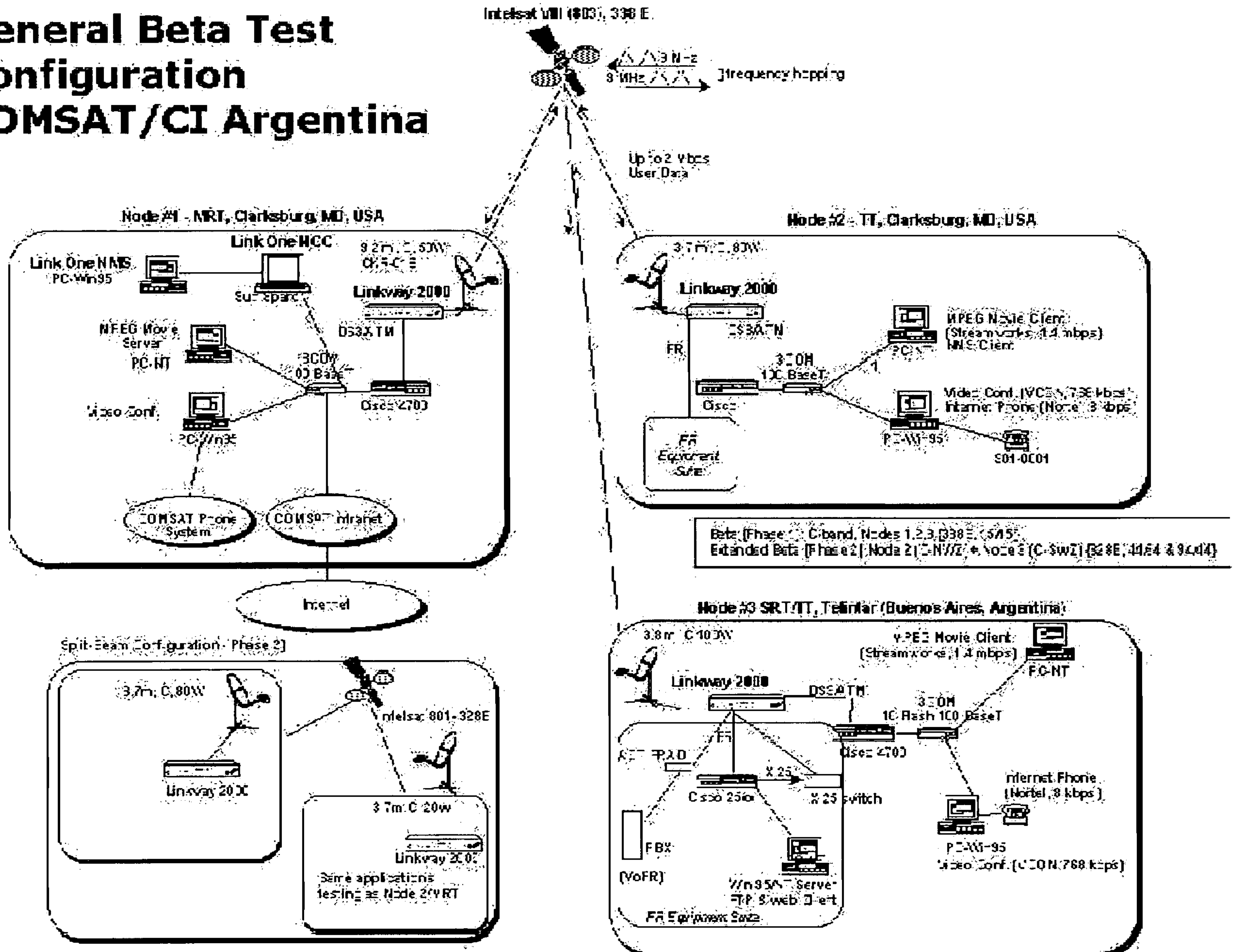
- Voice over IP

C. Internet Applications:

- Backbone access to ISPs in Argentina to US Tier1 service provider using Frame Relay over Link One
- Interoperability with Standard Equipment
- Interoperability tests with backbone class switches (Ascend)
- Satellite Beam Operation
- Global Hemi Beam Operation
- Split Zone Beam Operation

Figure 5 - Beta Test Network

General Beta Test Configuration COMSAT/CI Argentina



1396

Over the six week period of testing, the Linkway 2000TM indoor units proved to be highly reliable devices with less than 1 cyclic redundancy check loss over a million packets during ATM and FR performance tests. The dynamic bandwidth allocation mechanism, along with the bandwidth reallocation function performed without problem. PVCs were set up, changed, and taken down without incident. With multiple ATM PVCs and a mix of 1397

CBR and UBR traffic operational, the results showed that the system's traffic management guaranteed the requisite QoS to the CBR traffic, and that UBR PVCs were throttled back with bandwidth shared fairly among all of the UBR PVCs.

The Internet access over Frame Relay over Link One application was solid on every aspect of the testing. No customer reported any kind of link problem and throughput was normal over the three week commercial service.

Additionally, the process of starting up the NCC, and the acquisition of the MRT was extremely fast. No manual intervention or adjustments were required in setting up and adding sites under single and split beam operation.

VI. COMMERCIAL SERVICE CONCEPT

Link One^{SM} service will be offered as a managed network service over designated satellite capacity. This commercial model has the network manager assuming responsibility for all of the direct costs associated with the network.

In providing NCC/NMS services, decisions concerning machine and site redundancy are addressed, along with staffing for 24 x 7 operations and training. Engineering issues faced include sizing the network, modeling customer needs, preparing link budgets, securing capacity, monitoring traffic, analyzing network performance, and planning for additional requirements. Accommodating growth efficiently and effectively from the users and providers viewpoint are both extremely important. At the traffic site, the manager may assist in defining equipment requirements, site preparation, and in the arranging for the purchase or leasing of equipment. The network manager will also develop pricing models for the full range of packet and switched services available, and develop a billing system that accesses the database records and applies the pricing structure for customer billing.

Through the Link One service, customers who are service providers can extend their network services to customer premise or shared hub service providers regionally or internationally. The foreign end communications requirements may be handled through host PTT carriers/administrations or second-tier in-country providers. In one commercial arrangement, for example, Link One traffic will be billable to the service providers at both ends on a per minute or packet throughput basis, similar to arrangements for international telephony. Each entity pays for transmission facilities separately, collection on the call is at the point of origination, and service providers settle accounts collectively based on agreed upon accounting rates.

Highly detailed resource utilization records are maintained by the NCC, in a format compatible with ITU billing standards enabling separate billing capability for both halves of the connection. Such information will be provided to customers to support invoices. For the network manager, capacity can be allocated incrementally to allow for network growth.

Additionally, private managed networks can be separately operated in the overall Link One network. Dedicated bandwidth service is another option for service providers or multinationals who in turn would manage their own network or outsource the network management function. Here, the call accounting capability would support efficient internal use of the leased network.

VII. CONCLUSIONS

Link One^{SM} allows managed network or private network service operation, where satellite capacity is leased on a full-time basis by the network owner/operator and accessed with Linkway 2000^{TM} proprietary equipment for cost-effective use of satellite capacity in providing advanced broadband services. Link One differs in important ways from traditional TDMA systems and SCPC systems in that it uses a highly efficient TDMA architecture, and provides for ISDN, SS7, and full UNI FR and ATM service capabilities enabling seamless terrestrial interconnections. Link One incorporates a bandwidth on demand, metered service capability targeting large telecommunications users, service providers, and private corporations. Taken together, these features promise superior performance, a flexible architecture, satellite's global access; and provides outstanding value for every user and user application.

Return to Top View Full-screen

The Future is Here: New Satellite Ventures

Paul Dykewicz

Senior Analyst, Editor,

Satellite News Group

Phillips Business Information, Inc., USA

Abstract:

Not available

View Full-text

The Future Is Here: New Satellite Ventures

Introduction

A host of important satellite applications are ready to gain footholds this year. The development of new satellite applications will spur the exchange of ideas, news and entertainment. This year will make history with the growth in global, mobile satellite services. Also occurring this year is the launch of the world's first digital audio radio service by the appropriately named WorldSpace. In addition, commercial broadband satellite services will move ahead when CyberStar begins serving customers. All of these key developments are applications that once were considered part of the future. Ready or not, that future is here.

A key challenge for these service providers will be to find paying customers. The performance of these pioneering systems will be watched closely. Their success will determine whether they and the systems that follow will obtain essential financing. The stakes are enormous. Billions of dollars have been invested in these new systems. If technical flaws mount, projected customer demand falls short and other major difficulties occur, the money flow from investors could be redirected. Companies involved in the Internet or other high-growth industries would be happy to take the money instead. No one will need to ask them twice!

LEO Services

This year marks the widespread availability of low-Earth-orbit (LEO) satellite services. Iridium LLC, a global voice service, and Orbcomm, a global messaging service, began providing commercial communications last year. Iridium is the first so-called Big LEO. This year it is attempting to improve service reliability and reduce a dropped call rate that Iridium's CEO last fall described as unacceptable. Another Big LEO is Globalstar L.P. That proposed system is looking to recover from the loss of 12 satellites during a Zenit launch failure last October. No company in history had ever lost so many satellites at one time. Despite the setback, the Loral Corp. – Globalstar's deep-pocketed, 42 percent owner – continues to champion the system. Without Loral's unflagging financial support, Globalstar could have been in dire straits. Loral recently agreed to provide Globalstar with $150 million of $350 million financing package. Without it, Globalstar would have faced a severe cash crunch by the end of the first quarter this year. Globalstar President Doug Dwyre told me this week that his company now has enough cash to finish the third quarter.

At that time, Globalstar is expected to roll out commercial voice service. It also is expected to charge customers much less per minute than the $5 a minute that some Iridium customers now pay. Now, more than ever, Globalstar needs to avoid launch failures. Its limited cash reserves require revenue-generating service to begin by the third quarter. Otherwise, another cash crunch looms. Further delays also put Globalstar at risk for giving Iridium an enormous jump in signing up customers.

What do I expect this year among the LEOs? Watch for Iridium to significantly improve the quality and reliability of its service. When Globalstar starts service, expect fewer technical problems than Iridium suffered. Globalstar already has eight fully functioning satellites in orbit. Another 30 birds are on the ground ready to be launched. If any further launch failures occur, Globalstar's service may be delayed until 2000. Globalstar improved its outlook a couple of weeks ago when it named the Boeing Co.'s reliable Delta II rocket to launch 28 of its satellites. Those launches during the next three years are in addition to launches scheduled with dependable Arianespace and Soyuz rockets.

Globalstar still is awaiting government approval to use Russia's Soyuz rocket. Negotiations on a new launch agreement between U.S., Russian and Kazahkstan officials have dragged out for nearly five months. A Technical Safeguard Agreement is needed to govern the thorny issue of technology transfer. Once such an agreement is in place, Globalstar will require at least a month to prepare for a Soyuz launch. Any further delay will slow the system's deployment yet again. Why? Globalstar expects to use six Soyuz rockets to carry a total of 24 satellites. Globalstar also plans to launch six birds aboard an Ariane 4 rocket in September. That event would mark the first LEO launch for any Arianespace rocket.

Not to be overlooked is potential competitor ICO Global Communications. ICO is expecting to deploy its medium-Earth-orbit system and offer satellite-based, global, mobile voice services next year. Two other systems, Ellipso and ECCO, remain possibilities. However, they still need financing. If the three systems that precede them struggle, the deep desire for the others to find investors may turn into unrequited love.

In the Little LEO market, the story of 1999 will be Orbcomm. One reason: it is the only operating Little LEO. No other proposed global, mobile satellite messaging service will be ready to start operations for at least two or three years. Orbcomm has a big advantage because it can provide messaging services more cost-effectively than the voice-oriented Big LEOs. In addition, Orbcomm may prove to be the best use of investment dollars among the various LEOs. The Orbcomm system only cost hundreds of millions of dollars to build. The Big LEOs, meanwhile, each cost billions of dollars.

Orbcomm also will offer global positioning services and other innovations. One example is GlobalGrams. Orbcomm's GlobalGrams are designed as an alternative to conventional cellular and paging services.

Orbcomm is eyeing a big piece of a market that some forecasters estimate is upward of $40 billion. Despite its early lead, Orbcomm may well face competition from other Little LEOs. Final Analysis, which secured General Dynamics as its first major partner last week, remains very much alive. General Dynamics agreed to invest close to $20 million in Final Analysis. That investment won General Dynamics the chance to build new generation command and data-handling space processors for the Final Analysis system. Final Analysis plans to provide space-based commercial mobile and fixed two-way digital data information services beginning in 2001. The space processor is capable of producing more than 450 million instructions per second (MIPS). Planned applications include mobile asset tracking, remote monitoring and control, data acquisition, and two-way messaging and e-mail.

Final Analysis President Nader Modanlo told me last week that his planned 26-satellite venture now has $40 million in financing and he is looking for $50 million more this year. The announcement by General Dynamics to back the venture may well sway potential investors to support the project. The search for the first backer is always the toughest, Madanlo said. The cost of the Final Analysis system is expected to top $150 million. LEO One, a proposed $250 million system, is planning a 48-satellite constellation. The final contender is E-Sat, which still plans to use six satellites as part of a $50 million system.

Digital Audio Radio Services

In another industry breakthrough, the world's first digital audio radio service (DARS) will be introduced this year. Washington, D.C.-based WorldSpace launched its first satellite last October. That bird will serve Africa, a continent that previously did not have a single dedicated satellite. Two additional launches are planned this year to give WorldSpace a three-satellite system. The latter two birds will offer service to Asia and the Americas. WorldSpace potentially could serve 4.6 billion people in its coverage area. Those people account for 80 percent of the world's population. WorldSpace also recently lined up top manufacturers to build its radio receivers.

Each WorldSpace satellite will carry three spot beams, six transponders and two 150-watt traveling wave tube amplifiers. AfriStar became the first WorldSpace bird to be launched last October. AsiaStar and AmeriStar are scheduled for launch later this year. Each satellite will be able to offer 80+ channels of programming. The performance quality will range between AM (16 kbps) to near-CD level (128 kbps). WorldSpace officials recently named Harold "Buck" Adams as the company's new president and CEO. He is responsible for streamlining the operations. Adams is expected to reduce engineering positions and expand marketing efforts. The shift in workforce reflects that the company's in-orbit system is nearly complete. The new WorldSpace emphasis is on obtaining customers.

Broadband Satellite Systems

Next on the horizon are broadband systems. They will offer high-growth Internet services. Four proposed satellite-based broadband communications services have well-heeled backers. Testing the waters for the big four broadband constellations is the Loral Corp.-backed CyberStar system. It recently began a search for customers to use its combined satellite and terrestrial networks -- delivering information at speeds of up to 27 Mbps. More advanced broadband services will follow.

One example is SkyBridge, a next generation broadband service that is facing key regulatory and political issues this year. SkyBridge received good news last November when the FCC voted to open a proceeding on such fixed, broadband satellite systems. SkyBridge plans to launch 80 non-geostationary satellites. They will provide global data services around the world. The FCC's notice of proposed rulemaking to solicit comments recently ended. The agency has yet to render any pronouncements about the planned systems.

Other planned broadband service competitors include Hughes Spaceway and Astrolink. Hughes officials told me recently told me that a major announcement by Spaceway is coming next month. New details are expected.

The Teledesic system, backed by Craig McCaw and Bill Gates, also is looking to capture a big share of satellite-based, Internet services. Teledesic currently plans to develop a constellation of more than 300 Ka-band, non-geostationary satellites. Motorola last year became Teledesic's primary satellite contractor. Without reducing the planned size of the system, the production costs for Teledesic are estimated to exceed $10 billion.

Conclusion

In summary, the future of several long-awaited satellite applications has arrived. Watch for LEO services, DARS systems and broadband communications to make major strides. Beyond this year, the continuing demand for more and faster Internet services leaves satellite-based, broadband systems poised for enormous growth. Rest assured: the future is here. And more of it is yet to come. If my view of the future is correct, you won't want to miss it.

Return to Top View Full-screen

PTC'99 Concurrent Sessions Listing by Author

A to F, G to L, M to R, S to Z, Search Proceedings

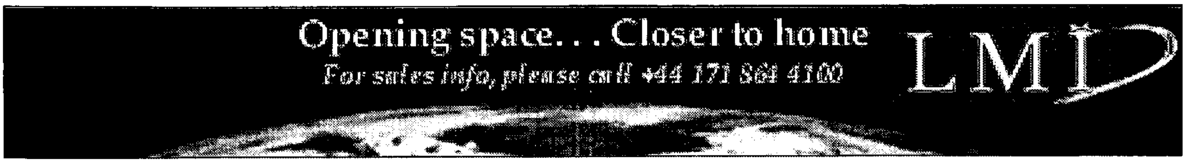
Author	Topic
A	
Agarwal, Y.L.	Development of Internet Services in India
Ahn, Kap-Dae	The Configuration Management System for the Cellular Networks
Arpakajorn, Pansak	B-ISDN Field Trial in Thailand
Asahara, Iwato	Technical Support for Establishment of Telemedicine between Gomel, Belarus and Nagasaki, Japan
Asai, Kikuo	Data Transmission On the Japanese Inter-University Satellite Network

Asano, Mutsuya	New opportunities & challenges To E-Commerce in The Cross Border Environment: Internconnection of E-Commerce Test-Beds Project in Asia Pacific Region
B	
Balnaves, Mark	Key Predictors of Adoption of New Media: A report on Australia's largest diffusion study
Bannan, James	Distance Learning in the Pacific Islands
Bersin, Heidi	PSTN and Internet Convergence for Telephony: Market Opportunity for Carriers in the Asia Pacific Region
Best, Owen	Beating the Bandwidth Bottleneck: How subsea cables can support E-commerce between Asia and Europe
Braunstein, Yale M.	Comparative Of Telecommunications Globalization
Burke, John	Monitoring Effective Use of Online Services

Byun, Jae-Ho	Foreign Ownership Regulations in Korean Telecom Market
C	
Castiel, David	Impact of Licensing Delays
Chaffee, Ellen	Learning with Laptops
Chan, Alice P.	Electronic Commerce Between Retailers And Suppliers: What Influences The Adoption And Use Of Information
Chhibber, N. K	Solutions For Providing Telephony Services In Rural Areas Of Less Development Countries
Christensen, Ted	Creating Transnational Distance Education Alliances
Coutts, Reg	An Analysis of the Australian PCS Auction(s)
Crowe, Thomas	The WTO Agreement on Basic Telecommunications Services: How is it affecting the Pacific Rim?
D	

Dadouris, Lisa	Telecom Reform and the Resultant Evolution of New Product Offerings in the Undersea Cable Arena
Darby, George	Status of Integrated Internet Digital Network Technology
Davis, Michael E.	Roaming between Satellite and Terrestrial Systems-New Concepts and New Legal Issues
Dodgson, Charles	New governments throughout Asia refocus telecommunications policy: The quest to overcome "Information Apartheid"
Dovens, Mathew	Trend in Asia-Pacific Internet Communications
Downey, Tom	Separation of IP Routing and Forwarding via Tag Switching and MultiProtocol Label Switching
Dwyre, Douglas G.	GMPCS-After The First 100 Days
Dykewicz, Paul	The Future is Here: New Satellite Ventures

E	
F	
Falshaw, Peter	Local Service Competition: Breaking the Bottleneck
Fitch, Michael	NGSO/GSO: Satellite Sharing Issues
Forster, Jane	The Demise Of Local Loop Power In Australia
Frieden, Rob	The Potential Regulatory and Universal Service Consequences of Internet Balkanization



Author	Topic
G	
Gerstell, Glenn	Telecom Mergers & Acquisitions Following The Asian Financial Crisis
Godeluck, Jean	The Submarine Cable Networks Industry Shifts Gears
Gong, Gary	Millions Online Residences & Enterprises (MORE)' Movement - Internet to the Families through the Tele-Homebook Experiment Program -
Gordon, Joshua	Internet Growth, Economic Development and Political Change in Malaysia, China, and Singapore
Goussal, Darío M.	Inverse Cross-Subsidization (Rural-Urban): Paradox And Evidence
H	
Harada, Osamu	Submarine Optical Fiber Cable Systems... Answering the Global Demands for Connectivity
Harbinson, Robert W.	Network Telephony: The NSP Perspectives
Hartmann, Kevin	Monopoly Infrastructure: A Trade Barrier to Electronic Commerce
Hatono, Atsuo	On Pricing Scheme and Traffic Monitor Method in ATM Networks
Heller, Mike	Insuring the Continnation of Universal Service
Hemmady, Jayant	CDMA Network and Technology Evolution
Higgins, Ron	The Role of the Private Premium Network (Overnets) in the Emerging Global Infrastructure
Hinchcliff, John	Creating Transnational Distance Education Alliances
Hudson, Heather E.	Rural Information Infrastructure: Myths and Realities
I	
Idris, Naswil	Role of Community TeleCenter (CTC) in Acclerating Educational (Community) Development in Indonesian Rural Area
Irwin, Susan	Digital Sattelite Business Communications
J	
Jacobsen, Eric	New Standards and Solutions for Satellite Communication Modulation and Error Correction

Janigan, Michael	Can the Competitive Model of Telecommunications Regulation Deliver the Goods?
Jarvie, Charles	Southern Cross Cable Network- A Sponsor's Perspective
Jew, Bernadette	Internet Connectivity: Open Competition in the Face of Commercial Expansion
Johnston, Malcolm	Local Service Competition: Breaking the Bottleneck
K	
Kamman, Alan N.	Attracting and Nurturing Small Businesses in Rural Areas: Telecommunications Solution
Katsutoshi, Nidaira	A Study on High-Speed FTP for Multimedia Interactive Satellite Communications System
Kim, Hyung-Sup	The Configuration Management System for the Cellular Networks
Kim, Hyun-Wook	Interactive Services using SMS in the CDMA network
Kim, Joo-Wan	Speech Quality Measurement in CDMA Cellular System Using Fast Cross-Correlation for Synchronization
Kim, Kwang-Hoon	Speech Quality Measurement in CDMA Cellular System Using Fast Cross-Correlation for Synchronization
Kim, Nae-Hee	The Configuration Management System for the Cellular Networks
Kim, Pang-Reong	Foreign Ownership Regulations in Korean Telecom Market
Kim, Yeon-Kyu	Interactive Services using SMS in the CDMA network
Kim, Yeong-Kwun	Perspectives on the Communication Network for the ITS Services
Kim, Yosub	The Configuration Management System for the Cellular Networks
Kim, Young-Rul	Speech Quality Measurement in CDMA Cellular System Using Fast Cross-Correlation for Synchronization
Kishimoto, Yasunari	Environment Adaptive Service using Dynamic Directory
Komandur, Sowri R.	Telecommunications in Inida and the Challenges Towards Growth
Kopinski, John W.	Link One-Advanced Business Services Over Satellite
Krebs, Arlene	Creating Transnational Distance Education Alliances
Krzywicky, John	Switched Voice Moving to Packetized (IP) Voice: A Trickle or an Avalanche?
Kubota, Teruhiro	Environment Adaptive Service using Dynamic Directory
Kurt, Dahm	ACTIVE NETWORKS- The Integration of Directory Services with Networking for User-Centric Telecommunications
L	

Lee, Sung-Bum	Interactive Services using SMS in the CDMA network
Levy, Larry	Increasing Ku Band Broadcast Satellite System Availability by the use of Dynamic, Adaptive Input Data Buffering
Liu, Lawrence S	Fixed Network and E-Commerce: Taiwan's Catch-up Plan for Telecom Liberalization
Liu, Poli	Taiwan's Telecommunications Liberalization and Its Current Status of Implementation
Loko, Peter	Current Status of Telecommunications Development in Pacific Islands Countries
Long, Geoff	Internet Coverage in Developing Countries of Asia

中華電信股份有限公司
Chunghwa Telecom Co., Ltd.

Author	Topic
M	
Martin, Michael P.	System Signaling Seven (SS7) Deployment in Canada's Remote Territory Using SCPC DAMA Technology
McGrath, Michael G.	A Framework for Evaluating Communications Industry Strategic Alliances
McNeill, David	Direct Broadcast TV in Taiwan - Whither Cable TV?
Middleton, Bruce	Market prospects for Satellite Mobile Services in the Asia Pacific
N	
Naff, Roger	Challenges & Trends in Satellite Based Communications- Future Applications
Ng, Roy	Broadening Information Access by Designing a Network Security Infrastructure

Nidaira, Katsutoshi	A Study on High-Speed FTP for Multimedia Interactive Satellite Communications System
Northfield, Dianne	The Information Policy Maze: Global Challenges - National Responses
O	
Oliveira-Gajdys, Mônica M.	The General Law for Telecommunications and the Development of a Competitive Market in Brazil
Ott, Steve	How a Carrier Can Offer Global IP Service Without Owning Equipment or Having Global Bi-lateral Agreements
P	
Park, Tae-Woong	Globalization Strategies World Major Telecos
Parker, Abdul R.	Organizational Adaptation Under Privatization And Liberalization

Peebles, Jacolyn	Building Hawaii's Telehealth Framework: Will Policy & Planning Overcome Social Challenges
Pietrogrande, Mario	Netplan Software: Design and Optimization of the Intelligent Network for IN and AIN Services
Pittampalli, Eshwar	Third Generation Partnership Project 2
Prasetio, Samudra	Rural Telemedicine in Indonesia: An Approach to Selecting Proper Application
Q	
R	
Rahman, Fazlur	Tele-Shastha-An Opportunity for Extension of Health Service in Bangladesh
Renner, John M.	Broadening Access Developmental Opportunities for Universities in the Asia-Pacific Region through Convergent Communication Technologies

Author	Topic
S	
Saravia, Eduardo	Prospects for the South Pacific Transit Undersea Cable
Schement, Jorge R.	Off the Net: Lack of Access and the Promise of Universal Service
Singh, Supriya	The Use of Electronic Commerce by Small Business
Slater, Tim	Meeting the Challenge - The installation, repair and maintenance of undersea fibre optic systems.
Smith, Steve	The State System Perspective
Sohn, Kyung-Han	Antitrust Consideration of Telecom in Korea
Song, Min-Zheong	Internet Publishing Strategies in Korea - Current market status & strategies
Steward, David	Pacific Island Resolutions
Sun, Lin	Satellite Communications In China: Potential and Risks
Sutherland, Ewan	The Virtual University-Higher Education as a Community Activity
Suvarnakudht, Kusolmongkol	Satellite Communications of Telephone Organization of Thailand
T	
Tagare, Neil	From Broadening Bandwidth to Broadening the Imagination
Taylor, Richard D.	Electronic Commerce in APEC: Tariffs, Taxes and Equity
Terashima, Nobuyoshi	An Experiment of Virtual Space Distance Learning System
Thakur, Manish	MSS: Financing and Investor Return
Trischitta, Patrick R.	Terabit/Sec Undersea Fiber Optic Telecommunication Network
Tulin, Thomas	Melanesian Paper
U	
Umeda, Masayoshi	Study on the Characterization of Music and A Retrieval Method Using Hummed Melody
V	
W	

Waldhutter, Jeff	Multimedia for the Masses Market, DSL Technology Maximizing the Existine Infrastructure
Wharton, Scott	Advanced Services and IP Telephony
Woodard, John	Integrating FM Broadcast Stations in VSAT Networks for Distance Education in the Pacific Islands
Worral, Brett K.	Explosion or Asian Implosion
X	
Y	
Yang, Chung-Chuan	Convergence of Telecommunications Technologies and It's Impacts on Universal Service Policy in Taiwan
Z	
Zita, Ken	Will China Embrace Competition? Foreign Equity in Telecoms Hangs in the Balance

PTC'99 Concurrent Sessions Listing By Day

M = Monday T = Tuesday W = Wednesday Search Proceedings

To view the proceedings, click on the author or topic.

SPACE SYSTEMS/LORAL = RELIABILITY

Monday 1400-1600

M 1.1 Business Developments

Location: Tapa I
Chair: JAGDISH RAO, Consultant, USA

- **M.1.1.1**
  New Opportunities and Challenges To Electronic Commerce in The Cross Border Environment: Interconnection of Electronic Commerce Test-Beds Project in the Asia Pacific Region
  MUTSUYA ASANO, Chair of Executive Board of MultiMedia Pilot Project Consortium in the Telecom Services Association in Japan, Japan
- **M.1.1.2**
  Electronic Commerce in APEC: Taxes, Tariffs and Equity
  RICHARD D. TAYLOR, Palmer Chair of Telecom Studies, Pennsylvania State University, USA
- **M.1.1.3**
  From Broadening Bandwidth to Broadening the Imagination
  NEIL TAGARE, Chairman, CTR Group, USA
- **M.1.1.4**
  Internet Content Industry: Current Market Status & Strategies
  MIN-ZHEONG SONG, Korea Telecom, Republic of Korea

M 1.2 Country Studies

Location: South Pacific I and II
Chair: TBA

- **M.1.2.1**
  The Demise of Local Loop Power in Australia?
  JANE FORSTER, Partner and CAROLINE LOVELL, Senior Solicitor, Clayton Utz, Australia
- **M.1.2.2**
  Convergence of Telecommunications Technologies and Its Impacts on Universal Service Policy in Taiwan
  CHUNG-CHUAN YANG, Associate Professor, Department of Marketing and Distribution Management, National Kaohsiung First University of Science and Technology, Taiwan
- **M.1.2.3**
  Foreign Ownership Regulation in Korean Telecom Market
  JAE-HO BYUN, Senior Researcher and PANG-RYONG KIM, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea
- **M.1.2.4**
  Taiwan's Telecommunications Liberalization and It's Current Status of Implementation
  POLI LIU, Taiwan Institute of Economic Research, Japan and TOSHIO KOSUGE, Professor, University of ElectroComms, Japan

M 1.3 CDMA

Location: Honolulu Suite
Chair: EIJI HAYASHI, Engineering Advisor, NEC Corporation, Japan

- **M.1.3.1**
  CDMA Network and Technoloby Evolution
  JAY HEMMADY, Technical Manager, Flexent MSC Architecture, AMPS/PCS Wireless Networks and JERRY E. ROG, Member of Technical Staff-Flexent MSC Architecture, AMPS/PCS Wireless Networks, Lucent Technologies, USA
- **M.1.3.2**
  The Configuration Management for the Cellular Networks
  KAP-DAE AHN, Associate Research Engineer; NAE-HEE KIM, Software Engineer; HYUNG-SUP KIM; and YOSUB KIM, Network Management Center, SK Telecom Central R&D Center, Republic of Korea
- **M.1.3.3**
  Interactive Services Using SMS in the CDMA Network
  Hyun-Wook Kim, Research Engineer; YEON-KYU KIM, Research Engineer, SUNG-BUM LEE, Research Engineer; SK Telecom Central R&D Center, Republic of Korea
- **M.1.3.4**
  Speech Quality Measurement in a CDMA Cellular Network
  KWANG-HOON KIM, Researcher; YOUNG-RUL KIM, Senior Researcher; SUNG-HEE SEO, Senior Researcher, JOO-WAN KIM, Master Researcher, SK Telecom Central R&D Center, Republic of Korea

M 1.4 Strategies

Location: South Pacific III and IV
Chair: YASUHIKO KAWASUMI, General Manager, Corporate Planning Division, Japan Telecom Company, Ltd., Japan

- **M.1.4.1**
  Telecom Mergers & Acquisitions Following the Asian Financial Crisis
  GLENN S. GERSTELL, Partner, Milbank, Tweed, Hadley & McCloy, USA
- **M.1.4.2**
  A Compatibility Framework for Evaluating Communications Industry Strategic Alliances
  G. MICHAEL MCGRATH, Research Fellow and Deputy Director, JRCASE School of MPCE and ELIZABETH MORE, Deputy Director, Macquire University, Australia
- **M.1.4.3**
  The Globalization Strategies of World Major Telecos
  TAE-WOONG PARK, Senior Researcher, HOE Il KANG, Senior Researcher, SUNG SOO HAN, Analyst, ETRI (Electronics and Telecommunications Research Institute), Republic of Korea
- **M.1.4.4**
  Comparative Analysis of Telecommunications Globalization
  YALE M. BRAUNSTEIN, Professor, Information Management & Systems, University of California, Berkeley; MEHEROO JUSSAWALLA, Senior Fellow Emerita, East-West Center; and STEPHEN MORRIS, Adjunct Professor, Information and Decision Sciences, McLaren School of Business, University of San Francisco, USA

M 1.5 New Technologies

Location: Tapa III
Chair: DALE ROGERS, Global Accounts Director, TCS-TeleCommunication Systems, USA

- **M.1.5.1**
  Advanced Services and IP Telephony
  SCOTT WHARTON, Director of Marketing, VocalTec Communications, Inc., USA
- **M.1.5.2**
  Switched Voice Moving to Packetized (IP) Voice: A Trickle or an Avalanche?
  JOHN E. KRZYWICKI, Chairman, Cambridge Strategic Management Group, USA
- **M.1.5.3**
  Study on the Characterization of Music and a Melody Retrieval Method Using Hummed Melody
  MASAYOSHI UMEDA, Research Engineer; YUICHI NISHIHARA, Researcher; SEIICHI KON'YA, Research Engineer; NOBUROU TANIGUCHI, Researcher; MASASHI YAMAMURO, Senior Research Engineer, KAZUHIKO KUSHIMA, Senior Research Engineer, NTT Information and Communication Systems Laboratories, Japan

M 1.6 First 100 Days of GMPCS
Location: Tapa II
Chair: EDWARD SLACK, Director, International Services, COMSAT, USA

- **M.1.6.1**
  Global Enterprises: The Early Days OF GMPCS
  MARY FROST, Vice President and Regional General Manager, ICO Global Communications-North America, USA
- **M.1.6.2**
  GMPCS-After The First 100 Days
  DOUGLAS G. DWYRE, President, Globalstar L.P., USA
- **M.1.6.3**
  Impact of Licensing Delays
  DAVID CASTIEL, President and Chief Executive Officer, Mobile Communications Holdings, USA
- **M.1.6.4**
  Iridium-Around the World in 80 Days
  CARLTON R. JENNINGS, CEO and Managing Director, Iridium South Pacific Ltd., Australia

Presenter: CHRIS PEARCE, Director, Sales and Marketing, Iridium South Pacific, Australia

Monday 1630-1830

M 2.1 Telephony
Location: Tapa I
Chair: JAMES HEBERLE, Vice President, Sales and Marketing, MTT Inc., USA

- M.2.1.1
  Integrated Internet Digital Networks: The Post-Convergence, Pure-IP Network Model
  GEORGE E. DARBY, Registered Patent Attorney, President, Teleport Asia, USA
- M.2.1.2
  Network Telephony: The NSP Perspectives
  ROBERT W. HARBISON, Chief Technology Officer, StarVox Inc., USA
- M.2.1.3
  How a Carrier Can Offer Global IP Service Without Owning Equipment or Having Global Bi-lateral Agreements
  STEVEN OTT, Vice President of Global Sales, ITXC Corporation, USA
- M.2.1.4
  PSTN and Internet Convergence for Telephony: Market Opportunity for Carriers in the Asia Pacific Region
  HEIDI BERSIN, Vice President-Marketing, Clarent Corporation, USA

M 2.2 Competition
Location: South Pacific I and II
Chair: JAMES G. SAVAGE, Vice President, Public Affairs—International, GTE Service Corporation, USA

- M.2.2.1
  Local Service Competition: Breaking the Bottleneck
  PETER FALSHAW, Director of Consulting and JIM HOLMES, Principal Consultant, Ovum Pty Ltd, Australia
- M.2.2.2
  The WTO Agreement on Basic Telecommunications Services: How is it Affecting the Pacific Rim?
  THOMAS K. CROWE, Attorney and ELIZABETH HOLOWINSKI, Associate, Law Offices of Thomas K. Crowe, USA M.
- 2.2.3
  Can the Competitive Model of Telecommunications Governance Deliver the Goods?
  MICHAEL JANIGAN, Executive Director and General Counsel of Public Interest Advocacy Centre, Canada
- M.2.2.4
  Organisational Adaption Under Privatisation and Liberalisation
  STEFAN WEIGAND, Head of Strategy and Organisation Group, Detecon Gmbtt, Germany and ABDUL RAUF PARKER, Manager, Corporate Planning, Q-Tel, Qatar

M 2.3 Network Planning Panel
Location: Honolulu Suites
Chair: DUYCK VAN GORDER, President, Network Technologies International, USA

- M.2.3.1
  Netplan Software: Design and Optimization of the Intelligent Network for IN and AIN Services
  MARIO PIETROGRANDE, Consultant, NETPLAN, USA
- M.2.3.2
  Growing Impact of Data Communications on Public Networks
  MARCO BURGASSI, CSELT (Telecom Italia), Italy
- M.2.3.3
  Meeting Diverse Market Demands
  EMILY THATCHER, GCI, USA
- M.2.3.4
  International Network Planning
  PHIL MURPHY, Telstra, Australia

M 2.4 Rural
Location: South Pacific III and IV
Chair: MARK HUKILL, Senior Lecturer, Division of Electronic and Broadcast Media, Nanyang Technological University, Singapore

- **M.2.4.1**
  The Role of Community TeleCenter (CTC) in Accelerating Educational (Community) Development in Indonesian Rural Area
  NASWIL IDRIS, Head of Communications, Universitas Terbuka, Indonesia; JOHN M. RENNER, Professor, Edith Cowan University, Australia
- **M.2.4.2**
  Attracting and Nurturing Small Businesses in Rural Areas: A Telecommunications Solution
  ALLAN B. KAMMAN, Executive Director, Vermont Telecommunications Application Center, USA and DUNCAN HOLADAY, Head, Division of Communication Research School of Communication Studies, Nanyang Technological University, Singapore
- **M.2.4.3**
  Solutions for Providing Telephony Services in Rural Areas of Less Developed Countries
  N.K. CHHIBBER, Director, India Resource Centre, India
- **M.2.4.4**
  Rural Information Infrastructure: Myths and Realities
  HEATHER E. HUDSON, Director, Evaluation and Learning Systems, Acacia Initiative, International Development Research Centre, & Professor and Director, Telecom Management and Policy Program, University of San Francisco, USA

M 2.5 Tele-Education I

Location: Tapa III
Chair: F. BARRY BROWN, Professor, University of Saskatchewan, College of Education, Canada

- **M.2.5.1**
  Integrating FM Broadcast Stations in VSAT Networks for Distance Education in the Pacific Islands
  BRUCE BEST, Research Associate, University of Guam and JOHN M. WOODARD, University of Guam, USA
- **M.2.5.2**
  Data Transmission on the Japanese Inter-University Satellite Network
  KIKUO ASAI, Research Associate; NORITAKA OHSAWA, Associate Professor; ZENJI HAYASHI, Associate Professor; YUJI SUGIMOTO, Professor; KIMIO KONDO, Professor; KIYOHIRO YUKI, Professor; National Institute of Multimedia Education, Japan
- **M.2.5.3**
  Broadening Access Developmental Opportunities for Universities in the Asia-Pacific Region
  JOHN M. RENNER, Professor, Edith Cowan University, Australia; WEERAPONG PAIRSUWAN, Associate Professor, Suranaree University of Technology, Thailand and NASWIL IDRIS, Universitas Terbuka, Indonesia
- **M.2.5.4**
  Creating Transnational Distance Education Alliances
  TED J. CHRISTENSEN, Assistant Vice President, George Washington University, ARLENE KREBS, President, New Orbit Communications, Author, The Distance Learning Funding $ource Book, USA; and JOHN HINCHCLIFF, President, Auckland Institute of Technology, New Zealand

M 2.6 Satellite Applications

Location: Tapa II
Chair: EUI KOH, Managing Director, INTELSAT-Asia Pacific

- **Digital Satellite Business Communications**
  SUSAN J. IRWIN, President, Irwin Communications, Inc., USA
- **M.2.6.2**
  Satellite Communications of Telephone Organization of Thailand (TOT)
  KUSOLMONGKOL SUVARNKUDHT, Engineer, Telephone Organization of Thailand, Thailand
- **M.2.6.3**
  Satellite TV Broadcast Market in China
  LIN SUN, Managing Director, China Telecom Resources, USA
- **M.2.6.4**
  System Signaling Seven (SS7) Deployment in Canada's Remote Territory Using Satellite based SCPC DAMA Architecture
  MICHAEL MARTIN, Director Buiness Development-Telesat Canada and PETER SMITH, Manager Carrier Engineering-Telesat Canada, Canada

---

Tuesday 0830-1030

T 1.1 E-Commerce
Location: Tapa I
Chair: DAN WEDEMEYER, Professor, Department of Communications, University of Hawaii at Manoa, USA

- **T.1.1.1**
  The Use of Electronic Commerce by Small Business
  SUPRIYA SINGH, Senior Research Fellow, Center for International Research on Communication and Information Technologies (CIRCIT), Australia
- **T.1.1.2**
  The E-Commerce Hosting Opportunity: Building, Managing and Marketing a High-Quality E-Commerce Solution
  JEFF EDWARDS, E-Commerce Segment Manager, Compaq Computer Corporation, USA
- **T.1.1.3**
  Electronic Commerce Between Retailers & Suppliers: What Influences The Adoption & Use of Information Technologies?
  ALICE P. CHAN, Assistant Professor, Department of Communication, Cornell University, USA
- **T.1.1.4**
  Monopoly Infrastructure: A Trade Barrier to Electronic Commerce
  KEVIN HARTMAN, Deputy, International Communications Program, Center for Strategic and International Studies, USA

T 1.2 Policy
Location: South Pacific I and II
Chair: SALLYE CLARK, Director, International and Government Affairs, Teledesic LLC, USA

- T.1.2.1
  The Information Policy Maze
  DIANNE NORTHFIELD, Research Fellow, Center for International Research on Communication and Information Technolgies-CIRCIT, Australia
- T.1.2.2
  New Governments throughout Asia Refocus Telecommunications Policy: The Quest to Overcome "Information Apartheid"
  CHARLES DODGSON, Editor, Telenews Asia, Australia
- T.1.2.3
  An Analysis of the Australian PCS Auction(s)
  REG COUTTS, Professor, Director, Centre for Telecommunications Information Networking (CTIN), University of Adelaide, Australia
- T.1.2.4
  Internet Connectivity: Open Competition in the Face of Commercial Expansion
  BERNADETTE JEW, Sr. Associate; ROB NICHOLLS, Consultant, Convergence Solutions; and MICHAEL REEDE, Partner, Gilbert & Tobin, Australia

T 1.3 Submarine Cables I
Location: Honolulu Suites
Chair: RAYNALD LECONTE, Director, Submarine Systems, France Telecom, France

- T.1.3.1
  Prospects for the South Pacific Transit Undersea Cable
  EDUARDO SARAVIA, Director of International Fiber Optic Cables, CTC Mundo and ROBERTO COFRE, Head of Fibre Optic Section International, ENTEL Chile, Chile
- T.1.3.2
  Submarine Optical Fiber Cable Systems...Answering the Global Demands for Connectivity and Capacity Expansion...
  OSAMU HARADA, Senior Manager, Submarine Cable System Division and YASUHIRO AOKI, NEC Corporation, Japan
- T.1.3.3
  Beating The Bandwidth Bottleneck: How Subsea Cables can Support E-Commerce between Asia & Europe
  OWEN BEST, Vice President-Asia Pacific, FLAG Telecom, United Kingdom
- T.1.3.4
  The Submarine Cable Networks Industry Shifts Gears
  JEAN GODELUCK, Vice President, Marketing & Contracting, Alcatel Submarine Networks, United Kingdom

T 1.4 Universal Service
Location: South Pacific III and IV
Chair: MICHAEL OGDEN, Assistant Professor, Department of Communication, University of Hawaii at Manoa, USA

- **T.1.4.1**
  Inverse Cross-Subsidization (Rural-Urban): Paradox and Evidence
  DARIO M. GOUSSAL, Research Coordinator, GTR-UNNE and MARIA SANDRA URDIZAR LEZCANO, Assistant Researcher, Northern University At Resistencia, Argentina
- **T.1.4.2**
  Insuring Universal Service: What's a PTO To Do?
  MIKE HELLER, Global Marketing Programs Manager, Service Provider Line of Business, Cisco Systems, Inc., USA
- **T.1.4.3**
  Global Access to Telecommunications: Toward an Informed Choice Model of Universal Service
  JORGE REINA SCHEMENT, Professor and Co-Director of the Institute for Information Policy, College of Communications and SCOTT C. FORBES, Ph.D. Candidate, College of Communications, Pennsylvannia State University, USA
- **T.1.4.4**
  Key Predictors of Adoption of New Media: A Report on Australia's Largest Diffusion Study
  MARK BALNAVES, Chair, Mass Communication and Multimedia, Murdoch University; PETER CAPUTI; PATRICK RAWSTORNE, Mass Communication Australia, Department of Psychology, University of Wollongong, Australia

T 1.5 Distance-Education II

Location: Tapa III
Chair: VICKI KAJIOKA, Advanced Technology Specialist, Department of Education, State of Hawaii, USA

- **T.1.5.1**
  An Experiment of Virtual Space Distance Learning System
  NOBUYOSHI TERASHIMA, Professor; NOBUO TSUDA, Waseda University, Japan and JOHN TIFFIN, Emeritus, Victoria University, New Zealand
- **T.1.5.2**
  PREL Star Distance Learning in the Pacific Islands
  JAMES BANNAN and STEVE BAXENDALE, Distance Learning Education Specialist, Pacific Resources for Education and Learning (PREL), USA
- **T.1.5.3**
  The Virtual University—Higher Education as a Community Activity
  EWAN SUTHERLAND, Dean of the Faculty of Arts, University of Wales, Lampeter, United Kingdom
- **T.1.5.4**
  "Millions Online Residences & Enterprises(MORE)" Movement-Internet to the Families through the Tele-Homebook Experiment Program
  GARY GONG, Director, and PAULINE CHEN, Senior Manager, Information Technology Promotion Division, Institute for Information Industry (III), Taiwan

T 1.6 Mobile Satellites

Location: Tapa II
Chair: GEORGE NOVELLI, Vice President, Marketing, Inmarsat

- **T.1.6.1**
  Broadband Access to Interactive Multimedia Services Via Satellite
  FRANCOIS BRUN, Vice President, Business Development, Skybridge, France
- **T.1.6.2**
  Roaming Between Satellite and Terrestrial Systems-New Concepts and New Commercial Issues
  MICHAEL E. DAVIS, Partner, Ward & Partners Lawyers, Australia
- **T.1.6.3**
  Market Prospects in Asia for Satellite Mobile Services
  BRUCE S. MIDDLETON, Managing Director, Asia Pacific Aerospace Consultants Pty Ltd, Australia
- **T.1.6.4**
  Beyond Space: Challenges of Operating a Global Communications Company
  JULIE COONS, Director, Asia-Pacific, Global Gateway Management, Iridium, USA

Tuesday 1530-1730

T 2.1 Internet Country Developments in Asia-Pacific
Location: Tapa I
Chair: KAZU YOZAWA, Vice President, NTT-America, Japan

- **T.2.1.1**
  Internet Coverage in Developing Countries of Asia
  GEOFF LONG, Ph.D Candidate, Southern Cross University, Australia
- **T.2.1.2**
  Internet Growth, Economic Development and Political Change in Malaysia, China, and Singapore
  JOSHUA GORDON, Degree Fellow; MEHEROO JUSSAWALLA, Emeritus Research Fellow, East-West Center; USA
- **T.2.1.3**
  Development of Internet Services in India
  YOGESHWAR LAL AGARWAL, Executive Director, HFCL Group International Division, India
- **T.2.1.4**
  Trends in Asia-Pacific Internet Communications
  MATTHEW P. DOVENS, Director, International Internet Marketing, Cable & Wireless, USA

T 2.3 Submarine Cable II
Location: Honolulu Suites
Chair: DONALD J. SCHROEDER, President and CEO, Neptune Communications LLC, USA

- T.2.3.1
  Telecom Reform and the Resultant Evolution of New Product Offerings in the Undersea Cable Arena
  LISA S. DADOURIS, Director of Business Development, Global Crossing Development Co., USA
- T.2.3.2
  Southern Cross Cable Network- A Sponsor's Perspective
  CHARLES JARVIE, International Business Development Manager, Telecom Corporationof New Zealand, New Zealand
- T.2.3.3
  Terabit / sec Undersea Fiber Optic Cable Networks
  PATRICK R. TRISCHITTA, Director, Product Management and Technical Marketing, Tyco Submarine Systems Ltd., USA
- T.2.3.4
  Meeting the Challenge- The Installation, Repair and Maintenance of Undersea Fibre Optic Systems
  MALCOLM JOHNSTON, Sales & Marketing Director, Cable & Wireless Global Marine, United Kingdom

T 2.4 Regional Development
Location: South Pacific III and IV
Chair: TBA

- T.2.4.1
  Opportunity out of Adversity
  BRETT K. WORRALL, Sales & Marketing Director, Tyco Submarine Systems, USA
- T.2.4.2
  China Closes the Door on Foreign Investment in Network Services
  KEN ZITA, Telecommunications Consultant, USA Discussants to be announced

T 2.5 Tele-Medicine
Location: Tapa III
Chair: IFAY CHANG, Executive Director, PRIDE/Polytechnic Research, USA

- T.2.5.1
  Building Hawaii's Telehealth Framework: Will Policy & Planning Overcome Social Challenges
  JACOLYN PEEBLES, USA
- T.2.5.2
  Technical Support for Establishment of Telemedicine between Gomel, Belarus and Nagasaki, Japan
  IWATO ASAHARA, Chairman, BHN Association, Chairman, Information and Communication Research Inc.; TAKEO NOBUSAWA, Secretary General, Basic Association and MORIJI KUWABARA, Vice President, BHN Association, Japan
- T.2.5.3
  Rural Telemedicine in Indonesia: (An Approach to Selecting Proper Application)
  SAMUDRA PRASETIO, and ANDREAS W. YANUARDI, R&D Division, PT Telekomunikasi Indonesia, Indonesia

T 2.6 Mobile Satellites II
Location: Tapa II
Chair and Panelists: PAUL BERMINGHAM, Principal Financial Analyst, Telecommunications and Informatics Division, The World Bank, USA

- **T.2.6.1**
  JAMES G. BEITCHMAN, President, Lockheed Martin Intersputnik, United Kingdom
- **T.2.6.2**
  ZHOUZEHE, President, China Telecommunications Broadcast Satellite Co., People's Republic of China
- **T.2.6.3**
  MING LOUIE, Vice President, Asia Pacific Region, Globalstar, USA
- **T.2.6.4**
  RICHARD DALBELLO, Vice President of Government Affairs, ICO Global Communications, USA
- **T.2.6.5**
  TUOMO RATANEN, Executive Director of Service Development, Iridium LLC, USA
- **T.2.6.6**
  TAL MEIZON, Product Manager of Rural Telephony, Gilat Satellite Networks, Israel

---

Wednesday 1100-1300

W 1.1 Internet Deployment
Location: Tapa I
Chair: DAVID LASSNER, Director of Information Technology, Information Technology Services, University of Hawaii, USA

- **W.1.1.1**
  The Potential Regulatory and Universal Service Consequences of Internet Balkanization
  ROBERT M. FRIEDEN; Professor of Telecommunications, Pennsylvania State University, USA
- **W.1.1.2**
  Data Exchanges and Peering in an Age of Competition
  ERIC LEE, Public Policy Director, Commercial Internet Exchange, USA
- **W.1.1.3**
  Monitoring the Effective Use of Online Services
  JOHN BURKE, Director; ROSS KELSO; SARAH MILLER, Researcher; SUPRIYA SINGH, Senior Research Fellow; Centre for International Research on Communication and Information Technologies (CIRCIT), Australia
- **W.1.1.4**
  The Role of the Private Premium Network (Overnets) in the Emerging Global Infrastructure
  RON HIGGINS, Founder and Chairman, Digital Island, USA

W 1.2 Broadcast: Country Studies
Location: South Pacific I and II
Opening : ROBERT WU, Marketing Director, Associates and Wu, LLC, USA Chair and Speaker:

- **W.1.2.1**
  Development of Foreign Investment
  JAY HU, Managing Director, United States Information Technology Office (USITO), People's Republic of China
- **W.1.2.2**
  Business Strategies that work with China and Socially Responsible Telecom Business Practices
  RICHARD FIGUEROA, Chairman and Chief Executive Officer, Golden Thread Communications, USA
- **W.1.2.3**
  Opportunities for Telecommunication Companies in the Rapid Development of Chinese Internet and Regulatory Issues Regarding these Opportunities
  YUN TAO, Vice President, Cenpok InterCom Technology Company, People's Republic of China
- **W.1.2.4**
  Current Status of Chinese Telecommunications Markets and Technology and Regulatory Policies
  LI ZHENPING, General Manager, United Telecommunications Corporation Tianjin Branch, People's Republic of China

W 1.3 Radio Standards

Location: Honolulu Suites
Chair: EDWARD M. RONEY, Vice President and Director of Standards and Technology Transfer, Motorola, Inc. and Chairman of ANSI Third Generation Adhoc Committee, USA Standards are evolving from the current second generation cellular telephony standards GSM, CDMA, etc. to the next generation of wireless communications. The new "Third Generation" standards now being developed extend the capabilities further by increasing data speed by orders of magnitude, supporting multimedia and high-speed internet access. This session will examine how this important transition is being led by standards organizations throughout the world in a new paradigm of global telecommunications standards development.

- **W.1.3.1**
  AKIO SASAKI, Director of Association of Radio Industries and Businesses, Japan
- **W.1.3.2**
  KARL-HEINZ ROSENBROCK, Director of European Telecommunications Standards Institute, France
- **W.1.3.3**
  ESHWAR PITTAMPALLI, Technology Director, Lucent Technologies and Chairman of TIA TR-45 Standards Committee, USA
- **W.1.3.4**
  NOBUHIRO HORISAKI, Executive Managing Director, The Telecommunications Technology Committee (TTC), Japan
- **W.1.3.5**
  ASOK CHATTERJEE, Vice President, Technology of ADC Telecommunications and Chairman of Standards Committee T1P1, USA

W 1.4 Country Studies

Location: South Pacific III and IV
Chair: MICHAEL OGDEN, Assistant Professor, Department of Communications, University of Hawaii at Manoa, USA

- **W.1.4.1**
  The General Law for Telecommunications and the Development of a Competitive Market in Brazil
  MONICA MEDEIROS DE OLIVEIRA-GAJDYS, Ph.D. Candidate, Communication and Information Science Program, University of Hawaii, USA
- **W.1.4.2**
  Tele-Shastha-An Opportunity for Extension of Health Service in Bangladesh
  FAZLUR RAHMAN, Chairman, South Asia Multi Media, Bangladesh
- **W.1.4.3**
  Telecommunications in India and the Challenges Towards Growth
  SOWRI RAJAN KOMANDUR, Head Telecommunications Division, Department of Telecoms India, India

W 1.5 Making Sense of Today's U.S. Higher Education Market

Location: Tapa III
Chair: JOHN WITHERSPOON, Senior Advisor, Western Cooperative for Educational Telecommunications, USA Higher education in the U.S. is in the midst of a major evolution in its uses of the technologies, with long-term effects on everything from the forces of competition to the organization of institutions. The impact is seen in the explosive development of virtual institutions, in the applications of video and computing on traditional campuses, in reinventing libraries, and in changes in the decisionmaking structures of educational institutions. The panel will review the major forces, trends, and hot technologies, with attention to the ways in which real-world technology decisions are made.

- **W.1.5.1**
  Making Sense of Today's U.S. Higher Education Market: The National Trends
  SALLY M. JOHNSTONE, Director, Western Cooperative for Educational Telecommunications, USA
- **W.1.5.2**
  Learning with Laptops
  ELLEN EARLE CHAFFEE, President, Valley City State University and Mayville State University, USA
- **W.1.5.3**
  The State System Perspective
  STEVEN SMITH, Chief Information Officer, University of Alaska System, US

W 1.6 Satellite Technical Issues
Location: Tapa II
Chair: GEORGE LISSANDRELLO, Senior Vice President, Sales and Marketing, AVIRNEX Communications Group, USA

- **W.1.6.1**
  Increasing Ku Band Broadcast Satellite System Availability by the Use of Dynamic, Adaptive Input Data Bufering
  LARRY LEVY, Senior Member Technical Staff; RICHARD WARREN, GTE Government Systems Division, USA
- **W.1.6.2**
  New Standards and Solutions for Satellite Communication Modulation and Error Correction
  ERIC JACOBSEN, Principal Member of Technical Staff, EFData Corporation, USA
- **W.1.6.3**
  NGSO/GSO Satellite Sharing Issues
  MICHAEL FITCH, Vice President, Regulatory Affairs and Spectrum Management, Hughes Communications Inc., USA
- **W.1.6.4**
  Study on High-Speed FTP for Multimedia Interactive Satellite Communications System
  KATSUTOSHI NIDAIRA, Research Engineer, NTT Wireless Systems Laboratories; SHUICHI YOSHINO, Submanage, NTT Multimedia Business Development and MASAYOSHI NAKAYAMA, Sr. Research Engineer, NTT Wireless Systems Laboratories, Japan

---

Wednesday 1415-1615

W 2.1 Internetworking Technology
Location: Tapa I
Chair: PHILIP BOSSERT, President and Senior Consultant, Strategic Information Solutions Inc., USA

- **W.2.1.1**
  Separation of IP Routing and Forwarding via Tag Switching and MultiProtocol Label Switching
  TOM DOWNEY, Director of Product Marketing, Cisco Systems, Inc., USA
- **W.2.1.2**
  On Pricing Scheme and Traffic Monitoring Method in ATM Networks
  ATSUO HATONO, Public Sector Systems, Information Systems Division and TADASHI TAMAOKI, Telecommunications Division, Hitachi, Ltd., Japan
- **W.2.1.3**
  Environment Adaptive Service Using Dynamic Directory
  YASUNARI KISHIMOTO, Research Engineer; TERUHIRO KUBOTA, Senior Research Engineer, NTT Information and Communication Systems Laboratories, Japan
- **W.2.1.4**
  ACTIVE NETWORKS- The Integration of Directory Services with Networking for User-Centric Telecommunications
  KURT DAHM and ALAIN MIGNOT, Service Provider Ind. Manager , Cisco Systems Inc., Australia

W 2.2 Policy-Regulatory

Location: South Pacific I and II
Chair: MICHAEL GERTLER, Legal and Regulatory Consultant, Australia

- **W.2.2.1**
  Anti-trust Considerations of Telecommunication Market in Korea
  KYUNG-HAN SOHN, Attorney at Law, Aram International Law Offices, Republic of Korea
- **W.2.2.2**
  The Philippine Information Infrastructure (PII): A Framework for Development
  Department of Transportation and Communications (DOTC), Republic of the Philippines and CD Castro Consultancy, Inc., Philippines
- **W.2.2.3**
  Fixed Network Market Opening: Taiwan's Catch-Up Plan for Telecom Liberalization
  LAWRENCE LIU, Counselor, Lee & Li Attorneys at Law, Taiwan

Presented by: JONG WANG, Lee & Li Attorneys At Law, Taiwan

- **W.2.2.4**
  Direct Broadcast TV in Taiwan Whither Cable TV?
  DAVID MCNEILL, Commercial Officer, American Institute in Taiwan, Taiwan

W 2.3 Transmission

Location: Honolulu Suites
Chair: ED WALVICK, Senior Consultant, San Francisco Consulting Group, USA

- **W.2.3.1**
  Multimedia for the Masses Market, DSL Technology Maximizing the Existine Infrastructure
  JEFF WALDHUTER, Director, Technology and Engineering, Bell Atlantic, USA
- **W.2.3.2**
  Perspectives on the Communication Network for the ITS Service
  YEONGKWON KIM, Senior Member of Technical Staff; SOONG BOK LEE, Managing Director, Wireless Communications Research Laboratories, Korea Telecom, Republic of Korea
- **W.2.3.3**
  B-ISDN Field Trial in Thailand
  PANSAK ARPAKAJORN, Director, Switching Engineering Technic Division, Telephone Organization of Thailand, Thailand
- **W.2.3.4**
  A Practical View of Network Evolution
  GRANT LENAHAN, Executive Director, NGN Solution Architecture, Bellcore, USA

W 2.4 Country Studies

Location: South Pacific III and IV
Chair : Sturt Eastwood, Chief Executive Officer, Telecom Services Kiribati Ltd., Kiribati.

- **W.2.4.1**
  Pacific Islands Resolutions
  STURTDAVIES, Chief Executive Officer, Telecom Cook Islands, Cook Islands
- **W.2.4.2**
  Current Status of Telecommunications Development in Pacific Islands Countries
  PETER LOKO, Director, International, Telikom PNG, Papua New Guinea
- **W.2.4.3**
  GEFFRY SALMON, Directeur General, Office des Postes et Telecommunications, French Polynesia

W 2.5 Finance

Location: Tapa III
Chair: ANTHONY GARDINER, Kensar Communications, Canada

- **W.2.5.1**
  Broadening Information Access by Designing a Network Security Infrastructure
  ALAIN BISSONNETTE, Vice President and ROY K. NG, Senior Consultant, CGI Information Systems Management Consultants Inc., Canada
- **W.2.5.2**
  Universal Service Funding Mechanism Compatible to Competition and Convergence-Universal Service Cost Embedded in Interconnection Charges
  MYUNGJA YANG, Researcher; DONGWON LEE, Researcher and WHAJOON CHO, Senior Researcher, Interconnection Pricing and Tariffs Team, Korea Telecom, Republic of Korea
- **W.2.5.3**
  MSS: Financing and Investor Return
  MANISH THAKUR, Chief Financial Officer, Ellipso, Inc., USA

W 2.6 New Satellite Applications

Location: Tapa II
Chair: GREGG DAFFNER, Senior Vice President and Chief, Strategic Planning, Lockheed Martin Intersputnik, United Kingdom

- **W.2.6.1**
  Trends in Satellite Based Applications
  ROGER T. NAFF, Senior Vice President, Marketing & Business Development, Hughes Space & Communications International, Inc., USA
- **W.2.6.2**
  Link One: An Advanced Satellite Network Service
  JOHN W. KOPINSKI, Director, Adv. Services Dev., COMSAT World Systems, USA
- **W.2.6.3**
  The Future is Here: New Satellite Ventures
  PAUL DYKEWICZ, Senior Analyst, Editor, Satellite News Group, Phillips Business Information, Inc., USA

Monday 1400-1600

M 1.1 Business Developments
Location: Tapa I
Chair: JAGDISH RAO, Consultant, USA

- **M.1.1.1**
  New Opportunities and Challenges To Electronic Commerce in The Cross Border Environment: Interconnection of Electronic Commerce Test-Beds Project in the Asia Pacific Region
  MUTSUYA ASANO, Chair of Executive Board of MultiMedia Pilot Project Consortium in the Telecom Services Association in Japan, Japan
- **M.1.1.2**
  Electronic Commerce in APEC: Taxes, Tariffs and Equity
  RICHARD D. TAYLOR, Palmer Chair of Telecom Studies, Pennsylvania State University, USA
- **M.1.1.3**
  From Broadening Bandwidth to Broadening the Imagination
  NEIL TAGARE, Chairman, CTR Group, USA
- **M.1.1.4**
  Internet Content Industry: Current Market Status & Strategies
  MIN-ZHEONG SONG, Korea Telecom, Republic of Korea

M 1.2 Country Studies
Location: South Pacific I and II
Chair: TBA

- **M.1.2.1**
  The Demise of Local Loop Power in Australia?
  JANE FORSTER, Partner and CAROLINE LOVELL, Senior Solicitor, Clayton Utz, Australia
- **M.1.2.2**
  Convergence of Telecommunications Technologies and Its Impacts on Universal Service Policy in Taiwan
  CHUNG-CHUAN YANG, Associate Professor, Department of Marketing and Distribution Management, National Kaohsiung First University of Science and Technology, Taiwan
- **M.1.2.3**
  Foreign Ownership Regulation in Korean Telecom Market
  JAE-HO BYUN, Senior Researcher and PANG-RYONG KIM, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea
- **M.1.2.4**
  Taiwan's Telecommunications Liberalization and It's Current Status of Implementation
  POLI LIU, Taiwan Institute of Economic Research, Japan and TOSHIO KOSUGE, Professor, University of ElectroComms, Japan

M 1.3 CDMA
Location: Honolulu Suite
Chair: EIJI HAYASHI, Engineering Advisor, NEC Corporation, Japan

- **M.1.3.1**
  CDMA Network and Technoloby Evolution
  JAY HEMMADY, Technical Manager, Flexent MSC Architecture, AMPS/PCS Wireless Networks and JERRY E. ROG, Member of Technical Staff-Flexent MSC Architecture, AMPS/PCS Wireless Networks, Lucent Technologies, USA
- **M.1.3.2**
  The Configuration Management for the Cellular Networks
  KAP-DAE AHN, Associate Research Engineer; NAE-HEE KIM, Software Engineer; HYUNG-SUP KIM; and YOSUB KIM, Network Management Center, SK Telecom Central R&D Center, Republic of Korea
- **M.1.3.3**
  Interactive Services Using SMS in the CDMA Network
  Hyun-Wook Kim, Research Engineer; YEON-KYU KIM, Research Engineer, SUNG-BUM LEE, Research Engineer; SK Telecom Central R&D Center, Republic of Korea
- **M.1.3.4**
  Speech Quality Measurement in a CDMA Cellular Network
  KWANG-HOON KIM, Researcher; YOUNG-RUL KIM, Senior Researcher; SUNG-HEE SEO, Senior Researcher, JOO-WAN KIM, Master Researcher, SK Telecom Central R&D Center, Republic of Korea

M 1.4 Strategies

Location: South Pacific III and IV
Chair: YASUHIKO KAWASUMI, General Manager, Corporate Planning Division, Japan Telecom Company, Ltd., Japan

- **M.1.4.1**
  Telecom Mergers & Acquisitions Following the Asian Financial Crisis
  GLENN S. GERSTELL, Partner, Milbank, Tweed, Hadley & McCloy, USA
- **M.1.4.2**
  A Compatibility Framework for Evaluating Communications Industry Strategic Alliances
  G. MICHAEL MCGRATH, Research Fellow and Deputy Director, JRCASE School of MPCE and ELIZABETH MORE, Deputy Director, Macquire University, Australia
- **M.1.4.3**
  The Globalization Strategies of World Major Telecos
  TAE-WOONG PARK, Senior Researcher, HOE II KANG, Senior Researcher, SUNG SOO HAN, Analyst, ETRI (Electronics and Telecommunications Research Institute), Republic of Korea
- **M.1.4.4**
  Comparative Analysis of Telecommunications Globalization
  YALE M. BRAUNSTEIN, Professor, Information Management & Systems, University of California, Berkeley; MEHEROO JUSSAWALLA, Senior Fellow Emerita, East-West Center; and STEPHEN MORRIS, Adjunct Professor, Information and Decision Sciences, McLaren School of Business, University of San Francisco, USA

M 1.5 New Technologies

Location: Tapa III
Chair: DALE ROGERS, Global Accounts Director, TCS-TeleCommunication Systems, USA

- **M.1.5.1**
  Advanced Services and IP Telephony
  SCOTT WHARTON, Director of Marketing, VocalTec Communications, Inc., USA
- **M.1.5.2**
  Switched Voice Moving to Packetized (IP) Voice: A Trickle or an Avalanche?
  JOHN E. KRZYWICKI, Chairman, Cambridge Strategic Management Group, USA
- **M.1.5.3**
  Study on the Characterization of Music and a Melody Retrieval Method Using Hummed Melody
  MASAYOSHI UMEDA, Research Engineer; YUICHI NISHIHARA, Researcher; SEIICHI KON'YA, Research Engineer; NOBUROU TANIGUCHI, Researcher; MASASHI YAMAMURO, Senior Research Engineer, KAZUHIKO KUSHIMA, Senior Research Engineer, NTT Information and Communication Systems Laboratories, Japan

M 1.6 First 100 Days of GMPCS

Location: Tapa II
Chair: EDWARD SLACK, Director, International Services, COMSAT, USA

- **M.1.6.1**
  Global Enterprises: The Early Days OF GMPCS
  MARY FROST, Vice President and Regional General Manager, ICO Global Communications-North America, USA
- **M.1.6.2**
  GMPCS-After The First 100 Days
  DOUGLAS G. DWYRE, President, Globalstar L.P., USA
- **M.1.6.3**
  Impact of Licensing Delays
  DAVID CASTIEL, President and Chief Executive Officer, Mobile Communications Holdings, USA
- **M.1.6.4**
  Iridium-Around the World in 80 Days
  CARLTON R. JENNINGS, CEO and Managing Director, Iridium South Pacific Ltd., Australia

Presenter: CHRIS PEARCE, Director, Sales and Marketing, Iridium South Pacific, Australia

Monday 1630-1830

M 2.1 Telephony

Location: Tapa I
Chair: JAMES HEBERLE, Vice President, Sales and Marketing, MTT Inc., USA

- **M.2.1.1**
  Integrated Internet Digital Networks: The Post-Convergence, Pure-IP Network Model
  GEORGE E. DARBY, Registered Patent Attorney, President, Teleport Asia, USA
- **M.2.1.2**
  Network Telephony: The NSP Perspectives
  ROBERT W. HARBISON, Chief Technology Officer, StarVox Inc., USA
- **M.2.1.3**
  How a Carrier Can Offer Global IP Service Without Owning Equipment or Having Global Bi-lateral Agreements
  STEVEN OTT, Vice President of Global Sales, ITXC Corporation, USA
- **M.2.1.4**
  PSTN and Internet Convergence for Telephony: Market Opportunity for Carriers in the Asia Pacific Region
  HEIDI BERSIN, Vice President-Marketing, Clarent Corporation, USA

M 2.2 Competition
Location: South Pacific I and II
Chair: JAMES G. SAVAGE, Vice President, Public Affairs—International, GTE Service Corporation, USA

- **M.2.2.1**
  Local Service Competition: Breaking the Bottleneck
  PETER FALSHAW, Director of Consulting and JIM HOLMES, Principal Consultant, Ovum Pty Ltd, Australia
- **M.2.2.2**
  The WTO Agreement on Basic Telecommunications Services: How is it Affecting the Pacific Rim?
  THOMAS K. CROWE, Attorney and ELIZABETH HOLOWINSKI, Associate, Law Offices of Thomas K. Crowe, USA M.
- **2.2.3**
  Can the Competitive Model of Telecommunications Governance Deliver the Goods?
  MICHAEL JANIGAN, Executive Director and General Counsel of Public Interest Advocacy Centre, Canada
- **M.2.2.4**
  Organisational Adaption Under Privatisation and Liberalisation
  STEFAN WEIGAND, Head of Strategy and Organisation Group, Detecon Gmbtt, Germany and ABDUL RAUF PARKER, Manager, Corporate Planning, Q-Tel, Qatar

M 2.3 Network Planning Panel
Location: Honolulu Suites
Chair: DUYCK VAN GORDER, President, Network Technologies International, USA

- **M.2.3.1**
  Netplan Software: Design and Optimization of the Intelligent Network for IN and AIN Services
  MARIO PIETROGRANDE, Consultant, NETPLAN, USA
- **M.2.3.2**
  Growing Impact of Data Communications on Public Networks
  MARCO BURGASSI, CSELT (Telecom Italia), Italy
- **M.2.3.3**
  Meeting Diverse Market Demands
  EMILY THATCHER, GCI, USA
- **M.2.3.4**
  International Network Planning
  PHIL MURPHY, Telstra, Australia

M 2.4 Rural
Location: South Pacific III and IV

Chair: MARK HUKILL, Senior Lecturer, Division of Electronic and Broadcast Media, Nanyang Technological University, Singapore

- **M.2.4.1**
  The Role of Community TeleCenter (CTC) in Accelerating Educational (Community) Development in Indonesian Rural Area
  NASWIL IDRIS, Head of Communications, Universitas Terbuka, Indonesia; JOHN M. RENNER, Professor, Edith Cowan University, Australia
- **M.2.4.2**
  Attracting and Nurturing Small Businesses in Rural Areas: A Telecommunications Solution
  ALLAN B. KAMMAN, Executive Director, Vermont Telecommunications Application Center, USA and DUNCAN HOLADAY, Head, Division of Communication Research School of Communication Studies, Nanyang Technological University, Singapore
- **M.2.4.3**
  Solutions for Providing Telephony Services in Rural Areas of Less Developed Countries
  N.K. CHHIBBER, Director, India Resource Centre, India
- **M.2.4.4**
  Rural Information Infrastructure: Myths and Realities
  HEATHER E. HUDSON, Director, Evaluation and Learning Systems, Acacia Initiative, International Development Research Centre, & Professor and Director, Telecom Management and Policy Program, University of San Francisco, USA

M 2.5 Tele-Education I

Location: Tapa III
Chair: F. BARRY BROWN, Professor, University of Saskatchewan, College of Education, Canada

- **M.2.5.1**
  Integrating FM Broadcast Stations in VSAT Networks for Distance Education in the Pacific Islands
  BRUCE BEST, Research Associate, University of Guam and JOHN M. WOODARD, University of Guam, USA
- **M.2.5.2**
  Data Transmission on the Japanese Inter-University Satellite Network
  KIKUO ASAI, Research Associate; NORITAKA OHSAWA, Associate Professor; ZENJI HAYASHI, Associate Professor; YUJI SUGIMOTO, Professor; KIMIO KONDO, Professor; KIYOHIRO YUKI, Professor; National Institute of Multimedia Education, Japan
- **M.2.5.3**
  Broadening Access Developmental Opportunities for Universities in the Asia-Pacific Region
  JOHN M. RENNER, Professor, Edith Cowan University, Australia; WEERAPONG PAIRSUWAN, Associate Professor, Suranaree University of Technology, Thailand and NASWIL IDRIS, Universitas Terbuka, Indonesia
- **M.2.5.4**
  Creating Transnational Distance Education Alliances
  TED J. CHRISTENSEN, Assistant Vice President, George Washington University, ARLENE KREBS, President, New Orbit Communications, Author, The Distance Learning Funding $ource Book, USA; and JOHN HINCHCLIFF, President, Auckland Institute of Technology, New Zealand

M 2.6 Satellite Applications

Location: Tapa II
Chair: EUI KOH, Managing Director, INTELSAT-Asia Pacific

- **Digital Satellite Business Communications**
  SUSAN J. IRWIN, President, Irwin Communications, Inc., USA
- **M.2.6.2**
  Satellite Communications of Telephone Organization of Thailand (TOT)
  KUSOLMONGKOL SUVARNKUDHT, Engineer, Telephone Organization of Thailand, Thailand
- **M.2.6.3**
  Satellite TV Broadcast Market in China
  LIN SUN, Managing Director, China Telecom Resources, USA
- **M.2.6.4**
  System Signaling Seven (SS7) Deployment in Canada's Remote Territory Using Satellite based SCPC DAMA Architecture
  MICHAEL MARTIN, Director Buiness Development-Telesat Canada and PETER SMITH, Manager Carrier Engineering-Telesat Canada, Canada

---

Tuesday 0830-1030

T 1.1 E-Commerce
Location: Tapa I
Chair: DAN WEDEMEYER, Professor, Department of Communications, University of Hawaii at Manoa, USA

- **T.1.1.1**
  The Use of Electronic Commerce by Small Business
  SUPRIYA SINGH, Senior Research Fellow, Center for International Research on Communication and Information Technologies (CIRCIT), Australia
- **T.1.1.2**
  The E-Commerce Hosting Opportunity: Building, Managing and Marketing a High-Quality E-Commerce Solution
  JEFF EDWARDS, E-Commerce Segment Manager, Compaq Computer Corporation, USA
- **T.1.1.3**
  Electronic Commerce Between Retailers & Suppliers: What Influences The Adoption & Use of Information Technologies?
  ALICE P. CHAN, Assistant Professor, Department of Communication, Cornell University, USA
- **T.1.1.4**
  Monopoly Infrastructure: A Trade Barrier to Electronic Commerce
  KEVIN HARTMAN, Deputy, International Communications Program, Center for Strategic and International Studies, USA

T 1.2 Policy
Location: South Pacific I and II
Chair: SALLYE CLARK, Director, International and Government Affairs, Teledesic LLC, USA

- T.1.2.1
  The Information Policy Maze
  DIANNE NORTHFIELD, Research Fellow, Center for International Research on Communication and Information Technolgies-CIRCIT, Australia
- T.1.2.2
  New Governments throughout Asia Refocus Telecommunications Policy: The Quest to Overcome "Information Apartheid"
  CHARLES DODGSON, Editor, Telenews Asia, Australia
- T.1.2.3
  An Analysis of the Australian PCS Auction(s)
  REG COUTTS, Professor, Director, Centre for Telecommunications Information Networking (CTIN), University of Adelaide, Australia
- T.1.2.4
  Internet Connectivity: Open Competition in the Face of Commercial Expansion
  BERNADETTE JEW, Sr. Associate; ROB NICHOLLS, Consultant, Convergence Solutions; and MICHAEL REEDE, Partner, Gilbert & Tobin, Australia

T 1.3 Submarine Cables I
Location: Honolulu Suites
Chair: RAYNALD LECONTE, Director, Submarine Systems, France Telecom, France

- T.1.3.1
  Prospects for the South Pacific Transit Undersea Cable
  EDUARDO SARAVIA, Director of International Fiber Optic Cables, CTC Mundo and ROBERTO COFRE, Head of Fibre Optic Section International, ENTEL Chile, Chile
- T.1.3.2
  Submarine Optical Fiber Cable Systems...Answering the Global Demands for Connectivity and Capacity Expansion...
  OSAMU HARADA, Senior Manager, Submarine Cable System Division and YASUHIRO AOKI, NEC Corporation, Japan
- T.1.3.3
  Beating The Bandwidth Bottleneck: How Subsea Cables can Support E-Commerce between Asia & Europe
  OWEN BEST, Vice President-Asia Pacific, FLAG Telecom, United Kingdom
- T.1.3.4
  The Submarine Cable Networks Industry Shifts Gears
  JEAN GODELUCK, Vice President, Marketing & Contracting, Alcatel Submarine Networks, United Kingdom

T 1.4 Universal Service
Location: South Pacific III and IV
Chair: MICHAEL OGDEN, Assistant Professor, Department of Communication, University of Hawaii at Manoa, USA

- **T.1.4.1**
  Inverse Cross-Subsidization (Rural-Urban): Paradox and Evidence
  DARIO M. GOUSSAL, Research Coordinator, GTR-UNNE and MARIA SANDRA URDIZAR LEZCANO, Assistant Researcher, Northern University At Resistencia, Argentina
- **T.1.4.2**
  Insuring Universal Service: What's a PTO To Do?
  MIKE HELLER, Global Marketing Programs Manager, Service Provider Line of Business, Cisco Systems, Inc., USA
- **T.1.4.3**
  Global Access to Telecommunications: Toward an Informed Choice Model of Universal Service
  JORGE REINA SCHEMENT, Professor and Co-Director of the Institute for Information Policy, College of Communications and SCOTT C. FORBES, Ph.D. Candidate, College of Communications, Pennsylvannia State University, USA
- **T.1.4.4**
  Key Predictors of Adoption of New Media: A Report on Australia's Largest Diffusion Study
  MARK BALNAVES, Chair, Mass Communication and Multimedia, Murdoch University; PETER CAPUTI; PATRICK RAWSTORNE, Mass Communication Australia, Department of Psychology, University of Wollongong, Australia

T 1.5 Distance-Education II

Location: Tapa III
Chair: VICKI KAJIOKA, Advanced Technology Specialist, Department of Education, State of Hawaii, USA

- **T.1.5.1**
  An Experiment of Virtual Space Distance Learning System
  NOBUYOSHI TERASHIMA, Professor; NOBUO TSUDA, Waseda University, Japan and JOHN TIFFIN, Emeritus, Victoria University, New Zealand
- **T.1.5.2**
  PREL Star Distance Learning in the Pacific Islands
  JAMES BANNAN and STEVE BAXENDALE, Distance Learning Education Specialist, Pacific Resources for Education and Learning (PREL), USA
- **T.1.5.3**
  The Virtual University—Higher Education as a Community Activity
  EWAN SUTHERLAND, Dean of the Faculty of Arts, University of Wales, Lampeter, United Kingdom
- **T.1.5.4**
  "Millions Online Residences & Enterprises(MORE)" Movement-Internet to the Families through the Tele-Homebook Experiment Program
  GARY GONG, Director, and PAULINE CHEN, Senior Manager, Information Technology Promotion Division, Institute for Information Industry (III), Taiwan

T 1.6 Mobile Satellites

Location: Tapa II
Chair: GEORGE NOVELLI, Vice President, Marketing, Inmarsat

- T.1.6.1
  Broadband Access to Interactive Multimedia Services Via Satellite
  FRANCOIS BRUN, Vice President, Business Development, Skybridge, France
- T.1.6.2
  Roaming Between Satellite and Terrestrial Systems-New Concepts and New Commercial Issues
  MICHAEL E. DAVIS, Partner, Ward & Partners Lawyers, Australia
- T.1.6.3
  Market Prospects in Asia for Satellite Mobile Services
  BRUCE S. MIDDLETON, Managing Director, Asia Pacific Aerospace Consultants Pty Ltd, Australia
- T.1.6.4
  Beyond Space: Challenges of Operating a Global Communications Company
  JULIE COONS, Director, Asia-Pacific, Global Gateway Management, Iridium, USA

Tuesday 1530-1730

T 2.1 Internet Country Developments in Asia-Pacific
Location: Tapa I
Chair: KAZU YOZAWA, Vice President, NTT-America, Japan

- T.2.1.1
  Internet Coverage in Developing Countries of Asia
  GEOFF LONG, Ph.D Candidate, Southern Cross University, Australia
- T.2.1.2
  Internet Growth, Economic Development and Political Change in Malaysia, China, and Singapore
  JOSHUA GORDON, Degree Fellow; MEHEROO JUSSAWALLA, Emeritus Research Fellow, East-West Center; USA
- T.2.1.3
  Development of Internet Services in India
  YOGESHWAR LAL AGARWAL, Executive Director, HFCL Group International Division, India
- T.2.1.4
  Trends in Asia-Pacific Internet Communications
  MATTHEW P. DOVENS, Director, International Internet Marketing, Cable & Wireless, USA

T 2.3 Submarine Cable II
Location: Honolulu Suites
Chair: DONALD J. SCHROEDER, President and CEO, Neptune Communications LLC, USA

- **T.2.3.1**
  Telecom Reform and the Resultant Evolution of New Product Offerings in the Undersea Cable Arena
  LISA S. DADOURIS, Director of Business Development, Global Crossing Development Co., USA
- **T.2.3.2**
  Southern Cross Cable Network- A Sponsor's Perspective
  CHARLES JARVIE, International Business Development Manager, Telecom Corporationof New Zealand, New Zealand
- **T.2.3.3**
  Terabit / sec Undersea Fiber Optic Cable Networks
  PATRICK R. TRISCHITTA, Director, Product Management and Technical Marketing, Tyco Submarine Systems Ltd., USA
- **T.2.3.4**
  Meeting the Challenge- The Installation, Repair and Maintenance of Undersea Fibre Optic Systems
  MALCOLM JOHNSTON, Sales & Marketing Director, Cable & Wireless Global Marine, United Kingdom

T 2.4 Regional Development
Location: South Pacific III and IV
Chair: TBA

- **T.2.4.1**
  Opportunity out of Adversity
  BRETT K. WORRALL, Sales & Marketing Director, Tyco Submarine Systems, USA
- **T.2.4.2**
  China Closes the Door on Foreign Investment in Network Services
  KEN ZITA, Telecommunications Consultant, USA Discussants to be announced

T 2.5 Tele-Medicine
Location: Tapa III
Chair: IFAY CHANG, Executive Director, PRIDE/Polytechnic Research, USA

- **T.2.5.1**
  Building Hawaii's Telehealth Framework: Will Policy & Planning Overcome Social Challenges
  JACOLYN PEEBLES, USA
- **T.2.5.2**
  Technical Support for Establishment of Telemedicine between Gomel, Belarus and Nagasaki, Japan
  IWATO ASAHARA, Chairman, BHN Association, Chairman, Information and Communication Research Inc.; TAKEO NOBUSAWA, Secretary General, Basic Association and MORIJI KUWABARA, Vice President, BHN Association, Japan
- **T.2.5.3**
  Rural Telemedicine in Indonesia: (An Approach to Selecting Proper Application)
  SAMUDRA PRASETIO, and ANDREAS W. YANUARDI, R&D Division, PT Telekomunikasi Indonesia, Indonesia

T 2.6 Mobile Satellites II
Location: Tapa II
Chair and Panelists: PAUL BERMINGHAM, Principal Financial Analyst, Telecommunications and Informatics Division, The World Bank, USA

- **T.2.6.1**
  JAMES G. BEITCHMAN, President, Lockheed Martin Intersputnik, United Kingdom
- **T.2.6.2**
  ZHOUZEHE, President, China Telecommunications Broadcast Satellite Co., People's Republic of China
- **T.2.6.3**
  MING LOUIE, Vice President, Asia Pacific Region, Globalstar, USA
- **T.2.6.4**
  RICHARD DALBELLO, Vice President of Government Affairs, ICO Global Communications, USA
- **T.2.6.5**
  TUOMO RATANEN, Executive Director of Service Development, Iridium LLC, USA
- **T.2.6.6**
  TAL MEIZON, Product Manager of Rural Telephony, Gilat Satellite Networks, Israel

---

Wednesday 1100-1300

W 1.1 Internet Deployment
Location: Tapa I
Chair: DAVID LASSNER, Director of Information Technology, Information Technology Services, University of Hawaii, USA

- **W.1.1.1**
  The Potential Regulatory and Universal Service Consequences of Internet Balkanization
  ROBERT M. FRIEDEN, Professor of Telecommunications, Pennsylvania State University, USA
- **W.1.1.2**
  Data Exchanges and Peering in an Age of Competition
  ERIC LEE, Public Policy Director, Commercial Internet Exchange, USA
- **W.1.1.3**
  Monitoring the Effective Use of Online Services
  JOHN BURKE, Director; ROSS KELSO; SARAH MILLER, Researcher; SUPRIYA SINGH, Senior Research Fellow; Centre for International Research on Communication and Information Technologies (CIRCIT), Australia
- **W.1.1.4**
  The Role of the Private Premium Network (Overnets) in the Emerging Global Infrastructure
  RON HIGGINS, Founder and Chairman, Digital Island, USA

W 1.2 Broadcast: Country Studies
Location: South Pacific I and II
Opening : ROBERT WU, Marketing Director, Associates and Wu, LLC, USA Chair and Speaker:

- **W.1.2.1**
  Development of Foreign Investment
  JAY HU, Managing Director, United States Information Technology Office (USITO), People's Republic of China
- **W.1.2.2**
  Business Strategies that work with China and Socially Responsible Telecom Business Practices
  RICHARD FIGUEROA, Chairman and Chief Executive Officer, Golden Thread Communications, USA
- **W.1.2.3**
  Opportunities for Telecommunication Companies in the Rapid Development of Chinese Internet and Regulatory Issues Regarding these Opportunities
  YUN TAO, Vice President, Cenpok InterCom Technology Company, People's Republic of China
- **W.1.2.4**
  Current Status of Chinese Telecommunications Markets and Technology and Regulatory Policies
  LI ZHENPING, General Manager, United Telecommunications Corporation Tianjin Branch, People's Republic of China

W 1.3 Radio Standards

Location: Honolulu Suites
Chair: EDWARD M. RONEY, Vice President and Director of Standards and Technology Transfer, Motorola, Inc. and Chairman of ANSI Third Generation Adhoc Committee, USA Standards are evolving from the current second generation cellular telephony standards GSM, CDMA, etc. to the next generation of wireless communications. The new "Third Generation" standards now being developed extend the capabilities further by increasing data speed by orders of magnitude, supporting multimedia and high-speed internet access. This session will examine how this important transition is being led by standards organizations throughout the world in a new paradigm of global telecommunications standards development.

- **W.1.3.1**
  AKIO SASAKI, Director of Association of Radio Industries and Businesses, Japan
- **W.1.3.2**
  KARL-HEINZ ROSENBROCK, Director of European Telecommunications Standards Institute, France
- **W.1.3.3**
  ESHWAR PITTAMPALLI, Technology Director, Lucent Technologies and Chairman of TIA TR-45 Standards Committee, USA
- **W.1.3.4**
  NOBUHIRO HORISAKI, Executive Managing Director, The Telecommunications Technology Committee (TTC), Japan
- **W.1.3.5**
  ASOK CHATTERJEE, Vice President, Technology of ADC Telecommunications and Chairman of Standards Committee T1P1, USA

W 1.4 Country Studies

Location: South Pacific III and IV
Chair: MICHAEL OGDEN, Assistant Professor, Department of Communications, University of Hawaii at Manoa, USA

- **W.1.4.1**
  The General Law for Telecommunications and the Development of a Competitive Market in Brazil
  MONICA MEDEIROS DE OLIVEIRA-GAJDYS, Ph.D. Candidate, Communication and Information Science Program, University of Hawaii, USA
- **W.1.4.2**
  Tele-Shastha-An Opportunity for Extension of Health Service in Bangladesh
  FAZLUR RAHMAN, Chairman, South Asia Multi Media, Bangladesh
- **W.1.4.3**
  Telecommunications in India and the Challenges Towards Growth
  SOWRI RAJAN KOMANDUR, Head Telecommunications Division, Department of Telecoms India, India

W 1.5 Making Sense of Today's U.S. Higher Education Market

Location: Tapa III
Chair: JOHN WITHERSPOON, Senior Advisor, Western Cooperative for Educational Telecommunications, USA Higher education in the U.S. is in the midst of a major evolution in its uses of the technologies, with long-term effects on everything from the forces of competition to the organization of institutions. The impact is seen in the explosive development of virtual institutions, in the applications of video and computing on traditional campuses, in reinventing libraries, and in changes in the decisionmaking structures of educational institutions. The panel will review the major forces, trends, and hot technologies, with attention to the ways in which real-world technology decisions are made.

- **W.1.5.1**
  Making Sense of Today's U.S. Higher Education Market: The National Trends
  SALLY M. JOHNSTONE, Director, Western Cooperative for Educational Telecommunications, USA
- **W.1.5.2**
  Learning with Laptops
  ELLEN EARLE CHAFFEE, President, Valley City State University and Mayville State University, USA
- **W.1.5.3**
  The State System Perspective
  STEVEN SMITH, Chief Information Officer, University of Alaska System, US

W 1.6 Satellite Technical Issues
Location: Tapa II
Chair: GEORGE LISSANDRELLO, Senior Vice President, Sales and Marketing, AVIRNEX Communications Group, USA

- **W.1.6.1**
  Increasing Ku Band Broadcast Satellite System Availability by the Use of Dynamic, Adaptive Input Data Bufering
  LARRY LEVY, Senior Member Technical Staff; RICHARD WARREN, GTE Government Systems Division, USA
- **W.1.6.2**
  New Standards and Solutions for Satellite Communication Modulation and Error Correction
  ERIC JACOBSEN, Principal Member of Technical Staff, EFData Corporation, USA
- **W.1.6.3**
  NGSO/GSO Satellite Sharing Issues
  MICHAEL FITCH, Vice President, Regulatory Affairs and Spectrum Management, Hughes Communications Inc., USA
- **W.1.6.4**
  Study on High-Speed FTP for Multimedia Interactive Satellite Communications System
  KATSUTOSHI NIDAIRA, Research Engineer, NTT Wireless Systems Laboratories; SHUICHI YOSHINO, Submanage, NTT Multimedia Business Development and MASAYOSHI NAKAYAMA, Sr. Research Engineer, NTT Wireless Systems Laboratories, Japan

---

Wednesday 1415-1615

W 2.1 Internetworking Technology
Location: Tapa I
Chair: PHILIP BOSSERT, President and Senior Consultant, Strategic Information Solutions Inc., USA

- **W.2.1.1**
  Separation of IP Routing and Forwarding via Tag Switching and MultiProtocol Label Switching
  TOM DOWNEY, Director of Product Marketing, Cisco Systems, Inc., USA
- **W.2.1.2**
  On Pricing Scheme and Traffic Monitoring Method in ATM Networks
  ATSUO HATONO, Public Sector Systems, Information Systems Division and TADASHI TAMAOKI, Telecommunications Division, Hitachi, Ltd., Japan
- **W.2.1.3**
  Environment Adaptive Service Using Dynamic Directory
  YASUNARI KISHIMOTO, Research Engineer; TERUHIRO KUBOTA, Senior Research Engineer, NTT Information and Communication Systems Laboratories, Japan
- **W.2.1.4**
  ACTIVE NETWORKS- The Integration of Directory Services with Networking for User-Centric Telecommunications
  KURT DAHM and ALAIN MIGNOT, Service Provider Ind. Manager , Cisco Systems Inc., Australia

W 2.2 Policy-Regulatory

Location: South Pacific I and II
Chair: MICHAEL GERTLER, Legal and Regulatory Consultant, Australia

- **W.2.2.1**
  Anti-trust Considerations of Telecommunication Market in Korea
  KYUNG-HAN SOHN, Attorney at Law, Aram International Law Offices, Republic of Korea
- **W.2.2.2**
  The Philippine Information Infrastructure (PII): A Framework for Development
  Department of Transportation and Communications (DOTC), Republic of the Philippines and CD Castro Consultancy, Inc., Philippines
- **W.2.2.3**
  Fixed Network Market Opening: Taiwan's Catch-Up Plan for Telecom Liberalization
  LAWRENCE LIU, Counselor, Lee & Li Attorneys at Law, Taiwan

Presented by: JONG WANG, Lee & Li Attorneys At Law, Taiwan

- **W.2.2.4**
  Direct Broadcast TV in Taiwan Whither Cable TV?
  DAVID MCNEILL, Commercial Officer, American Institute in Taiwan, Taiwan

W 2.3 Transmission

Location: Honolulu Suites
Chair: ED WALVICK, Senior Consultant, San Francisco Consulting Group, USA

- **W.2.3.1**
  Multimedia for the Masses Market, DSL Technology Maximizing the Existine Infrastructure
  JEFF WALDHUTER, Director, Technology and Engineering, Bell Atlantic, USA
- **W.2.3.2**
  Perspectives on the Communication Network for the ITS Service
  YEONGKWON KIM, Senior Member of Technical Staff; SOONG BOK LEE, Managing Director, Wireless Communications Research Laboratories, Korea Telecom, Republic of Korea
- **W.2.3.3**
  B-ISDN Field Trial in Thailand
  PANSAK ARPAKAJORN, Director, Switching Engineering Technic Division, Telephone Organization of Thailand, Thailand
- **W.2.3.4**
  A Practical View of Network Evolution
  GRANT LENAHAN, Executive Director, NGN Solution Architecture, Bellcore, USA

W 2.4 Country Studies

Location: South Pacific III and IV
Chair : Sturt Eastwood, Chief Executive Officer, Telecom Services Kiribati Ltd., Kiribati.

- **W.2.4.1**
  Pacific Islands Resolutions
  STURTDAVIES, Chief Executive Officer, Telecom Cook Islands, Cook Islands
- **W.2.4.2**
  Current Status of Telecommunications Development in Pacific Islands Countries
  PETER LOKO, Director, International, Telikom PNG, Papua New Guinea
- **W.2.4.3**
  GEFFRY SALMON, Directeur General, Office des Postes et Telecommunications, French Polynesia

W 2.5 Finance

Location: Tapa III
Chair: ANTHONY GARDINER, Kensar Communications, Canada

- **W.2.5.1**
  Broadening Information Access by Designing a Network Security Infrastructure
  ALAIN BISSONNETTE, Vice President and ROY K. NG, Senior Consultant, CGI Information Systems Management Consultants Inc., Canada
- **W.2.5.2**
  Universal Service Funding Mechanism Compatible to Competition and Convergence-Universal Service Cost Embedded in Interconnection Charges
  MYUNGJA YANG, Researcher; DONGWON LEE, Researcher and WHAJOON CHO, Senior Researcher, Interconnection Pricing and Tariffs Team, Korea Telecom, Republic of Korea
- **W.2.5.3**
  MSS: Financing and Investor Return
  MANISH THAKUR, Chief Financial Officer, Ellipso, Inc., USA

W 2.6 New Satellite Applications

Location: Tapa II
Chair: GREGG DAFFNER, Senior Vice President and Chief, Strategic Planning, Lockheed Martin Intersputnik, United Kingdom

- **W.2.6.1**
  Trends in Satellite Based Applications
  ROGER T. NAFF, Senior Vice President, Marketing & Business Development, Hughes Space & Communications International, Inc., USA
- **W.2.6.2**
  Link One: An Advanced Satellite Network Service
  JOHN W. KOPINSKI, Director, Adv. Services Dev., COMSAT World Systems, USA
- **W.2.6.3**
  The Future is Here: New Satellite Ventures
  PAUL DYKEWICZ, Senior Analyst, Editor, Satellite News Group, Phillips Business Information, Inc., USA

Agenda and Related Events-At-A-Glance

Sunday
17 January 1999

0845-0930
Morning Coffee

0900-1200
Workshops

1000-1600
Exhibits Open

PlanetPTC Open

Live Jazz at PlanetPTC

1000-1130
Breakfast in Exhibit Area

1100-1300
Topic Tables

1300-1530
Panels/ Round Tables

1530-1600
Break

1600-1800
Kick-Off Plenary (Live via Web Cast)

1830-2000
Opening Reception

Monday
18 January 1999

0715-0815
Speakers' Breakfast

0715-0815
First time Attendee/ New Members Breakfast

0800-1700
PlanetPTC Open

0900-1030
Opening Plenary (Live via Web Cast)

1030-1045
Break

1045-1245
Super Sessions (2)

1200-1630
Exhibits Open

1230-1400
Deli Lunch

Live Jazz at PlanetPTC

1400-1600
Concurrent Sessions (6)

1600-1630
Break

1630-1830
Concurrent Sessions (6)

Tuesday
19 January 1999

0730-0830
Speakers'Breakfast

0800-1900
PlanetPTC Open

0830-1030
Concurrent Sessions (6)

1030-1100
Break

1030-1845
Exhibits Open

1100-1300
Deli Lunch in Exhibit Area

Live Jazz at PlanetPTC

1300-1500
Super Sessions (2)

1500-1530
Break

1530-1730
Concurrent Sessions (5)

1730-1845
Exhibitors' Reception

Wednesday
20 January 1999

0730-0830
Speakers' Breakfast

0800-1500
PlanetPTC Open

0830-1030
Round Tables / Panels and Vendor Presentation
Honolulu Suite

0815-1100
Board of Trustees'/ Members' Meeting

0830-1030
Round Tables/ Panels/ Vendor Presentations

1030-1100
Break

1100-1300
Concurrent Sessions (6)

1300-1430
Lunch with Speaker

1430-1630
Concurrent Sessions (6)

1630-1700
Break

1700-1830
Closing Plenary (Live via Web Cast)

1900-2100
Closing Event

Thursday
21 January 1999

0800-1500
PTC Committee Meetings

1600-1830
PTC Executive Board Meeting

Panels, Workshops & Topic Tables

Sunday, 17 January 1999
Exhibit Location: Coral Ballroom-Mid Pacific Center

Panels

1300-1530
Panel 1 Broadening Access and Improving Service: The Human Side
Panel 2 Risk Management Aspects of Financing Global and Regional Satellite Systems
Panel 3 Internet Development and Evolution
Panel 4 Fiberoptic Submarine Cable Facilities Planning, Development & Finance
Panel 5 New Satellite Services for Asia/Pacific
Panel 6 Consultative Working Group on Cooperation in Telecommunications in North East Asia-Status Report and Discussion

Round Tables

1350-1530
Round Table 1 Federation of Regional Associations (FORA)

Topic Tables

1100-1300
Topic Table 1 Telecommunications in the Service of Humanitarian Assitance: The Tampere Convention
Topic Table 2 The Economic Crisis and Asia Pacific Telecomms-Impact and Response
Topic Table 3 Telecommunications Competitiveness in the Asia Pacific Region

Workshops

0900-1200
Workshop 1 Delivering (PTC)/Telecommunications Presentations: Getting the Message Across
Workshop 2 Joint Ventures and Strategic Alliances in Asia: Their Role in the Information Economy.
Workshop 3 Funding Global Distance Education
Workshop 4 Commercial Launch Service
Workshop 5 Essentials of Broadband and Emerging Technologies
Workshop 6 Broadening Access: Telecoms and Information Ethics
Workshop 7 A Discussion of Bandwidth Financing, IT Skills Training, and Other Issues

Wednesday, 20 January 1999
Exhibit Location: South Pacific I

Panels

0830-1000
Panel 1 Fact over Fiction in Voice Over IP

Panels

Sunday, 17 January 1999
1300-1530

Panel I [top]
Broadening Access and Improving Service: The Human Side
Location: Honolulu I
Moderator: TOM COOPER, Professor, Emerson College and Publisher, Media Ethics Magazine, USA
Participants: JACK CHANG, President/COO, SpaceTel Asia Ltd., Taiwan;MAJID TEHRANIAN, Professor, University of Hawaii,MEHEROO JUSSAWALLA, Senior Research Fellow, East-West Center; and CLIFFORD CHRISTIANS, Director, Communication Research Institute, University of Illinois, USA

When economic growth becomes more important than equal access and quality service, many ethical, social, and economic problems develop. This panel intends to discuss these "human" problems haves and have nots, information rich and information poor, cultural chauvinism; "elite" professions, companies, technologies, languages, and ethnic groups; economic deprivation due to information starvation, cross-cultural insensitivities, and many other complex challenges which develop when growth is unbridled, unstudied, and unequal. In such situations, service is lacking for those already "on-line" and for those "in line"- that is, too poor to be deemed suitable markets for what Majid Tehranian is correctly calling "commodified information" production and distribution.

Panel 2 [top]
Risk Management Aspects of Financing Global and Regional Satellite Systems
Location: South Pacific II
Moderator: TREVOR W. NAGEL, Partner, Shaw Pittman Potts & Trowbridge, USA
Participants: RONALD LEPES, Managing Director, Global Media & Telecommunications, Chase Securities, Inc.; JOHN F. DEALY, President, The Dealy Strategy Group LLC; MICHAEL J. HOUTERMAN, President, Hughes Space and Communications International, Inc.; DENIS J. CURTIN, Senior Vice President and General Manager, Loral Orion Inc.; STEVEN P. GAVENAS, Senior Vice President, WorldSpace Corporation; and JANE SULLIVAN ROBERTS, Partner, Shaw Pittman Potts & Trowbridge, USA

The panel's objective is to explore the issues raised in financing global and regional satellite systems from diverse perspectives and to stimulate a dialogue among the different participants, including, for example, operators, financiers, and manufacturers. The panel will begin with a brief presentation outlining the various sources of financing, how to avoid financial structuring pitfalls, and recent innovative financing approaches. Following are presentations by representatives of satellite operators on the financing programs implemented by their respective companies, financiers on the marketplace perspectives on satellite projects, and manufacturers on their evolving efforts to meet the financing needs of their customers through equity investments and vendor financing.

Panel 3 [top]
Internet Development and Evolution
Location: South Pacific III
Moderator: REVA LEUNG SAY, Director, International Marketing, Bellcore, USA Presenters: TOM SPACEK, Executive Director, Global Information Infrastructure and Internet Initiatives, Bellcore, USA; CHAIN-CHIN YEN, Managing Director, Switching Technology Labs, Chunghwa Telecom, Taiwan; FREDER-IC M. LITTO, Professor, University of Sao Paolo; Brazil; and

YUKIMASA ITO, NTT Worldwide Telecommunications, Japan

This panel seeks to examine the guiding principles of policies that would increase the effectiveness and fairness of the Internet. It also looks at the evolution of the Internet from different country perspectives.

Panel 4 [top]
Fiberoptic Submarine Cable Facilities Planning, Development & Finance
Location: South Pacific I
Facilitator:THOMAS A. SOJA, President, T Soja & Associates, *USA*
Participants:CHRISTIAN REINAUDO, Chairman and Chief Executive Officer, Alcatel Submarine Networks, France; JACKIE WILSON, AT&T, USA; ALAN ROBINSON, Cable & Wireless; United Kingdom;. ANDY EVANS, FLAG Telecom Limited, USA; PATRICK JOGGERST, Vice President, Global Sales and Marketing, Global Crossing, Bermuda; ROBERT STUART, Managing Director, Global Telecommunications Industry, CIBC Oppenheimer Corporation, USA; SATOSHI FUJITA, President, NTT Worldwide Network Corporation, Japan; NEIL GARVEY, President, Tyco Submarine Systems, USA; JOHN TIBBLES, General Manager, WorldCom, USA and COLIN WILLIAMS, President and Chief Executive Officer, Level 3 International, USA

What are the real growth drivers in the industry and how will new applications effect the forecast for facilities over time?

- Can the facilities providers keep pace with projected demand?
- What types of new technologies will be deployed over the next ten years that will enable new systems to accommodate the new levels of demand?
- What is the economic outlook in the region? What factors will either accelerate growth or possibly temper take-up of newly-deployed capacity?
- What types of scaleability options are available to protect against over-deployment of and over-investment in new facilities?
- Indeed, do the new systems announcements portend a glut of circuit capacity across the Pacific?
- What of plans or requirements for new high-bandwidth facilities within Asia that would feed/distribute traffic for the transpacific systems?
- How will the directionality of traffic change over time as the Internet and Internet-like applications gain greater market penetration throughout the region?
- How will submarine cable facilities be developed in the future? Will independent private carriers' carrier cable systems continue to thrive alongside more traditional structures of consortium arrangements and the many hybrid types of arrangements that lie in between?
- What level of development can the financial markets support? Are funds available to finance these projects and what are the key success factors for successfully financial new telecom facilities?
- What will be the effect of "spot markets" for circuit capacity and traffic minutes on facilities development?

Panel 5 [top]
New Satellite Services for Asia/Pacific
Location: South Pacific IV
Facilitator:TIM LOGUE, Space and Telecom Policy Analyst, Coudert Brothers, *USA*
Participants:LOUK JURGENS, Vice President, Satellite Services, Loral Orion Asia-Pacific,

Singapore; GREGG DAFFNER, Senior Vice President & Chief of Strategic Planning, Lockheed Martin Intersputnik, *United Kingdom*; and JAMES STUART, Chief Executive Officer, KITComm; and ERIC WISWELL, Advanced Systems Manager, TRW, *USA*

Panelists will discuss new satellite services coming to the Asia/Pacific region in the next year, as well as advanced satellite concepts that hold great promise for the next generation of satellite services. The Asian financial crisis has slowed, but not stopped the development of innovative services to meet the Pacific Basin's growing telecommunication and information services needs.

Panel 6 [top]
Consultative Working Group on Cooperation in Telecommunications in North East Asia-Status Report and Discussion
Location: Honolulu II
Chair: LEE JAY CHO, Program Director East West Center and Chairman, North East Asia Economic Development Forum
Panelists: MEHEROO JUSSAWALLA, Research Economist, East-West Center; DAVID HUSBAND and Representatives of industry and government from Japan, PRC, Mongolia, North Korea, South Korea, and Russia

This panel will hold a brief overview of the meetings held in Honolulu in 1998 and discuss the background on the forum - How far have we come. Other topics to be discussed are "UNDP's inintiative in developing the infrastructure for the Tumen River Area; briefing on UNDP's investment forum in Hun Chun, China, September, 1998" and "Country views and regional issues pertaining to telecommunications"

Wednesday, 20 January 1999
830-1030

Panel 1 [top]
Fact over Fiction in Voice Over IP
Location: South Pacific I
Moderator:PEG DONOVAN, VOIP Product manager, Custom Systems, Compaq Computer Company, *USA*
Participants: TOM KERSHAW, Marketing Director, Clarent
CHRIS GIBNEY, Multilateral Services Director, AT&T
JEFF PILVER, President & CEO, Pulver.Com

Panel members will describe the lessons they have learned through their real life experience with Voice Over IP implementation and testing. Come hear how you can overcome the myths of deploying Voice Over IP. This session will help your installation go smoother. You can learn how to avoid common pitfalls that are only learned through experience.

Round Tables
Sunday, 17 January 1999
1300-1530

Table 1 [top]
Federation of Regional Associations (FORA)
Location: Honolulu III
Facilitator: RICHARD J. BARBER, Executive Director, Pacific Telecommunications Council
Participants: DIANA SHARPE, Chair, INTUG (International Telecommunications Users Group); JANET PEARCE STENZEL, Executive Director, PECC Telecommunications and Information Industries Forum; BILL GRAHAM, Special Assistant to the Chair, APEC Telecommunications Working Group; JERRY NORRIS, Director, Pacific Basin Development Council; SAVENACA VOCEA, Manager, Pacific Islands Telecommunications Association; and RODERICK SANATAN, Secretary General, Caribbean Telecommunications Union (CTU)

This is a Round Table discussion among heads of the leading international/regional membership organizations regarding common issues, resource sharing and enhanced communication.

Topic Tables

Sunday, 17 January 1999
1100-1300

TT1 [top]
Telecommunications in the Service of Humanitarian Assistance: The Tampere Convention
Location: Iolani V
Facilitator: MOHAMED HARBI, Special Adviser to the ITU Secretary General, ITU
Participants: ROXANA DUNNETTE, WorldSpace Switzerland; ERIN PHAM, IRIDIUM, USA; EI OH, WGET Consultant, USA. Other participants to be announced.

The Tampere Convention provides an international framework whereby the provision of telecommunication assistance for humanitarian actions can be carried out effectively. Within this framework, request and termination of assistance, payments and reimbursements, privileges and immunities, as well as dispute settlements are covered. UN/OCHA is the Operational Coordinator under the Tampere Convention, and the ITU will assist OCHA in fulfilling the objectives of the Convention. In addition, many provisions of the Convention are also applicable to non-state entities such as international organizations and non-governmental organizations. In addition, states will prepare telecommunication assistance information inventories detailing, among other items, points of contacts and terms of telecommunication assistance. This Topic Table will (1) highlight the challenges faced by this Convention; and (2) explore how the Convention will be implemented on the field.

TT2 [top]
The Economic Crisis and Asia Pacific Telecomms-Impact and Response
Location: Iolani VI
Presenter: JOHN EDWARDS, Head of Asia Pacific Telecoms Consulting, Ernst & Young, *Australia* and assisted by RAJESH MAHAJIN, Consultant to Ernst & Young, Australia

The current economic crisis is likely to have a major impact on the speed and breadth of telecommunications advancement in Asia Pacific. Capital rationing, declining growth in most geographic markets of Asia, and under-performing new entrants saddled with high costs of capital are creating new challenges for the industry, with significant implications for regulators, investors, incumbent telcos and new entrants alike. Ernst & Young have recently interviewed globally some 60-70 CEO's and COO's of major telcos and telecomms equipment suppliers, in order to build a comprehensive picture of the industry's future directions. During this process some very interesting perspectives on the regional impact of the economic crisis have emerged. This topic table will explore these and develop appropriate responses to the challenges for telcos in Asia Pacific.

TT3 [top]
Telecommunications Competitiveness in the Asia Pacific Region
Location: Iolani VII
Facilitator: SATISH NAMBISAN, National University of Singapore, Singapore
Participants: S. J. ROH, Institute for Future Technology, Tokyo, Japan;JANET STENZEL, Pacific Economic Coordination Council; JOHN URE, University of Hong Kong, Hong Kong; and WEI KWOK KEE, National University of Singapore, Singapore

The Asia Pacific Telecommunications Competitiveness Index 1999 will be presented. In addition, the panel members will discuss various issues related to the competitiveness in the Asia Pacific telecommunications industry (e.g., regulatory and policy changes and the mobile telecom market).

Workshops

Sunday, 17 January 1999
0900-1200

Workshop 1 [top]
Delivering (PTC)/Telecommunications Presentations: Getting the Message Across
Location: Honolulu II
Presenter: DI LANDAU, President, Global Resources, USA; Assisted by Anonymous Audience Member/Strategic Affiliates of Global Resources

In this interactive workshop, members and audience affiliates of Global Resources will deliver a presentation that demonstrates and reviews successful telecommunications presentation techniques. In particular, the workshop will highlight the challenges faced when delivering telecommunications presentations to large, anonymous audiences. Telecommunications presentations are complex as presenters must often weave multiple perspectives into one message (technical, policy, and business) or strive to make dense technical concepts understandable to an "average" listener. The workshop assumes that attendees understand presentation design and will delve deeper into the subtleties of how a professional (telecommunications) speaker can organize their time, venue and style to maximize the personal send of every point of their complex presentation message. The workshop would be particularly useful for non-US PTC attendees who are often challenged to present in a fairly "American" style.

Workshop 2[top]
Joint Ventures and Strategic Alliances in Asia: Their Role in the Information Economy.
Location: South Pacific I
Moderator: PHILLIP L. SPECTOR, Partner & Chair, Communications Practice Group, Paul, Weiss Rifkind, Wharton & Garrison (PWRW&G), Washington, DC Office

Participants: JEANETTE K. CHAN, Partner, PWRW&G, Hong Kong Office; SAMUEL SOON-YUB KWON, International Counsel, PWRW&G, Washington, DC Office; and LIONEL H. OLMER, Partner, PWRW&G, Washington, DC Office

A key element of the information economy in the Asia-Pacific region is the strategic alliance. It is increasingly the case that companies in the region recognize the need for the synergies and completmentarities that a joint venture or other alliance can bring, particularly as they seek means to deal with technological change and the increasing demands for access to information. In telecommunications, the transnational joint venture-as a means of starting up a new telecom service offering-is not just common, it is essentially the norm. This workshop will focus on the practical, "hands-on" aspects of forming transnational joint ventures and strategic alliances in the telecommunications and information industries. After an overview of issues common to all such alliances, the workshop will provide a country-specific analysis with respect to three major Asian nations: China (including Hong Kong), Japan and Korea. The emphasis will be on the practical-the "how to" and "with whom"-and there will also be discussion of both financial and legal issues.

Workshop 3 [top]
Funding Global Distance Education
Location: Honolulu I
Participants: ARLENE KREBS, President, New Orbit Communications; Author, The Distance Learning Funding Sourcebook, USA

Funding is essential to initiate, maintain or expand educational technology and distance learning projects. This session will assist participants in learning how to fund technology and telecommunications facilities for schools, universities, health and social service agencies, and grassroots community organizations. Participants will learn about current trends and grant priorities among foundation, corporate and government agencies for equipment, networking, multimedia, curricula, teacher and staff training and distance education.

Emphasis will be on how to form unique, international partnerships that target the priorities of key funding agencies. As well, the session will focus on funding for projects in the developing world. Grant writing tips and skills including advice on how to target grant requests, approach funding agencies, how to develop collaborative projects and complete the grants application process. Ms. Krebs will also discuss the review process-how to write, format and gain points on proposal submissions.

Workshop 4 [top]
Commercial Launch Service
Location: South Pacific II
Moderator: ED WARD, Vice President, International Launch Services, USA
Participants: WILLIAM TRAFTON, Executive Vice President, International Launch Services, *USA*; AMY BUHRIG, Manager-Space Transportation, Sea Launch Company, *USA*; TOM PARKINSON, The Boeing Company, *USA*; Zuoyi Huang, Chief Representative-US, China Great Wall Company, *People's Republic of China*; and CHUCK BURCH, Vice President-Sales, Arianespace Inc., *USA*

The commercial launch services industry is in a period of dynamic change. Several new launch vehicle entrants – Sea Launch, Atlas III, Delta's III & IV, and Arianspace V – have all experienced significant delays or anomalies. Rapid growth in both satellite quantity and size has challenged the launch industry. The panel will discuss these critical events and current issues relating to the launch of communications satellites to include the new launch vehicle entrants, the match (or mismatch) of launch capacity to launch demand, and how satellite growth affects launch availability.

Workshop 5 [top]
Essentials of Broadband and Emerging Technologies
Location: Nautilus II
Presenter: RAY HORAK, an internationally acclaimed lecturer, author and consultant, USA

This workshop is a comprehensive discussion of the latest in network technologies and their practical applications. Decoded and demystified are infrastructure and service technologies including xDSL, Fixed Wireless, SONET and DWDM, Frame Relay, VoIP (Voice over IP) and ATM. This session has broad appeal. Whether you are new to telecommunications, or experienced and seeking a refresher or update, this workshop will help position you for continued success in the broadband networked world.

Workshop 6 [top]
Broadening Access: Telecoms and Information Ethics
Location: Nautilus I
Facilitators: MICHAEL OGDEN, Assistant Professor, University of Hawaii at Manoa and DINEH DAVIS, Assistant Professor, University of Hawaii at Manoa, *USA*
Participants: TOM COOPER, Professor, Emerson College and CLIFFORD CHRISTIANS, Director, University of Illinois, *USA*

This Round Table began as an Internet-based PTCyberForum. Issues germane to the PTC'99 conference theme include discussion of participation in the "Information Age" by those with and/or without access to information and communication technology at the individual, regional, national and international levels. Discussions begun online and continuing through this workshop revolve around issues of ethics in the age of technology, privacy and security of information contained in online information databases, electronic commerce, information flows, and critical aspects of actualizing the brodening of access to information and communication technologies for development.

Workshop 7 [top]
A Discussion of Bandwidth Financing, IT Skills Training, and Other Issues
Location: South Pacific III
Discussion Leaders: BILL GRAHAM, Assistant to the chair of the APEC Working Group on Telecommunications; JANET PEARCE STENZEL, Executive Director, PECCTelecom and IT Forum; and a representative of the Deputy Chair of the APEC working group on Telecommunications

The PECC Telecommunications and Information Industry Forum and the APEC Telecommunications Working Group (TEL)have a well established partnership which has served to bring the business perspective to the work of APEC in its four main areas of interest: liberalization; business facilitation; development cooperation; and human resource development. A major new effort in APEC in 1999 will be a study of sustainable international charging arrangements for the internet in the region. This workshop will review the work plan for the APEC and PECC, and provide an opportunity for discussion of major issues - particularly of factors affecting the international charging arrangements study.

See these pages for more information:

- Tentative Program Listing by Day
- Tentative Program Listing by Topic
- Agenda and Related Events-At-A-Glance

Plenary Sessions

Agenda At-A-Glance

Sunday 17, January 1999
1600-1800

Kickoff Plenary Session

(Live via Web Cast)
Location: Tapa Suite
Chair: RICHARD HOOPER, Hooper Communications, United Kingdom
Panelists: CONNY KULLMAN, Director General, INTELSAT
STEVE LIDDELL, International Vice President- Asia Pacific Region, MCI WorldCom, USA
DIANA SHARPE, Chair, International Telecommunications User Group

Monday 18, January 1999
0830-1030

Opening Plenary

(Live via Web Cast)
Location: Tapa Suite
Chair: ROBERT WALP, Vice Chairman, GCI, USA
Panelist: LE NAM THANG, Director-General, Post and Telecommunications Policy Department, Department General of Posts and Telecommunications, Socialist Republic of Vietnam
NORIMASA HASEGAWA, Vice Minister for International Affairs, Ministry of Posts & Telecommunications, Japan

Wednesday 20, January 1999
1700-1830

Closing Plenary

(Live via Web Cast)
Location: Tapa Ballrooms II and III
Chair: TEDSON MEYERS, Partner, Coudert Brothers, USA
Panelists: JOHN EGER, Executive Director, International Center for Communications, San Diego State University, USA
DENIS GILHOOLY, Information Infrastructure Advisor, The World Bank, USA
RICHARD HOOPER, Hooper Communications, United Kingdom
PETER JACKSON, Chief Executive Officer, Asia Satelite Telecommunications, Hong Kong, China
KARL K. ROSSITER, Chair, ISOG (Inter-Union Satellite Operations Group), New Media Committee for the Eight World Broadcasting Unions
JUNG UCK SEO, Vice Chairman, SK Telecom, Republic of Korea

Super Sessions

Agenda At-A-Glance

Monday 18, January 1999
1045-1245

Super Sessions (2)

SS.1.1

New Business Paradigms of Electronic Commerce

Chair: JEAN PREWITT, Vice President, Podesta Associates, Inc., USA Panelist: JAWAID EKRAM, Sr. Vice President- Networks & Host Services, VISA Corporation, USA TERRY JARMAN, President & CEO, Bell National Broadband Corp., Canada ALAN COHEN, Managing Director, Services Provider, Internet Business Solutions, Cisco, USA Other panelists to be announced

SS.1.2

Improving Communications in Developing Countries

Chair: EITEL RIZZONI, Consultant, NETPLAN, USA Panelist: MDM. JOSEFINA LICHAUCO, Undersecretary for Communications, Department of Transportation and Communications, Office of the Secretary, Philippines SAM PITRODA, Chairman & CEO, WorldTel Limited, United Kingdom SETHAPORN CUSRIPITUCK, Deputy Director General, Post and Telegraph Department, Thailand Other panelists to be announced.

Tuesday 19, January 1999
1300-1500

Super Sessions (2)

SS.2.1

Multimedia, Broadcast, HDTV, and Satellite Developments

Chair: DAVID COLVILLE, Vice Chairman, CRTC, Canada Panelist to be announced

SS.2.2

Impact of Communications on Society

Chair: TBA Panelists: SHIRLEY SERAFINI, Associate Deputy Minister, Industry Canada, Canada ZHENG YOUJING, Executive Director, Center for Information Infrastructure & Economic Development (CIIED), Chinese Academy of Social Services, China JUSTICE S.S. SODHI, Chairman, Telecom Regulatory Authority of India, India ING. JORGE KUNIGAMI, Chairman of the Board, OSIPITEL, Peru

PTC'99 Exhibitors

Exhibit Area Map

For more information on an exhibitor, please select their booth number.

Aerospace Corporation, The Booth #11

America's Network & Telecom Asia Booth #35-36

Analytical Graphics, Inc. Booth #12

Arbinet Communications, Inc. Booth # 72

Arianespace Booths #94–95

Asian Communications Booth #96

AT&T Booths #101-102

BizTone.com Booth #118

Boeing Company Booths #109-113

Cable & Wireless USA Booth #75

Cambridge Strategic Management Group (CSMG) Booth #31

Clarent Corporation Booth #100

CORDELL MANUFACTURING. INC. BOOTH # 50

CPDI Booth #67

D.W. Smith & Associates Booth #46

Design Publishers Booth # 23

Digital Lightwave, Inc. Booth # 51

ECI Telecom Booths # 41-42

Eraatel Corporation Booth #24

FLAG Telecom Ltd. Booths #104-105

France Telecom Booths # 117,125-126

GST Telecommunications, Inc. Booths # 44-45, 53-54

GTE Booths #56-59

Guam-Philippines Cable Limited Partnership Booths # 114-116

H.M.S., Inc. Booth #124

Harris Corporation Booth # 43

Hawaii Connections Booth #7-9, 15-18

ICG Satellites Services, Inc. Booth # 22

ICO Global Communications Booths #80-81

IDT Corporation Booth #53

INTELSAT Booths #85-86

International Engineering Consortium Booth # 1

ITXC CORP Booth #93

Japan-US Cable Network Booth # 89

Justice Technologies Booth #82

KDD Submarine Cable Systems Inc. (KDD-SCS) Booths #25-27

Lascomm Booth #90

Launchspace Publications, Inc. Booth #52

Lockheed Martin Global Telecommunications Booths #19-21/28-30

Loral Space & Communications (SPACE SYSTEMS/LORAL) Booths # 97-99 / 106-108

Lucent Technologies Booth #77

Lyncole XIT™ Grounding Booth #76

MCI WorldCom Booths # 39- 40

Mobilecomms / IBC Business Publishing Ltd. Booth #87

N.E.T. Booth #37-38

Nortel Networks Booth #83

NTT Booths # 73-74

NASA Lewis Research Center Booths #119-122

Nuera Communications, Inc. Booth # 84

Orbital Sciences Corporation Booth #34

PacAmTel, LLC. Booth #123

Pacific Communications Co. Booth #33

Phoenix International Systems, Inc. Booth #55

pulver.com Booth #6

REDCOM Laboratories, Inc. Booths #64-65

RevCom, Inc. Booth #60

Satellite Communications Booth # 70

SK Telecom Booths # 62-63

SkyTiger Internet Services, Inc. Booth #54

Space News Booth # 103

Stanford Telecom Booth #66

STAR TELECOM Booth(s)# 4-5/13-14

Telemobile Booth #47

TimePlex Group Booth #78-79

TRW Booth #32

TTC Booth #69

Tundra Communications Inc. Booth #61

ViaSat Inc. Booths #48-49

Via Satellite Booth #68

Viatel Global Communications Booths # 2-3

Vision Accomplised Hawaii Booth #88

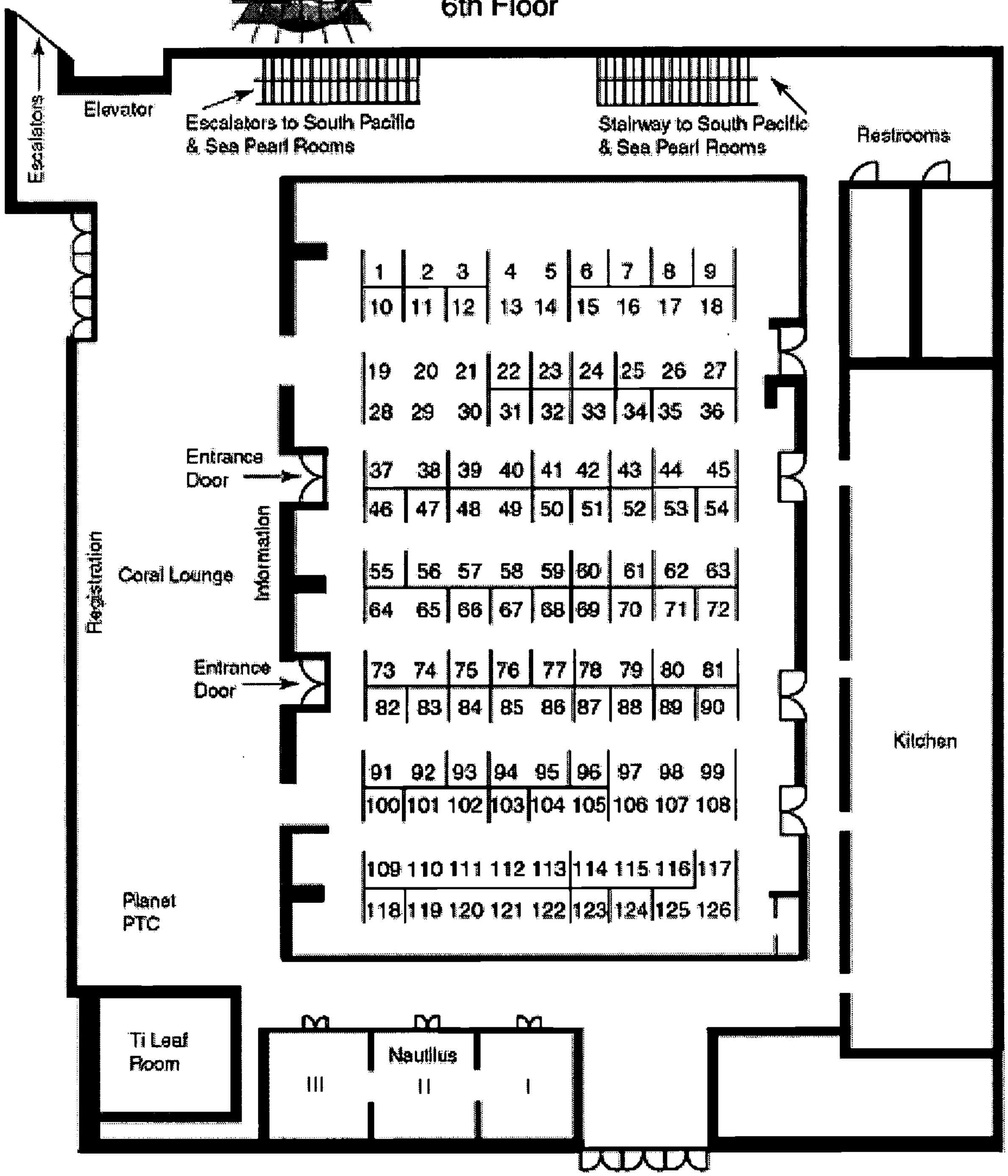
Voiceware Systems Booth #10

Westell, Inc. Booth # 71

WorldxChange Communications Booths #91-92

PTC'99

Exhibit Area
Hilton Hawaiian Village
Mid Pacific Conference Center
6th Floor

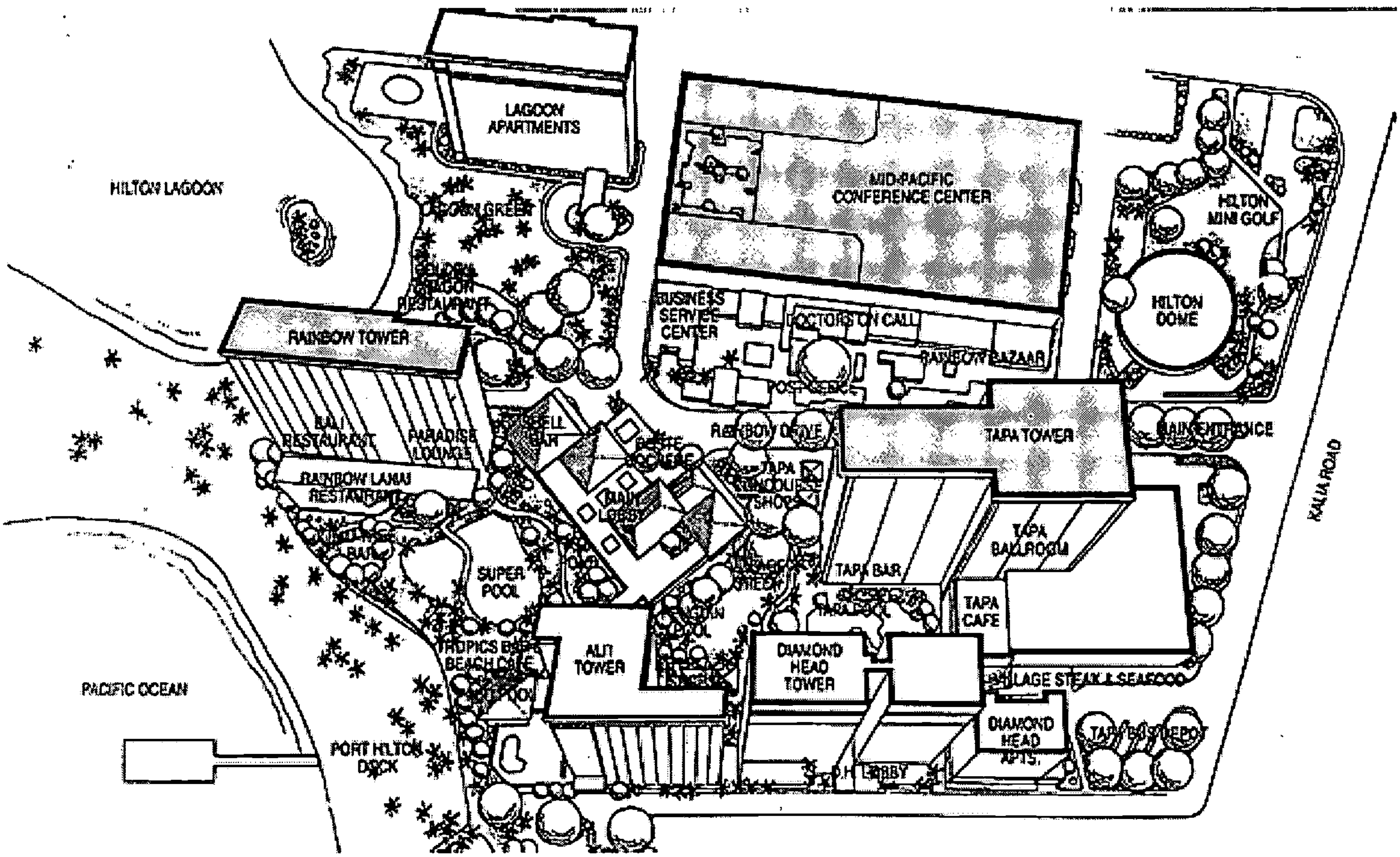


Ceiling Height 17' 11.5"
Booth Size 8'x10' (approx. 2.44 x 3.056 meters)
8' High backwall (2.44 meters)
3' High Side Dividers (.91 meters)

Fire Escape

Hilton Hawaiian Village Map

Click on a building to zoom in.



BEST COPY AVAILABLE

Monday Morning Sessions

Monday 18 January 1999

Previous Page|Next Page

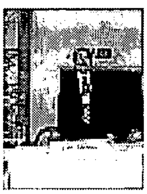

PIC00001.jpg

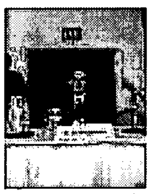

PIC00002.jpg


PIC00004.jpg


PIC00005.jpg


PIC00006.jpg


PIC00007.jpg

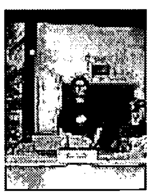

PIC00008.jpg

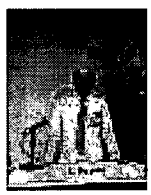

PIC00010.jpg


PIC00011.jpg


PIC00013.jpg


PIC00015.jpg


PIC00016.jpg

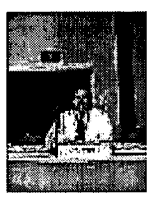

PIC00017.jpg


PIC00018.jpg


PIC00019.jpg


PIC00020.jpg


PIC00021.jpg


PIC00022.jpg


PIC00023.jpg

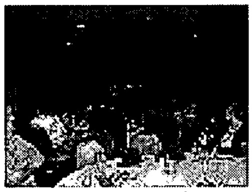

PIC00026.jpg

Page 1 of 4

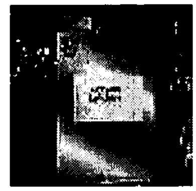
Tuesday Morning Sessions

Tuesday 19 January 1999


PIC00004.jpg


PIC00005.jpg


PIC00006.jpg


PIC00008.jpg


PIC00009.jpg


PIC00010.jpg


PIC00011.jpg


PIC00016.jpg


PIC0004.jpg


PIC00058.jpg

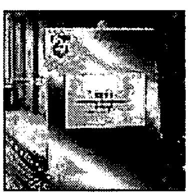

PIC0045.jpg


PIC0046.jpg


PIC0047.jpg


PIC0048.jpg

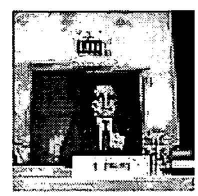

PIC0049.jpg


PIC0050.jpg


PIC0051.jpg


PIC0052.jpg


PIC0053.jpg


PIC0054.jpg


PIC0055.jpg


PIC0056.jpg

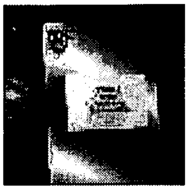

PIC0057.jpg


PIC006.jpg

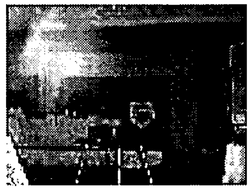
Wednesday Morning Sessions

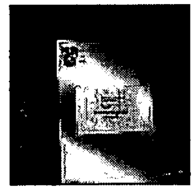
Wednesday 20 January 1999

Previous Page|Next Page


PIC00001.jpg

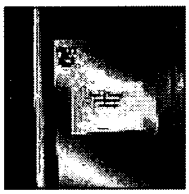

PIC00002.jpg


PIC00003.jpg


PIC00004.jpg

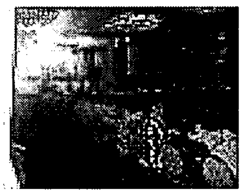

PIC00005.jpg


PIC00006.jpg


PIC00007.jpg

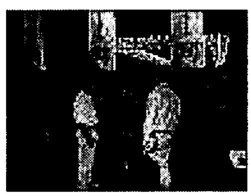

PIC00008.jpg

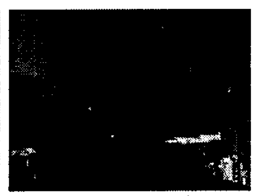

PIC00009.jpg

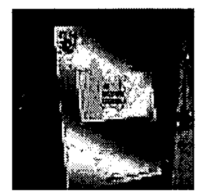

PIC00010.jpg


PIC00011.jpg


PIC00012.jpg

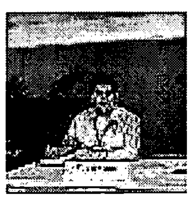

PIC00013.jpg


PIC00014.jpg

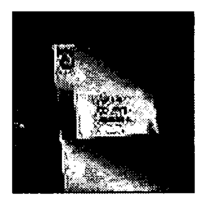

PIC00015.jpg


PIC00016.jpg


PIC00017.jpg


PIC00018.jpg

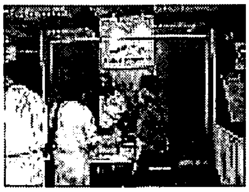

PIC00019.jpg


PIC00020.jpg

Page 1 of 3

PTC'99 Exhibitors

Previous Page|Next Page

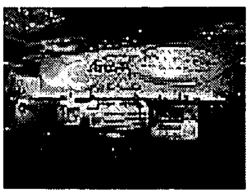

k.jpg


km.jpg


PI0012.jpg

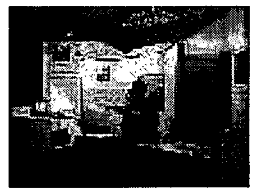

PIC00007.jpg

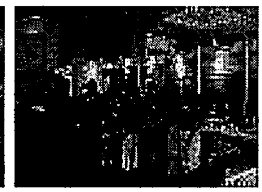

PIC00008.jpg


PIC00009.jpg

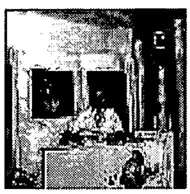

PIC00010.jpg

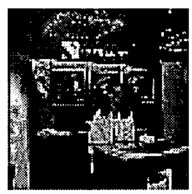

PIC00011.jpg

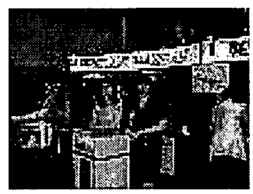

PIC00012.jpg


PIC00013.jpg


PIC00014.jpg


PIC00015.jpg


PIC00016.jpg

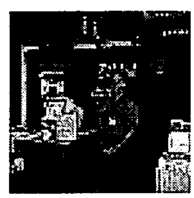

PIC00017.jpg

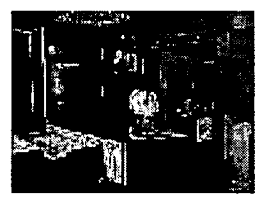

PIC00018.jpg


PIC00019.jpg


PIC0002.jpg


PIC00020.jpg


PIC00021.jpg


PIC00022.jpg

Page 1 of 4

Welcome

Aloha! Welcome to the Council's 21st Annual Conference

Each year the delegates to the conference say that, "This is the best one yet." Each conference has significant information provided by the professionally produced and presented papers, by the high level panels and by notable keynote speakers. An expanded exhibit hall for PTC'99 adds substance and interest in cutting-edge technologies and services.

The conference is a great facilitator of human connections of networking. On the conference floor, in the corridors, in the hotel, and sometimes on the beach, contacts are made, friendships reinforced, and opportunities are generated. Coffee breaks, luncheons, receptions and breakfast meetings are all geared to informal, productive interaction.

The PlanetPTC with its many PC stations provides for state-of-the-art Internet access to the workings of the conference. Conference papers, the conference program, the general schedule and special announcements are available on-line. Use the system to make contacts, to set up meetings, to request information and to contact other conference delegates. For external connections, use the same system to contact your colleagues to tell them what they are missing!

So, if you need an excuse to be in Hawaii in the middle of January, you now have one. You will be able to say, "this is the best one yet!". Please register early and make your travel and hotel arrangements well in advance. We look forward to seeing you in Hawaii.

Aloha!

Richard J. Barber
Executive Director

Registration Information

PTC'99 Registration Form

Hotel Registration Form

Welcome to PTC'99!

Registration includes admission to all sessions, round tables, panel discussions, topic tables, workshops, exhibits, , receptions, coffee breaks, luncheons plus a copy of the conference proceedings on CD-ROM. (Hotel reservations and travel arrangements are the responsibility of the registrant.) Fee rates will be determined by the date payment or purchase order is received. Written cancellation between 30 September 1998 and 29 December 1998 are subject to a US$100 administrative fee. No refunds will be made after 29 December 1998. Substitutions made after 29 December 1998 are subject to a US$50 administrative fee. Liability of sponsor is limited to the amount of the registration fee. Registration fees include official programmed events, materials, social events, exhibition and all scheduled meal functions as outlined in the program. A valid form of photo identification must be presented to claim attendee badge and materials. Materials may not be picked up for another person.

Paid registrations may be transferred to a substitute attendee.
Substitutions made after 29 December 1998 will be subject to a US$50 administrative fee.

Please include payment or purchase order with the registration form. No admittance to the conference will be allowed without proper payment of registration fees.

Registration Fee Schedule [TOP]

Fee rates will be determined by the date payment or purchase order is received and the membership status on that date.

Attendee Type	Up to: 31-Dec-98	Up to: 1-Jan-99: On Site
Non-member	US$1,100	US$1,250

PTC For-Profit/Non-Profit Member	US$700	US$750
PTC Individual Member/Program Participant	US$600	US$650
Faculty	US$550	US$650
Student	US$125	US$150

Registration Services [TOP]

The Conference registration services will be located at the Mid-Pacific Conference Center at the Hilton Hawaiian Village (the conference hotel) and will be open the following days and times for you to pick up registration materials:

Saturday, 16 January	1400-1800 hrs
Sunday, 17 January	0715-1800 hrs
Monday, 18 January	0715-1700 hrs
Tuesday, 19 January	0715-1630 hrs
Wednesday, 20 January	0715-1630 hrs

Badges and Admittance [TOP]

Official PTC99 attendee badges must be worn at all conference events. There will be a US$25 charge to replace lost badges.

PTC'99 Conference Registration Form

PTC'99 Registration is a 4-Step Process:

1. Indicate Your PTC Membership Status [Jump Down]
2. Select Your Registration Fee [Jump Down]
3. Registrant and Payment Details [Jump Down]
4. Submit Registration [Jump Down]

Membership Definitions

Individual Member
includes those who are members in the individual category.

Program Participant
includes panelist, author (primary/secondary), chairperson, speaker or presenter.

Faculty
includes Full-time faculty at a recognized academic institution. Proof via a brief letter on official letterhead is required.

Student
applies only to full-time undergraduate & graduate students. Proof of school/university registration is required.

1. Please Indicate Your PTC Membership Status

Member Type

○ PTC For-Profit/Non-Profit Member

○ PTC Individual Member/Program Participant

○ Non-member

○ Faculty

○ Student

2. Select Your Registration Fee

Attendee Type	Up to: 31-Dec-98			
Non-member	US$1,100	○	US$1,250	○
PTC For-Profit/Non-Profit Member	US$700	○	US$750	○
PTC Individual Member/Program Participant	US$600	○	US$650	○
Faculty	US$550	○	US$650	○
Student	US$125	○	US$150	○

3. Registrant and Payment Details

Name

Email

Title

Organization

Mailing Address

City **State**

Country **Postal Code**

Phone Number **Fax Number**

Hotel where you will be staying

Hilton Hawaiian Village Reservation Form

Badge Information

Name/Nickname

Organization

Country

Guest Name and Information

Name/Nickname

Additional fees for guests or spouse for the opening and closing ceremonies are $55 each per person.

Opening Reception ☐ **Closing Reception** ☐

Payment Terms

Checks/cheques should be made payable to **PTC'99** and should be drawn in United States Dollars. Fee rates will be determined by the **date payment or purchase order is received**. Written cancellation prior to 30 September 1998 will be subject to a US$50 administrative fee; between 30 September 1998 and 29 December 1998 subject to US$100 administrative fee.

No refunds will be made after 29 December 1998.
Liability of sponsor is limited to amount of the registration fee.

Payment Method:

○ I will mail payment to PTC at the address below:

○ Please bill me according to the credit card details below:

○ Please telephone me for my Credit Card Details

MasterCard VISA AmExpress Carte Blanche Diners Club

○ ○ ○ ○ ○

Name of Card Holder:

Credit Card Number:

Expiration Date:

Comments / Questions / Special Needs:

If you have any special needs or special requests, please describe them below.

Conference proceedings on CD-ROM will be mailed to all registrants after conference.

4. Submit you will recieve confirmation.

Press Start Over if you need to clear all fields.

PTC'99 Registration Mailing Address:

Pacific Telecommunications Council
2454 South Beretania Street, Suite 302
Honolulu, Hawaii 96826, USA
Tel. +1-808-941-3789
Fax. +1-808-944-4874
E-mail: ptc99@ptc.org

Last Modified:undefined

Hotel Registration Information

PTC has blocked a limited number of rooms.
Make your reservations early!

Hotel Registration is a 3-Step Process:

1. Room Selection
2. Registrant and Payment Information
3. Print and Fax Reservation

1. Room Selection

Please indicate room choice.
(Should the rate be sold out, the next available category will be confirmed.)

Diamond Head Tower	○ $ 125*
Garden View	○ $ 170*
Partial Oceanview	○ $ 195*
Oceanview	○ $ 225*
Alii Tower	○ $ 250*

The above pricing is for single or double occupancy. The additional charge for third and fourth person is US$30 per person.

* *In agreement with the Hilton Hawaiian Village, this rate includes a US$2 per day contribution to defray expenses of delegates from developing countries.*

A first-night's deposit will be due on all rooms and suites. Deposits for suites will be non-refundable after 11 December 1998. For additional information on suites, please contact the hotel. Group Reservations

Department directly.

Important:
Requests received **after 11 December 1998 will be on a space-available basis only**. Deposit will be refunded if reservation is cancelled at least 72 hours in advance of arrival date.
If your travel date should change after this form has been submitted, please notify the Hilton Hawaiian Village immediately.
No charge for children 18 years and under sharing same room as parents. Please advise ages. To reserve accommodations, select desired room category and enclose a check or money order for one-night's deposit made payable to the hotel, or guarantee on a major credit card. After check-in, any departure prior to the stated departure date will be assessed a US$50 charge.

2. Registrant and Payment Information

Name

Email Address

No. of persons

Name person(s)

Arrival Date

Arrival Time

Departure Date

Confirmation to be mailed to:

Mailing Address

Mailing Address

City

State

Country **Postal Code**

Phone Number

Fax Number

Payment Method:

MasterCard ☐ VISA ☐ AmExpress ☐

Credit Card Number:

Expiration Date:

Name of Card Holder:

3. Print and Fax Registration to:

Hilton Hawaiian Village
2005 Kalia Road
Honolulu, Hawaii 96815-1999, USA
Tel. +1-808-949-4321
Fax. +1-808-947-7898

Housing/Hotel Information

The Pacific Telecommunications Council has blocked a number of rooms at the Hilton Hawaiian Village [map] specifically for PTC'99. To secure hotel accommodations, complete the hotel reservation form. Room rates are listed below, and are subject to the Hawaii state room tax, presently at 10.16%.

Diamond Head Tower	$ 125
Garden View	$ 170
Partial Oceanview	$ 195
Oceanview	$ 225
Alii Tower	$ 250

*(Should the rate be sold out, the next available category will be confirmed.)

The above pricing is for single or double occupancy. The additional charge for third and fourth person is US$30 per person. Also, in agreement with the Hilton Hawaiian Village, this rate includes a US$2.00 per day contribution to defray expenses of delegates from developing countries.

No charge for children 18 years and under sharing same room as parents. Please advise ages. To reserve accommodations, select desired room category and enclose a check or money order for one-night's deposit made payable to the hotel, or guarantee on a major credit card. After check-in, any departure prior to the stated departure date will be assessed a US$50 charge.

A first-night's deposit will be due on all rooms and suites. Deposits for suites will be non-refundable after 11 December 1998. For additional information on suites, please contact the hotel Group Reservations Department directly.

Important:
Requests received after 11 December 1998 will be on a space-available basis only. Deposit will be refunded if reservation is cancelled at least 72 hours in advance of arrival date.

If your travel date should change after your hotel registration has been submitted, please notify the Hilton Hawaiian Village immediately.

Car Information

Alamo

ALAMO has been selected as the official car rental provider for PTC'99. Special rates are available one week prior through one week after the meeting dates and include FREE UNLIMITED MILEAGE. Call ALAMO toll-free, 24 hours at 1-800-732-3232, provide the agent with the Group ID#: 443384 and Rate Code:GR and the name and date of the meeting to make your reservations. International attendees may fax their reservation requests to: 1-954-527-4700.

Airline Information

United Airlines

United Airlines has been selected as the official airline provider for PTC'99. United will provide round trip transportation to PTC'99 in the United States and Canada at fares of either 5% discount off any United, United Express or Shuttle by United published fares, including First Class, in effect when tickets are purchased subject to all applicable restrictions, or a 10% discount off applicable BUA, or like fares in effect when tickets are purchased 0 days in advance. United Airlines is also pleased to offer an additional 5% discount towards the purchase of tickets purchased at least 60 days in advance of travel. Reservations and schedule information may be obtained by calling the United Meeting desk at 1-800-521-4041 and referencing Meeting ID #525HF.

Last Updated on 15 February 1999

Sort by organization.

name	organization	country
Mr. Robert Aamoth	Kelley Drye & Warren	USA
Mr. Roger Abbott	WORLDxCHANGE Communications	USA
Mr. Larry Abe	TRW Components International Inc.	USA
Mr. George Abi Zeid	GAZ Associate	USA
Mr. Benny Ablan	Philippine Long Distance Telephone Co.	
Mr. Kevin Able	Corning Incorporated	USA
Ms. Joan Abramson	ALOHA Networks Inc.	USA
Dr. Norman Abramson	ALOHA Networks Inc.	USA
Ms. Mary Absalom	Willis Corroon Inspace	Malaysia
Ms. Deborah Achin	Teleglobe	USA
Ms. Jennifer Adams	Ascent Communications	USA
Ms. Lisa Adelman	Lorel Skynet	USA
Mr. Howard Ady	OAO Corporation	USA
Ms. Carol Agard	University of Phoenix	USA
Mr. Christian Agard	University of Hawaii At Manoa	USA
Mr. Yogeshwar Lal Agarwal	HFCL Group-International Div	India
Mr. George Ageno	GTE Pacifica Incorporated	USA
Mr. Edward Aguon	Guam Telephone Authority	Guam
Mr. Asamu Ah Sam	ROCOM	New Zealand
Ms. Veronica Ahern	Nixon Hargrave Devans & Doyle	USA
Mr. Jason Ahn	Frontier Communications	USA
Mr. Kap-Dae Ahn	SK Telecom	Republic of Korea
Mr. Takuro Akinaga	FSM Telecommunications Corp	Fed. States of Micronesia
Mr. George Alatsatianos	Columbia Communications Corp	USA
Mr. Javier Alba	Telefonica of Spain	Spain
Mr. John Albert	Orion Network Systems Inc	USA
Dr. Andrew Aldrin	TRW	USA
Mr. Wayne Alexander	SBC International Inc	USA

Mr. Joel Allen	AllenConsultants, LLC	USA
Mr. Philip Allen	Dinsdale & Associates	Australia
Mr. Wayne Allen	Gateway Co-location	USA
Mr. Robert Allison	MCI Worldcom	USA
Mr. David Alston	Kinko's International, Inc.	USA
Mr. Joao Alves	EMBRATEL	Brazil
Mr. Eugenio Alviz	Lucent Technologies	USA
Mr. Kevin Alward	EconoPhone, Inc.	USA
Mr. Phil Amend	STAR Telecommunications	USA
Mr. Kjell Amundsen	TELENOR	Norway
Ms. Romana Anastascio	Palau National Communications Corporation	Republic of Palau
Mr. Ron Anderson	Pacific Gateway Exchange	USA
Mr. Patrik Andreasson	Telia North America	USA
Mr. Christian Annocque	Alcatel Submarine Networks	Singapore
Ms. Carol Ansley	IXC Communications, Inc	USA
Mr. Agnes Antonio		USA
Ms. Miranda Aoieong	Global One Communications, Limited	Hong Kong, China
Mr. Alejandro Aquino	Ocean View Telecom, LLC	USA
Mr. Shinichi Arai	Japan Telecom America Inc.	USA
Mr. Ken Araki	Pacific Telecom Co.	Japan
Mr. Kurniawan Arinanto	PT Indosat	Indonesia
Mr. Francesco Armato	Telecom Italia	Italy
Mr. Ronald Armstrong	Tyco Submarine Systems Ltd	USA
Mr. Sudipt Arora	United News of India	India
Mr. Pansak Arpakajorn	Telephone Organization of Thailand	Thailand
Mr. Vincent Arriola	Guam Telephone Authority	Guam
Mr. Nick Arroyo	RSL Com USA	USA
Mr. Iwato Asahara	BHN Association	Japan
Mr. Hiroshi Asahina	Ultra-Highspeed-Network & Computer Tech Lab	Japan
Mr. Kikuo Asai	National Institute of Multimedia Education	Japan
Ms. Bernice Asakura	Dept. of Educ. State of Hawaii	USA
Mr. Masahiro Asano	Global Access Limited	Japan

Mr. Mutsuya Asano	IBM Japan Ltd	Japan
Ms. Sharon Ashby	Pacific Telecom Council	USA
Mr. Tadashi Ashida	KDD Submarine	Japan
Mr. Zalmen Ashkenazi	Technet International	USA
Ms. Emily Aspell-Science	North American Gateway Inc.	Canada
Mr. Eric Assimakopoulos	The Gnome Group Inc.	USA
Ms. Leanne Avery	Asia Pacific Telecom	Australia
Ms. Patricia Bagnell	T Soja & Associates	USA
Mr. Yusinata Baharuddin	Singapore Exhibition Services Pte Ltd	Singapore
Ms. Samia Bahsoun	SetWave Communications, Inc.	USA
Mr. Tom Bainbridge	Siemens	USA
Mr. Leigh Baker	Oracle Corporation	Australia
Mr. Raleigh Baker	TRW / ESD	USA
Mr. Terry Baker	SBC International Development	USA
Dr. Mark Balnaves	Murdoch University	Australia
Ms. Gina Bamba	Guam Cellular & Paging	Guam
Mr. J. Bamba	Guam Telephone Authority	USA
Mr. Enrico Banfi	Pirelli Cables & Systems	Italy
Mr. James Bannan	Department of Education	USA
Mr. James Bannan	PREL	USA
Mr. Arun Bansal	Global One	USA
Mr. Chris Bantoft	WorldXChange Communications	USA
Mr. Richard Barber	Pacific Telecomms Council	USA
Mr. Bob Barker	World Digitel Corporation	USA
Mr. Glenn Barney	COM DEV	USA
Mr. Thomas Barr	COMSAT Corporation	USA
Mr. James Barrett	Tyco Submarine Systems Ltd	USA
Mr. Dan Bart	Telecomms Industry Association	USA
Mr. Gombio Basanjav	Ministry of Infrastructure Dev.	Mongolia
Mr. John Baudier	Intel Corporation	Malaysia
Mr. W. Neil Bauer	Loral Orion	USA
Mr. Robert Baulch	AT&T	USA
Mr. Steve Baxendale	PREL	USA
Mr. Phillippe Beaudoux	Global One Communications	France
Mr. Jean-Marie Beaufils	Alcatel Submarine Networks	Singapore

Ms. Kathryn Beck		USA
Mr. William Becker	HCC	USA
Mr. William Beckett	Project Oxygen	Bermuda
Mr. Philippe Bednarek	Atlas Telecom	France
Mr. James Beitchman	Lockheed Martin Intersputnik Ltd	United Kingdom
Mr. Ian Bell	Racal Survey Singapore	Singapore
Mr. Larry Bennet	Com Tech Internaional	USA
Mr. Rusty Bennett	CPDI	USA
Ms. Yona Benyamini	Fonorola Corporation	USA
Mr. Robert Berry	Space Systems/Loral	USA
Mr. Russell Berry	Clayton Utz	Australia
Mr. Steve Bershader	MRJ Technology Solutions	USA
Ms. Heidi Bersin	Clarent Corporation	USA
Mr. Bruce Best	University of Guam	Guam
Mr. Owen Best	FLAG Telecom Limited	Hong Kong, China
Mr. George Betts	SetWave Communications, Inc.	USA
Mr. Alex Bing	Marshall Is Natl Telecom Auth	Rep of Marshall Isla
Mr. Jim Black	WorldPort Communications	USA
Mr. Walter Blackwell	Bell Canada	Canada
Mr. Frank Blaha	CPI Satcom	USA
Mr. Frederic Blanc	France Telecom	France
Mr. Pierre Blanchard	Of. Des P&T French Polynesia	French Polynesia
Ms. Nalani Blane	UH Manoa	USA
Mr. John Blau	Tele.Com Magazine	Germany
Mr. Michael Blendell	New Media Corporation	Hong Kong, China
Mr. Didier Bloch	Compaq Computer Asia/Pacific	Singapore
Mr. Jean-Jacques Bloch	AEROSPATIALE	France
Mr. Seth Blumenfeld	MCI International	USA
Mr. Jon Blumhardt	Honolulu Community College	USA
Mr. Eldon Blust	MCI International	USA
Mr. Raymond Bodemer	Trans Pacific Telecom	Japan
Mr. Larry Boisvert	Telesat Canada	Canada
Mr. Roger Boisvert	Global OnLine Japan	Japan
Mr. David Bolas	VIP Calling, Inc.	USA
Mr. Alain Bolea	Deutsche Bank Securities	USA

Mr. John Bolus	Millennium 3 Communications, Inc.	USA
Attorney Fred Bordallo	Guam Telephone Authority	Guam
Mr. John Borlas	IT&E Overseas Inc	Guam
Ms. Puja Borries	Pacific Telecom Council	USA
Mr. Jack Borsting	Center for Telecom. Management	USA
Dr. Philip Bossert	Strategic Info Solutions Inc	USA
Mr. Matthew Botwin	PanAmSat Corporation	USA
Mr. Wayne Bouffler	WorldXChange	Australia
Mr. David Bourgoin	TCR Productions	USA
Mr. Richard Bowles	Arianespace	Singapore
Mr. Jonathan Boxold	UH Manoa	USA
Mr. Gary Branham	MITEL Enterprises	USA
Mr. David Brauer	PREL	USA
Dr. Yale Braunstein	Kalba International, Inc	USA
Mr. Jim Brennan	Tyco Submarine Systems Ltd	USA
Mr. Ted Brewer	Margus Co Inc	USA
Dr. Arturo Briceno	OSIPTEL	Peru
Mr. Donald Briggs	U.S. Electrodynamics, Inc.	USA
Mr. Anthony Briscoe	Telecom New Zealand Limited	New Zealand
Mr. Bob Brogdon	Avirnex	USA
Mr. Terrence Brooks	Guam Public Utilities Commission	Guam
Mr. Ronald Brouwers	Infonet Services Corporation	Singapore
Dr. Barry Brown	University of Saskatchewan	Canada
Mr. Gary Brown	Dept of Foreign Affairs-Trade	Australia
Mr. Joseph Brown	Project Oxygen	Bermuda
Ms. Valerie Brugere	Alcatel Submarine Networks	France
Mr. Francois Brun	Skybridge	USA
Mr. John Bryan	BT	United Kingdom
Mr. Robert Bucher	Norsat	Canada
Mr. Michael Buchholz	Nokia Pte. Ltd.	Singapore
Ms. Amy Buhrig	The Boeing Company	USA
Ms. Lydia Bulseco	UH Manoa	USA
Mr. Kevin Bunka	Hutchison Corporate Access (HK) Ltd	Hong Kong, China
Ms. Deborah Bunyard	PacAmTel LLC	New Zealand
Mr. Charles Burch	Arianespace Inc	USA

Mr. Peter Burge	Allen & Overy	Hong Kong, China
Ms. Myrna Burigsay	GTE Hawaiian Tel	USA
Ms. Laure Burke	UH Manoa	USA
Mr. Reed Burkhart	Imedia Corporation	USA
Mr. Campbell Burns	Orbit Telecommunications	Australia
Mr. German Burtscher	ECHARGE Corporation	USA
Mr. John Busch	DMR	USA
Mr. Paul Bush	Telesat Canada	Canada
Mr. Terry Bussell	Hawaii Pacific University	USA
Ms. Wendy Bussen	Auckland Institute of Technology	New Zealand
Mr. Randall Butler	TIRM - UH	USA
Mr. Jim Byous	Cable & Wireless Global Marine	USA
Ms. Joan Byrnes	Loral Skynet	USA
Mr. Jae-Ho Byun	ETRI	Republic of Korea
Mr. Gerard Caccappolo	Hermes Europe Railtel (Ireland) Ltd.	Ireland
Ms. Claire Calandra	Tyco Submarine Systems Ltd	USA
Mr. Richard Callahan	Callahan Associates Int'l., LLC	USA
Mrs. Jacqueline Callari	Redcom Laboratories Inc	USA
Mr. Kevin Camenares	WorldCom International	USA
Mr. Sid Campbell	Global Crossing	United Kingdom
Mr. Alfredo Candal	Viatel	USA
Mr. William Carlin	STM Wireless, Inc.	USA
Mr. Ferdinand Carlos	ComTech International	USA
Mr. Zenon Carlos	Bell Atlantic	USA
Mr. Sean Carr	Telecom Asia Magazine	Hong Kong, China
Mr. William Carter	Global Crossing Development Co	USA
Mr. Wayne Carvalho	Teleport-Asia	USA
Mr. Dean Cary	Forval International Telecom	USA
Mr. Mike Castell	Honolulu Community College	USA
Mr. Cris Castro	CRC Consulting	USA
Mr. Simon Cathcart	PanAmSat Corp	Australia
Mr. Joseph Cavanagh	Guam Telephone Authority	Guam
Mr. J.P. Caveen	Teleglobe	Canada
Mr. Michael Cayouette	Teleglobe	USA
Mr. Robert Cazelais	Teleglobe Australia Pty Ltd	Australia

Mr. Yi Chae	Loral Skynet	USA
Mr. Mark Chamberlin	Guam Cellular & Paging	Guam
Mr. Jean Chamoux	LeCommunicateur	France
Dr. Alice Chan	Cornell University	USA
Ms. Jeanette Chan	Paul Weiss Rifkind Wharton	Hong Kong, China
Mr. Joseph Chan	New World Telephone Ltd	Hong Kong, China
Ms. Michelle Chan	Centennial Communications Pte Ltd	Singapore
Mr. H. Henry Chang	Baker & McKenzie	Taiwan
Mr. Jack Chang	SpaceTel Asia, Ltd.	Taiwan
Mr. Jerry Chang	Clarent Corporation	USA
Mr. Sun-Tell Chang	Suretone Communications Co. Ltd	Taiwan
Mr. Wayne Chang	Kellogg School of Management Northwestern University	USA
Mr. Ying Chang	Apollo Communications	USA
Mr. Geoff Chant	Racal Survey Limited	United Kingdom
Mr. Steven Chapman	GTS	USA
Ms. Sherry Charles	Concert Communications Company	USA
Mr. Terry Charman	Telstra	Australia
Mr. Scott Chase	Via Satellite	USA
Mr. Melvin Chastain	Educational Communications Center Kansas State University	USA
Mr. Robert Chastain	Com Tech International	USA
Ms. Aniltra Chaudhari	Pacific Telecom	Fiji
Mr. Mani Chawla	Media4, Inc.	USA
Mr. Kevin Chen	SuperSat Telecommunications Inc	Taiwan
Ms. Liang-Yu Chen	UH Manoa - Student	USA
Mr. Ligun Chen	Asia Satellite Telecomms (AsiaSat)	Hong Kong, China
Mr. Steven Chen	Chunghwa Telecom Co. Ltd.	Taiwan
Ms. Carolyn Cheney	AT&T	USA
Mr. John Cheung	GTE Hawaiian Tel	USA
Mr. K.Y. Cheung	Lucent Technologies	USA
Mr. N.K. Chhibber	India Resource Centre	India
Dr. Choon-Wei Chia	FLAG Telecom	Singapore
Mr. Kevin Chia	Centennial Communications Pte Ltd	Singapore
Dr. Larry Chiang	Siemens Telecom Systems Ltd	Taiwan

Mr. Pedro Ching	New World Elephone Ltd.	People's Republic of Chin
Mr. Frank Chinh	Antiem (BVI) Limited	Hong Kong, China
Mr. Stuart Chiron	Global One	USA
Mr. Peter Chiu	SENAO International Co., Ltd.	Taiwan
Mr. Ya-hui Chiu	Asia Satellite Telecom	Hong Kong, China
Mr. Dong Man Cho	Hansol PCS Co., Ltd	Republic of Korea
Mr. Nam-Jin Cho	Korea Telecom	Republic of Korea
Dr. Whajoon Cho	Korea Telecom Business Cooperation Planning Office	Republic of Korea
Mr. Jun Yong Choi	SK Telecom., Co. Ltd.	Republic of Korea
Mr. Seung Choi	SK Telecom	Republic of Korea
Mr. Seung-Doo Choi	Korea Telecom	Republic of Korea
Ms. Rachelle Chong	Coudert Brothers	USA
Mr. George Chou	Hongkong Telecom Taiwan	Taiwan
Mr. Steven Chou	ACT Networks, Inc	USA
Mr. Chin-Yuan Chow	Chunghwa Telecom Co. Ltd.	Taiwan
Ms. Erica Chow	Hawaii Pacific University	USA
Ms. Wendy Chow	Coudert Brothers	USA
Mr. T.H. Chowdary	Ctr for Telecom Mgmt & Studies	India
Mr. Ted Christensen	George Washington University	USA
Mr. Sean Chu	Directorate General of Telecommunications	Taiwan
Mr. Albert Chung	Loral Skynet	USA
Ms. Kathy Chung	Pacific Star Communications Co Ltd	Hong Kong, China
Mr. Nicholas Ciaravino	Neptune Communications LLC	USA
Mr. John Ciardullo	Stratos Global Corporation	Canada
Mr. Rick Ciccone	Teleglobe International Corp	USA
Mr. Martin Ciupa	Objective Systems Integrators	Singapore
Ms. Sallye Clark	Teledesic LLC	USA
Mr. Robert Cleave	Space Systems/Loral	USA
Mr. Mark Cleaver	Cable & Wireless Global Marine	Singapore
Mr. Terry Clontz	Starhub Pte. Ltd	Singapore
Ric Cmiel	ICON	USA
Mr. Jacques-Marie Coache	Alcatel Submarine Networks	USA

Mr. Roberto Cofre	ENTEL Chile	Chile
Mr. James Cogswell	Broadband Infrastructure Group Limited	Philippines
Mr. Alan Cohen	Cisco	USA
Mr. Laurence Cole	The Fantastic Corporation Pty Ltd	Australia
Mr. Robert Collet	Teleglobe International Corp	USA
Mr. Daniel Collins	Space Systems/Loral	USA
Mr. Jesse Collins	UH Manoa	USA
Mr. Anthony Colucci	Space Systems/Loral	USA
Mr. David Colville	CRTC	Canada
Mr. Bob Condurso	Loral Skynet	USA
Mr. John Conley	TYCO Submarine	USA
Mr. Mark Cook	Teleport-Asia	USA
Mr. Pat Cooper	Space Systems/Loral	Hong Kong, China
Mr. Paul Cooper	Teledesic Australia P/L	Australia
Dr. Thomas Cooper	Emerson College	USA
Mr. Stuart Corner	3rd Wave Communication	Australia
Ms. Amy Cosper	Satellite Communications	USA
Mr. Dennis Coston	Associated Press	USA
Mr. Brian Cote	ECI Telecom Inc.	USA
Mr. William Coulter	Coudert Brothers	USA
Ms. Marjorie Courtis	Hitech Marketing Services Pty Ltd	Australia
Dr. Reg Coutts	Centre for Telecoms Info Netorking	Australia
Ms. Melissa Cowan	Satellite Communications	USA
Ms. Melissa Craig	General Telecom	USA
Mr. Robert Craver	Pacific Gateway Exchange	USA
Mr. William Crawley	FLAG Telecom System	Japan
Mr. Graeme Crayford	Oracle Asia Pacific	Singapore
Mr. Mike Crimmins	DirectNet Telecommunications	USA
Mr. Robert Cringle	Pacific Gateway Exchange	USA
Ms. Cathy Crockett	Space Systems/Loral	USA
Mr. David Crumly	STAR Telecommunications	USA
Mr. Florente Cruz	Subic Telecommunications Company, Inc.	Philippines
Ms. Sabrina Cubbon	Asia Satellite Telecom	Hong Kong, China
Mr. Robert Cullen		USA

Mr. Denis Curtin	Loral Orion Inc.	USA
Mr. Sethaporn Cusripituck	Post and Telegraph Department	Thailand
Mr. Terry Cutler	Cutler & Company	Australia
Ms. Lisa Dadouris	Global Crossing Development Co.	USA
Mr. Gregg Daffner	Lockheed Martin Intersputnik Ltd.	United Kingdom
Mr. Richard DalBello	ICO Global Communications	USA
Ms. Cheryl Dale	Network Plus	USA
Mr. Luke Dallafior	BellSouth International ACCESS	USA
Mr. Larry Damewood	Booz-Allen & Hamilton	USA
Mr. Terry Daniels	Daniels Electronics Ltd.	Canada
Mr. Mark Dankberg	ViaSat Inc.	USA
Mr. George Darby	Teleport Asia	USA
Mr. Michael Darragh	Gnome Group, Inc., The	USA
Mr. Simon Davies	ASIAcom	Hong Kong, China
Mr. Stuart Davies	Telecom Cook Islands	Cook Islands
Dr. Dineh Davis	University of Hawaii At Manoa	USA
Mr. Eugene Davis	TotalTel USA	USA
Mr. Michael Davis	Ward & Partners	Australia
Mr. Paul Davis	Space Systems/Loral	USA
Mr. Stephen Davis	Direct Net Telecommunications	USA
Mr. S.Wallace Dawson	Global Crossing	Bermuda
Mr. John Day	PCI Communications Inc	Guam
Mr. Ricardo De Bastos	Orbital Sciences Corp.	USA
Mr. Thomas De Brum	Marshall Is Natl Telecom Auth	Rep of Marshall Isla
Mr. Danny De Can	BELGACOM	Belgium
Mr. Maria De Los Angeles Rivero		Argentina
Mr. Jerry De Martino	MCI International	USA
Mr. Frank De Monbrun	Tokyo Bay Connection	Japan
Ms. Monica De Oliveira-Gajdys		USA
Mr. Kenneth DeFontes	Defontes Broadcasting	Bermuda
Mr. Vincent DeRosa	RSL Communications Ltd	USA
Mr. Chris Deacon	Deacon Communications P/L	Australia
Mr. John Dealy	The Dealy Strategy Group	USA
Mr. David Dean	Sasktel International	Canada

Mr. Donald Dean	Oceaneering Technologies	USA
Mr. John Delaney	SkyTiger	USA
Mr. Ned Dement	New Global Telecom, Inc.	USA
Mr. Paul Demerly	Napa Valley Consulting Group	USA
Mr. Allan Dempster	BT Malaysia	Malaysia
Mr. Doug Denton	ECHARGE Corporation	USA
Mr. Jean-Michel Desobeau	Arianespace Inc	USA
Mr. Leonard Dest	Hughes Space & Communications Int'l	USA
Mr. Jean Devos	Tyco Submarine Systems Ltd	USA
Mr. John Dhar	MCI International	USA
Ms. Cynthia Dickins	GE American	Singapore
Mr. Alejandro Diez Palma	CTC Mundo	Chile
Ms. Helen Disenhaus	Swidler & Berlin	USA
Mr. Lee Dixson	Pacific Telecom Council	USA
Mr. Arnold Djiwatampu	Tiara Titian Telekomunikasi	Indonesia
Mr. John Do	MilleCom, Inc.	USA
Mr. Stephen Do	Global Crossing	Singapore
Mr. Mark Dobie	Com Tech INternational	USA
Mr. A.H. Dodeman	Margus Co Inc	USA
Mr. Charles Dodgson	3rd Wave Communication	Australia
Mr. Mark Dodman	MCI International	USA
Ms. Barbara Donatelli	Startec Global Communications Corp.	USA
Mr. Garry Donoghue	Telecom Niue	USA
Ms. Peg Donovan	Compaq	USA
Ms. Trish Dougherty	Global Crossing	United Kingdom
Dr. Mathew Dovens	Cable & Wireless USA	USA
Mr. Richard Dowling	GCI	USA
Mr. Bruce Drake	Industry Canada	Canada
Mr. Kevin Duane	Global One	USA
Mr. Larry Dubow	AT&T/ACC TeleCom	USA
Mr. Terry Dudak		USA
Ms. Sandra Dudley	Global One	USA
Mr. Laurence Dunbar	Johnston & Buchan	Canada
Mr. Gregor Duncan	NEWCALL Communications Ltd.	New Zealand
Ms. Dana Dunn	CyberPoint Corporation	USA

Mr. Danny Dunn	WorldPort Communications	USA
Mr. Stephen Dunn	AMP Asset Management Australia	Australia
Ms. Roxana Dunnette	International Union Of Electronic Press	Switzerland
Mr. Laurent Duplantie	Globenet Communications Group	Canada
Mr. Tom Durkin	Pacific Gateway Exchange	USA
Mr. Doug Dwyre	Globalstar	USA
Mr. Paul Dykewicz	Satellite News	USA
Mr. Sturt Eastwood	Telecom Services Kiribati Ltd	Republic of Kiribati
Mr. Chris Edgecomb	STAR Telecommunications	USA
Mr. Jeff Edwards	Compaq Computer Corporation	USA
Mr. John Edwards	Ernst & Young Consulting	Australia
Mr. John Eger	International Center for Comms	USA
Ms. Angela Eggers	Fort Hays State University	USA
Mr. Butch Ekena	Caterpillar, Inc.	USA
Mr. Ury Eldar	Interglobe Communications ICC Corp	USA
Mr. David Eldridge	Motorola, Inc. - GTSG	USA
Mr. Murray Eldridge	Cable & Wireless Global Marine	Singapore
Mr. Leonard Elfenbein	Lynx Technologies, Inc	USA
Mr. Dieter Elixmann	WIK	Germany
Mr. Troy Ellington	Space Systems/Loral	USA
Mr. Aristoteles Elvina	Philippine Comm Satellite Corp	Philippines
Mr. Russell Elwell	TIRM - UH	USA
Mr. Teruhiko Ena	Space Communications Corp.	Japan
Mr. Steven Eng	Duke University	USA
Mr. Robert Engelbardt	Hicks & Ragland Engineering Co	USA
Mr. Jose Escudero	TC2 International Ltd	USA
Mr. Patrick Estenes	WCI Cable, Inc.	USA
Mr. Graham Evans	EGS (Asia) Ltd	Singapore
Mr. Ho Fah Siang	Singapore Telecommunications Ltd.	Singapore
Mr. Francis Fahey	Guam-Philippines Cable LLP	Hong Kong, China
Mr. Greg Falce	Intel Corp / I.T.	USA
Mr. Peter Falshaw	Ovum Pty Ltd	Australia
Mr. David Farris	STAR Telecommunications	USA
Mr. Donald Felbaum	OPTEL Limited	Philippines
Mr. Edward Feldman	Global One	USA

Ms. Elizabeth Fell	Cable & Satellite Asia	Australia
Ms. Mary Feng	AGIS	USA
Mr. Daniel Fermine	Telecom Vanuatu Limited	Vanuatu
Mr. Jack Finlayson	Global Crossing	Bermuda
Mr. Chris Fisher	CyberPoint Corporation	USA
Ms. Kathy Fisher	Industry Canada	Canada
Mr. Michael Fitch	Hughes Communications, Inc.	USA
Mr. John Fleming	IXC Communications, Inc	USA
Mr. Gerald Foley	IT-International Telecom Inc	Canada
Lt Col Choon Khin Fong	Television Corporation of Singapore	Singapore
Ms. Desiree Fong	Chaminade University - Student	USA
Mr. Richard Fong	Alcatel Submarine Networks	Singapore
Mr. Scott Forbes	Pennsylvania State University	USA
Mr. Donovan Forges	UH Manola	USA
Ms. Jane Forster	Clayton UTZ	Australia
Mr. Grant Forsyth	TUANZ	New Zealand
Mr. Alan Fowler	Marshall Is Natl Telecom Auth	Rep of Marshall Isla
Mr. Greg Fowler	MDCD, Inc, The Boeing Company	USA
Mr. Mike Fowler	Columbia Communications Corp	USA
Ms. Joanne Fox	Stentor International	United Kingdom
Mr. Scott Fox	Bellsouth Cellular Corp.	USA
Mr. Richard Franklin	Cable & Wireless Global Business	United Kingdom
Dr. Howard Frederick	New Zealand Internet Institute	New Zealand
Mr. Joseph Freitag	TRW Inc.	USA
Mr. Jeffery Freitas	Millennium 3 Communications, Inc.	USA
Mr. Robert Frieden	Pennsylvania State University	USA
Mr. Arnold Friedman	Space Systems/Loral	USA
Ms. Mary Frost	ICO Global Communications	USA
Mr. Michio Fujisaki	Fujitsu Limited Int'l Telecomm Business Group	Japan
Mr. Makoto Fujisawa	Fujitsu Limited Int'l Telecomm Business Group	Japan
Mr. Satoshi Fujita	NTT Worldwide Network Corporation	Japan
Mr. Keith Fukuda		USA
Ms. Susan Fukuda		USA

Mr. Bob Fullerton	Tyco Submarine Systems	USA
Mr. Kiyoshi Funaki	Ocean Cable Co Ltd	Japan
Mr. Taketo Furuhata	International Digital Comms Inc	Japan
Mr. Yasushi Furukawa	UsAsiaCom, Inc.	USA
Mr. Paul Gabla	Alcatel Submarine Networks	France
Mr. Eugene Gaetano	Pacific Telecom Cable Inc.	USA
Mr. Paul Gagnier	Swidler Berlin Shereff Friedman, LLP	USA
Mr. Jacob Gale	Geotek Int'l Network Operations	USA
Mr. Sanjaa Ganbaatar	Mongolia Telecom	Mongolia
Mr. Anthony Gardiner	Kensar Telecommunications Ltd	Canada
Mr. Dave Gardner	Loral Skynet	USA
Mr. Donn Garrison	University of Alberta	Canada
Mr. Neil Garvey	Tyco Submarine Systems	USA
Ms. Bonnie Gatlin	Fusion	USA
Ms. Patricia Gauld	Oracle Corporation	Canada
Mr. Steven Gavenas	WorldSpace Corporation	USA
Mr. Aldo Gebbia	Sonsub International	United Kingdom
Mr. James Gebhard	Hughes Space & Comm Int'l Svcs	Singapore
Mr. Daniel Gee	DirectNet Telecommunications	USA
Mr. Renato Gendrano	PLDT	Philippines
Mr. Christopher Gentsch	TIRM	USA
Ms. Melissa Gerken	PTC	USA
Mr. Glenn Gerstell	Milbank, Tweed, Hadley & McCloy	USA
Mr. Michael Gertler	Denton Hall	Hong Kong, China
Ms. Amarjit Ghataore	The Boeing Company	USA
Mr. Denis Giannini	France Telecom Mexico	Mexico
Mr. Christopher Gibney	AT&T	USA
Mr. Daniel Gibson	Network Approach Corp	USA
Mr. Denis Gilhooly	The World Bank	USA
Mr. Duncan Gillibrand	Nortel Networks	Canada
Mr. James Gima	Micronesian Telecommunications Corp.	CNMI
Mr. Tan Gin	StarHub Pte. Ltd.	Singapore
Ms. Tara Giunta	Coudert Brothers	USA
Dr. Arthur Gloster	Florida International University	USA
Mr. Debra Gluskin	New Global Telecom, Inc.	USA

Mr. Ofer Gneezy	VIP Calling, Inc.	USA
Mr. Brian Go	DIGITEL	Philippines
Mr. Jean Godeluck	Alcatel Submarine Networks	France
Ms. Evelyn Goh	Telecom Authority of Singapore	Singapore
Ms. Melissa Goldberg	Ameritech Global Gateway Services	USA
Ms. Judy Goldberger	UH Manoa	USA
Ms. Carol Goldstein	Morgan Stanley & Company Inc.	USA
Mr. Michael Goldstone	Heidrick & Struggles	Hong Kong, China
Mr. Gary Gong	Institute for Information Industry	Taiwan
Mr. Joshua Gordon	University of Hawaii	USA
Sidney Gorham	ALOHA Networks, Inc.	USA
Ms. Stacey Gould	Fort Hays State University	USA
Mr. Dario Goussal	Northeastern U. at Resistencia	Argentina
Mr. John Graham	IT-International Telecom Inc	Canada
Mr. William Graham	Industry Canada	Canada
Mr. Richard Grange	New Global Telecom Inc.	USA
Ms. Gail Granton	Pacific Gateway Exchange	USA
Mr. Richard Greco	Orion Atlantic	USA
Dr. Richard Green	Cable Television Laboratories	USA
Ms. Laina Raveendran Greene	Get IT Pte Ltd/APIA	Singapore
Mr. Jerry Greer	Stentor Resource Centre Inc	Canada
Ms. Sandra Grey	Pacific Gateway Exchange	USA
Mr. James Gribbon	Lockheed Martin Commercial Space Systems	Singapore
Mr. Richard Geoffrey Grice	Cable & Wireless	Singapore
Mr. Thomas Grimm	Loxley Public Company Limited	Thailand
Mr. Randall Gromlich	GTE Service Corporation - International	USA
Mr. Kenneth Gross	Columbia Communications Corp	USA
Mr. Harold Grossnickle	Global Crossing	USA
Mr. Bradley Grunewald	New Global Telecom Inc.	USA
Mr. Klaus Gueldenpfennig	Redcom Laboratories Inc	USA
Mr. Edward Guida	Global Crossing Ltd	USA
Mr. Thomas Guilfoy	SBC International Development	USA
Mr. Terry Gunsel	Neptune Communications LLC	USA
Mr. Carlos Guzman-Perry	The Yankee Group	USA

Mr. John Gwynn	PanAmSat Corp	USA
Mr. Godik Gyldenege	Oceaneering International	Singapore
Mr. Max Hagan	New Global Telecom, Inc.	USA
Mr. Eiji Hagiya	NTT Worldwide Network Corporation	Japan
Mr. Cliff Halevi	Bellcore	USA
Mr. Chris Hall	ITO Telecom	USA
Mr. Marc Halpern	QWEST Communications	USA
Mr. Ed Hamilton	STAR Telecommunications	USA
Mr. Fred Hamilton	Tyco Submarine Systems	USA
Mr. Leslie Hamilton	Infonet Services Corporation	USA
Mr. Stephen Hamilton	U.S. Coast Guard	USA
Mr. Ismet Hamiti	ITU	Thailand
Mr. Waleed Hanafi	Visa International	Singapore
Ms. Amy Hancock	Satellite Communications	USA
Mr. Jerrold Hancock		USA
Mr. William Haner	Pacific Gateway Exchange	USA
Mr. John Hann	Teleglobe International	USA
Mr. Matthew Hannon	CIBC Oppenheimer Corp.	USA
Mr. Ron Hansen	ETEC-Electronics & Telecom Eval Ctr	Japan
Mr. Osamu Harada	NEC Corporation	Japan
Mr. Mohammed Harbi	International Telecommunication Union UIT/ITU	Switzerland
Mr. Robert Harbison	Starvox	USA
Mr. Richard Harding	PT-1 Communications Inc	USA
Mr. Shawn Harding	SBC Communications Inc SBC Long Distance	USA
Ms. Genevieve Hardy-Curry	Pacific Telecommunications Council	USA
Mr. Ziad Harfouche	ALPHA-TEL	USA
Mr. Stephen Harkness	Pacific Telecom Council	USA
Mr. Gregory Harms	Space Systems/Loral	USA
Dr. L. Harms	University Of Hawaii	USA
Mr. Nick Harris		USA
Ms. Paini Harris	Hawaii Pacific University	USA
Mr. Keith Harrison	Hong Kong Telecommunications	Hong Kong, China
Mr. Keith Harrison	WorldxChange	USA

Mr. Michael Harrison	SAIC/MARIPRO	USA
Mr. Terry Hart	Loral Skynet	USA
Mr. Howard Hartenbaum	Hughes	Japan
Mr. Kevin Hartman	Center for Strategic & International Studies	USA
Mr. Warren Haruki	GTE Hawaiian Tel	USA
Mr. Norimasa Hasegawa	Ministry of Posts & Telecommunications	Japan
Mr. Mohamad Halim Hashim	SyraNET Global PLC	Malaysia
Mr. Atsuo Hatono	Hitachi	Japan
Mr. Bernie Haughian	Telesat	Canada
Mr. Osamu Hayama	University of East Asia	Japan
Mr. Eiji Hayashi	NEC Corporation	Japan
Mr. David Hayden	Kinko's International, Inc.	USA
Ms. Tina Hayest	ITM - AT&T	USA
Mr. Timothy Haynes	CSMG	USA
Mr. Ke Rang He	APT Satelitte Holdings Limited	Hong Kong, China
Mr. Wayne Heads	The University of the South Pacific	Fiji
Mr. Richard Heaps	Clarent Corporation	USA
Mr. James Heberle	MTT Inc.	USA
Milda Hedblom	Dain International	USA
Dr. Robert Hedinger	Loral Skynet	USA
Mr. Bill Heil	Sprint - Int'l Planning Group	USA
Mr. Christopher Hein	Department of Defence, Australia	Australia
Ms. Paula Helfrich	Hawaii Island Econ Dev Board	USA
Mr. Mike Heller	Cisco Systems Inc.	USA
Amb. Gerald Helman	Ellipso, Inc.	USA
Mr. Jay Hemmady	Lucent Technologies	USA
Mr. Phillip Henderson	Telecom Cook Islands	Cook Islands
Mr. Peter Heng	StarHub Pte Ltd	Singapore
Mr. Paul Henkels	Henkels & McCoy Inc	USA
Mr. William Henry	Network Equipment Technologies	USA
Mr. John Henson	VIP Calling, Inc.	USA
Mr. Sau Ping Heong	Hawaii Pacific University	USA
Mr. Conrad Hernandez	Smart Communications, Inc.	Philippines

Mr. David Hess	TotalTel Carrier Services	USA
Ms. Joyce Hewins	Pacific Gateway Exchange	USA
Mr. Michael Hewins	Space Ventures Interantional	USA
Mr. Robert Hewitt	Lucent Technologies	USA
Mr. John Hibbard	Telstra Corporation Limited	Australia
Ms. Christina Higa	PEACESAT	USA
Mr. Ron Higgins	Digital Island Inc	USA
Ms. Heidi Hijikata	EDS	USA
Mr. John Hinchcliff	Auckland Institute of Technology	New Zealand
Mr. Jesse Hindemith	AdvancedTech Communications Inc	USA
Mr. Richard Hipa	Telecom Niue	Niue
Mr. Hiroshi Hirai	KDD America	USA
Mr. Kazunori Hirata	Ocean Cable Co Ltd	Japan
Mr. Peter Hitchiner	J.W.Dinsdale & Associates Pty Ltd	Australia
Mr. Salvador Hizon	Eastern Telecomm. Philippines	Philippines
Mr. Lam Ho	Project OXYGEN	Bermuda
Mr. Tim Ho	Net T&T Hong Kong Limited	People's Rep. of China
Mr. Charles Hogan	Global Crossing	USA
Mr. Wing Chee Hoh	Singapore Telecoms Pte Ltd	Singapore
Mr. Brian Holbutt	Eastern Telecomm. Philippines	Philippines
Mr. James Hollansworth	NASA Lewis Research Center	USA
Mr. Elmar Hollenstein	Swisscom Ltd.	Switzerland
Amb. Bradley Holmes	Project Oxygen, Ltd.	Bermuda
Mr. Jim Holmes	Ovum Pty. Ltd.	Australia
Ms. Elizabeth Holowinski	Law Offices of Thomas K. Crowe, P.C.	USA
Ms. Geriann Hong	Teleschool Branch, Dept. of Education	USA
Mr. Won Pyo Hong	Korea Telecom Freetel	Republic of Korea
Mr. Richard Hooper	Hooper Communications	United Kingdom
Mr. Ray Horak	Context Corporation	USA
Mr. Nobuhiro Horisaki	TTC - Telecommunications Technology Committee	Japan
Mr. Michael Houterman	Hughes Space & Comm Co	USA
Mr. Ken Hovaldt	ECI Telecom Inc.	USA
Mr. Peter Howard	ALCATEL	United Kingdom
Mr. Chris Hoyle	Rakisons	United Kingdom

Mr. Arthur Hsieh	Elite International Law Offices	Taiwan
Dr. Chi-Chia Hsieh	Microelectronics Technology	Taiwan
Mr. Cheng-En Hsiung	Hawaii Pacific University - Student	USA
Mr. Alex Hsu	Lockheed Martin	USA
Mr. Allen Hsu	Yulon Group	Taiwan
Mr. Eddie Hsu	Jet Propulsion Laboratory	USA
Mr. Robert Hsu	AT&T	USA
Mr. Stephen Hsu	INFOCOMM International Corp.	Taiwan
Mr. Jay X. Hu	USITO	People's Rep. of China
Ms. Qing Hu	N.E.T.	USA
Ms. Wan Yu Huang	UH Manoa	USA
Mr. Zuoyi Huang	China Great Wall Industry	USA
Ms. Yvette Hubbel	Arianespace, Inc.	USA
Dr. Heather Hudson	University of San Francisco	USA
Mr. Elisha Huggins	Dartmouth College	USA
Mr. E. Hughes	Oceaneering Technologies Inc.	USA
Mr. Michael Hughes	VIP Calling, Inc.	USA
Dr. Mark Hukill	Nanyang Technological Univ	Singapore
Mr. Glenn Hunger	AT&T	USA
Ms. Jane Hurd	Severance International, Inc.	USA
Ms. Anne Hurley	American Express Int'l Inc	Australia
Mr. Thomas Hwang	DACOM Corporation	Republic of Korea
Ms. Valerie Ianieri	Teleglobe	USA
Dr. Naswil Idris	Universitas Terbuka	Indonesia
Mr. Tadashi Iida	Pacific Telecom Co.	Japan
Mr. Shigeru Iijima	International Digital Comms Inc	Japan
Dr. Richard Inciardi	Ellipso, Inc	USA
Mr. Nick Ingelbrecht	FT Asia Pacific Telecoms Analyst	Australia
Mr. Masami Inoue	Ocean Cable Co Ltd	Japan
Mr. Craig Inouye	Direct Net Telecommunications	USA
Mr. Aukitino Ioane	Telecom Services Kiribati Ltd.	Republic of Kiribati
Mr. Donald Irvin	ETEC-Electronics & Telecom Eval Ctr	Japan
Ms. Susan Irwin	Irwin Communications Inc	USA
Ms. Linda Ishii	North American Cellular Network	USA
Mr. Kiyoshi Isozaki	NTT Worldwide Telecommunication	Japan

Mr. Koji Ito	NEC Corporation	Japan
Ms. Suzanne Iverson	STAR Telecommunications	USA
Mr. Peter Jackson	Asia Satellite Telecomms (AsiaSat)	Hong Kong, China
Mr. Lincoln Jacobe	Hawaii Internet & Telecom Publishing	USA
Mr. Shirley Jacobe	Hawaii's Web & Internet News	USA
Mr. Eric Jacobsen	EF Data	USA
Mr. Gary Jaeckel	WinStar International, Inc.	USA
Mr. Don Jagoe	Science Applications International Corporation	USA
Mr. David James	Upside Magazine	USA
Mr. Michael Janigan	Public Interest Advocacy Centre	Canada
Mr. Robert Janowiak	Int'l Engineering Consortium	USA
Mr. Peter Jansen	Cable & Wireless USA	USA
Mr. Ragchaa Jargalsaihan	Mongolia Telecom	Mongolia
Mr. Charles Jarvie	Telecom New Zealand Ltd	New Zealand
Ms. Annie Javerzac	SITA Equant	France
Mr. Tom Jeanettes	MCI International	USA
Mr. Tom Jeffries	WorldPort Communications	USA
Mr. Keith Jennings	NTL	United Kingdom
Mr. Richard Jensen	ASEM Corporation	USA
Ms. Bernadette Jew	Gilbert & Tobin	Australia
Ms. Eva Jimenez	Telefonica of Spain	Spain
Mr. Victor Jodjana	Unocal Corporation	USA
Mr. Patrick Joggerst	Global Crossing	Bermuda
Mr. Pertti Johansson	Motorola	USA
Mr. Craig Johnson	Transnational Data Reporting Service	USA
Mr. Douglas Johnson	ASEM Corporation	USA
Mr. Steve Johnson	University of Hawaii	USA
Dr. Joan Johnson-Freese	Asia-Pacific Center for Security Studies	USA
Mr. Malcolm Johnston	Cable & Wireless Marine	United Kingdom
Dr. Sally Johnstone	Western Cooperative for Edu Telecom	USA
Ms. Christy Jones	STAR Telecommunications	USA
Mr. David Jones	DEMJ International	USA
Mr. G. Morgan Jones	Boating Newspaper	USA
Mr. Rick Jones	PrimeTEC International, Inc	USA

Mr. Emiliano Jurado	Eastern Telecomm. Philippines	Philippines
Mr. Louk Jurgens		Singapore
Dr. Meheroo Jussawalla	East-West Center	USA
Dr. Konrad Kalba	Kalba International, Inc	USA
Mr. Richard Kalbrener	Cignal Global Communications	USA
Mr. Wesley Kam	Teleglobe International Corp	USA
Ms. Debra Kamealoha	Pacific Telecom Council	USA
Mr. William Kamei	Hughes Space & Comm. Co.	USA
Mr. Alan Kamman	Vermont Telecomm. Application Center	USA
Mr. Tim Kang	Hansol PCS Co., Ltd	Republic of Korea
Mr. Kai-Sheng Kao	Directorate General of Telecommunications	Taiwan
Mr. Fouad Karam	Nortel	Canada
Dr. Terence Karran	University of Lincolnshire and Humbersid Centre for Access and Lifelong Learning	United Kingdom
Hideki Kato	Orbital Sciences Corporation	USA
Mr. Yoshio Katsumata	NTT Worldwide Network Corporation	Japan
Mr. Russell Kaurloto	Associated Press	USA
Mr. Toyokazu Kawaguchi	KDD-Kokusai Denshin Denwa Co Ltd	Japan
Mr. Masaru Kawajiri		USA
Mr. Yasuhiko Kawasumi	Japan Telecom Co Ltd	Japan
Mr. Gerry Kealey	Stentor Resource Centre	Canada
Ms. Christine Keck	Telecomms Industry Association	USA
Mr. Michael Kedar	Globenet Communications Group	Canada
Mr. Charles Keene	AT&T Government Markets	USA
Dr. Michael Kelly	A.T. Kearney	Australia
Mr. Steve Kelly	Switch & Data Facilities Co	USA
Mr. Carl Kendrick	PrimeTEC International, Inc	USA
Mr. John Kessler	KMI Corporation	USA
Mr. Janne Kettunen	Hawaii Pacific University	USA
Mr. Rajesh Kheny	Tyco Submarine Systems Ltd	USA
Ms. Kari Kickler	Fort Hays State University	USA
Ms. Helene Kidary	PT-1 Communications Inc.	USA
Mr. Kevin Kidd	FaciliCom International, LLC	USA

Mr. Saufa Kila	Telikom PNG	Papua New Guinea
Mr. Bong Hyun Kim	SK Telecom	Republic of Korea
Mr. Bontae Kim	ETRI	Republic of Korea
Mr. Dong Won Kim	SK Telecom	Republic of Korea
Mr. Edward Kim	Asia Access Telecom, Inc.	USA
Mr. Han-Suk Kim	Korea Telecom	Republic of Korea
Mr. Kwang Hoon Kim	Sk Telecom	Republic of Korea
Mr. Moon-Hwan Kim	Kook Min University	Republic of Korea
Mr. Pang Kim	ETRI	Republic of Korea
Mr. Tae-Sik Kim	Onse Telecom Corp.	Republic of Korea
Mr. Yeon-kyu Kim	SK Telecom , R&D Center	Republic of Korea
Mr. Yeongkwun Kim	Korea Telecom, Wireless Comms Research Lab.	Republic of Korea
Mr. Hiroshi Kimura	Mitsubishi Electric Corporation	Japan
Ms. Ramona Kincaid	Kauai Community College	USA
Mr. Robert Kinn	Startec Global Comm. Corp.	USA
Mr. Fujio Kinoshita	IMME Ltd.	Japan
Mr. Shunji Kinoshita	IMME Co. Ltd.	Japan
Mr. Jeff Kirchner	Nortel Network	United Kingdom
Mr. Jon Kirchner	Loral Skynet	USA
Mr. Alan Kirk	Telia North America	USA
Mr. Junuchi Kishigawa	NTT Worldwide Telecommunications	Japan
Mr. Yasunari Kishimoto	NTT Info & Communication Systems Laboratories	Japan
Dr. Tadayoshi Kitayama	Mitsubishi Electric Corp. Communication Systems	Japan
Mr. Koshiro Kitazato	BT	Japan
Mr. Iouri Kiyachev	Russian Satellite Comm Co	Russia
Mr. Wolfgang Kleinwachter	Funk Correspondent Koln	Germany
Mr. Larry Knecht	Micronesian Telecommunications Corp.	CNMI
Mr. Alan Knight	BT	United Kingdom
Mr. Anthony Knight	GTE International - Asia Pacific	USA
Mr. Brian Knight	CPI Inc.-SATCOM Division	USA
Mr. Peter Knight	Telstra Japan	Japan
Mr. Ric Knight	PrimeTEC International, Inc	USA

Mr. Tapio Knuutila	IT-International Telecom Inc	Canada
Mr. Tomihiro Kobata		Japan
Mr. Masaaki Kobayashi	Research Institute of Telecom and Economics	Japan
Mr. Atuyuki Kodama	Fujitsu Limited Int'l Telecomm Business Group	Japan
Mr. Paul Kodama	Teleschool Branch, Dept. of Education	USA
Mr. Alan Koenigsberg	MediaOne International	Singapore
Dr. Eui Koh	INTELSAT-Asia Pacific	Singapore
Mr. John Koh	Project Oxygen Ltd.	Bermuda
Mr. Jim Kolsrud	STAR Telecommunications	USA
Dr. Sowri Komandur	Dept of Telecoms India	India
Mr. Keigo Komuro	Mitsubishi Electric Corp	Japan
Dr. Kimio Kondo	Nat'l Institute Multimedia Ed	Japan
Mr. Lucas Koons	GTE Internetworking	USA
Mr. John Kopinski	COMSAT Corporation	USA
Mr. Yasuo Koseki	KDD Engrg & Consulting Inc	Japan
Mr. Toshio Kosuge	University of Electro-Comms	Japan
Mr. Yasukuni Kotaka	JATES-Japan Techno-Economics Society	Japan
Mr. Moriya Koyama	PTC Japan Committee	Japan
Mr. Ron Koza	GTE Hawaiian Tel	USA
Mr. Steven Kozlowicki	Cignal Global Communications Inc	USA
Mr. B. Joseph Krabacher	Panda Communications Limited	USA
Mr. Gary Krach	GTE Washington Office International Department	USA
Mr. Steve Kracht	SBC Long Distance	USA
Mr. Louis Krcelic	Sprint Corporation	USA
Ms. Arlene Krebs	New Orbit Communications	USA
Mr. Johan Kremer	BELGACOM	Belgium
Mr. John Krzywicki	Cambridge Strategic Mgmt Group	USA
Dr. Ratnarajah Kularajah	Lockheed Martin Telecommunications	USA
Mr. Conny Kullman	INTELSAT	USA
Mr. Paul Kullman	Embassy of The United States of America	People's Rep. of China
Mr. Nirendra Kumar	FINTEL-Fiji Int'l Telecom Ltd	Fiji

Dr. Andrew Kuniyuki	College of Marshall Islands	Rep of Marshall Islands
Mr. Allen Kupetz	Kpartnerz	USA
Mr. Michio Kuroda	KDD-SCS	Japan
Mr. Shigeo Kurokawa	Space Systems/Loral	Japan
Mr. Shuji Kusuda	Research Institute of Telecom and Economics	Japan
Mr. Andrew Kwok Wing Pong	Teleglobe	USA
Mr. Samuel Kwon	Paul Weiss Rifkind Wharton	USA
Ms. Maylynne Lagua		USA
Mr. Yves Laliberte	AlphaNet Telecom Inc	Canada
Mr. Derek Lam		Hong Kong, China
Mr. Henry Lam	Pacific Star Communications Co Ltd	Hong Kong, China
Mr. Lee Lam	Pacific Star Communications Co Ltd	Hong Kong, China
Mr. Pius Lam	Elephant Talk, Inc.	Hong Kong, China
Mr. SuiMan Lam	UH Manoa - Student	USA
Mr. Richard Land	U.S. Electrodynamics Inc.	USA
Ms. Diane Landau	Global Resources	USA
Ms. Julie Langford-Brown	WORLDxCHANGE Communications	Australia
Mr. Jason Langston	New Global Telecom, Inc.	USA
Mr. Richard Larios	SBC International Development	USA
Mr. Pete Larraree		USA
Mr. Randall Larsen	UH - Manoa	USA
Mr. Bryan Larson	Commerce International Group,	Republic of Korea
Mr. Gary Larson	Larson Communication Engineers	USA
Dr. David Lassner	University of Hawaii	USA
Mr. Paul Latchford	Bechtel Telecommunications	USA
Mr. Tak Lau	WorldCom	Hong Kong, China
Mr. Clifford Laughton	Columbia Communications Corp	USA
Mr. James Lavin	Switch & Data Facilities Co	USA
Mr. Paul Lawler	Net Results	USA
Mr. David Lawrence	Pacific Gateway Exchange	Australia
Mr. Bruce Lawson	Call-Net Enterprises	USA
Mr. Quoc Le	Pacific Telecomm Council	USA
Dr. SeungKoog Le	ETRI	Republic of Korea
Mr. Fernand Le Maire	Startec Global	USA

Ms. Anne LeBoutillier	Tyco Submarine Systems Ltd.	Singapore
Ms. Debra Leclerc	Fonorola	USA
Mr. Raynald Leconte	France Telecom	France
Mr. Jose Lecour	AT&T	USA
Mr. Timoci Ledua	Fiji International Telecom Ltd	Fiji
Mr. Anthony Lee	Alcatel Philippines Inc.	Philippines
Mr. Bong Hoon Lee	Seoul Mobile Telecom	Republic of Korea
Mr. Chong-Dong Lee	Global One	Republic of Korea
Mr. David Lee	Global Crossing	USA
Mr. Dongwon Brian Lee	Korea Telecom	Republic of Korea
Mr. Eun Ouk Lee	Japan Advanced Institute Science and Technology	Japan
Mr. Jung-Wook Lee	Korea Telecom	Republic of Korea
Mr. Nick Lee	Innosys dba Callsave Telecom	USA
Mr. Sang Chul Lee	Korea Telecom Freetel	Republic of Korea
Mr. Trey Lee	Nortel Networks	USA
Mr. Wai Lee	Compaq	USA
Mr. Wai Lee	Nortel Networks	USA
Mr. Ying Ngok Lee	Cisco Systems Pte. Ltd.	Singapore
Mr. F. Donald Lehrmann	Infotel International Inc.	USA
Ms. Jodi Lehrmann	Infotel International Inc.	USA
Mr. Yi-Shun Leng	APT Satelitte Holdings Limited	Hong Kong, China
Mr. Carl Leon Guerrero	Guam Telephone Authority	Guam
Mr. Jose Leon Guerrero	Guam Telephone Authority	Guam
Mr. Michael Leonard	The Fantastic Corporation (Asia-Pacific) Pte. Ltd	Singapore
Mr. Martin Leone	KDD Submarine Cable Systems	USA
Mr. Keng Thai Leong	Telecom Authority of Singapore	Singapore
Ms. Julia Leonhardt	STAR Telecommunications	USA
Mr. Ronald Lepes	Chase Securities Inc.	USA
Ms. Nicole Lescarbeau	T Soja & Associates Inc	USA
Mr. P A Lessells	BT Worldwide Ltd.	People's Rep. of China
Mr. Richard Letter	Gnome Group, Inc., The	USA
Ms. Reva Leung	Bellcore	USA
Mr. William Leung	Asia Satellite Telecom Co. Ltd.	Hong Kong, China

Mr. Alan Levy	Econophone Inc.	USA
Mr. James Levy	SRCI/Bell	Canada
Mr. Jonathan Levy	IDT Corporation	USA
Mr. Larry Levy	GTE Information Systems Division	USA
Ms. Jenny Lewis	Ericsson	USA
Mr. Baoming Li	Asia Pacific Mobile Telecomm Satellite (APMT) Pte. Ltd.	Singapore
Ms. Wan-Ying Li	Hawaii Pacific University	USA
Mr. Steve Liddell	WorldCom Asia Pacific	Hong Kong, China
Mr. Fong Lien	Associated Press	USA
Mr. Chong Lim	Drew & Napier	Singapore
Mr. Craig Lin	MKY Telecommunications USA, Inc.	USA
Mr. Sean Lin	Vertex	USA
Mr. W. K. Lindhorst	AT&T Corporation	USA
Mr. Matthew Link	Palau National Communications	Republic of Palau
Mr. Frederick Lins	UH Manoa - Student	USA
Mr. Bruce Linton	Crosskeys Systems Corp.	Canada
Mr. Andrew Lipman	Directsat Corp (Swidler & Berlin)	USA
Mr. George Lissandrello	AVIRNEX Communications Group	USA
Mr. Tim Lister	CNN Intenational	USA
Mr. Fredric Litto	University of Sao Paulo	Brazil
Mr. Alex Liu	A. T. Kearney Inc	Hong Kong, China
Mr. Po-Li Liu	Taiwan Institute of Economic Research	Japan
Mr. Wellington Liu	Tsar & Tsai Law Firm	Taiwan
Mr. Zachary Lo	PTC	USA
Mr. Jamie Logan	University of Hawaii	USA
Mr. Jim Logan	N.E.T.	USA
Mr. Timothy Logue	Coudert Brothers	USA
Mr. Geoff Long		Singapore
Mr. Brian Lookofsky	The Boeing Company	USA
Mr. Rafael Lopez	ABS-CBN International, NA	USA
Mr. Mark Lopianowski		Canada
Ms. Caroline Lord	Teleglobe Canada	Canada
Mr. Ming Louie	Globalstar	USA
Mr. Stephen Lovas	Pacific Telecom Cable Inc	USA

Ms. Caroline Lovell	Clayton Utz.	Australia
Mr. Alan Lowe	BT	United Kingdom
Mr. Allen Lowry	PacAmTel	New Zealand
Mr. Suixi Lu	ChinaSat	USA
Mr. Jan Lubin		USA
Mr. Donald Lubitz	Friends of Learning Inc.	USA
Mr. Danny Lui	CrossKeys Systems Corp	Hong Kong, China
Mr. Nikolay Lukyantsev	Russian Satellite Comm Co	Russia
Mr. Burt Lum	Honolulu Advertising	USA
Ms. Cherisse Lum	Umiversity of Hawaii - Student	USA
Mr. Matthew Lum	Kaleo O Hawaii	USA
Mr. Raymond Lum	Guam Public Utilities Commission	Guam
Mr. Chris Lund	Siemens Business Services	Indonesia
Ms. Vivian Luo	Hughes Communications Inc.	USA
Mr. Gordon Lyall	Racal Pelagos, Inc.	USA
Mr. Thomas Lycan	Project Oxygen, Ltd.	Bermuda
Mr. Grahame Lynch	Telecom Asia Magazine	Hong Kong, China
Mr. John Lynn	EDS	USA
Mr. Phil Lyons	Guam Cellular & Paging	USA
Mr. Sung Ma	Shinawatra Int'l Public Co. Ltd.	Thailand
Mr. Vincent Ma	New T&T Hong Kong	Hong Kong, China
Mr. Raymond MacDonald	Oracle Corporation	Canada
Ms. Diane MacFarlane	BC Tel International	Canada
Ms. Kimberley MacIntyre	Global Crossing	USA
Mr. Andrew Maclean	Alcatel Submarine Networks	Australia
Ms. Jessica Madoc-Jones	The Yankee Group	USA
Mr. Logovi'i Magalei	American Samoa Telecom Authority	American Samoa
Mr. Malu Mageo	American Samoa Telecommunications Authority	American Samoa
Mr. Peter Magnus	Hermes Europe Railtel	Belgium
Mr. Steven Mah	BC TEL International	Canada
Mr. Rakesh Mahajan	Ernst & Young	Australia
Mr. Michael Mahoney	VIATEL Incorporated	USA
Ms. Rana Mahoutchi	Pacific Telecom Council	USA
Dr. Eng. Mai Liem Truc	Directorate General of Posts	Vietnam

Mr. Lawrence Malone	VIATEL Incorporated	USA
Mr. Robert Maloney	PCI Communications Inc	Guam
Mr. Lemeki Malu	Tonga Telecoms Commission	Tonga
Mr. Lap Man	LinkAGE	Hong Kong, China
Mr. Sheel Manchanda	AT&T	USA
Mr. Frank Mancuso	MCI International	USA
Mr. David Manion	Hutchison Corporate Access (HK) Ltd	Hong Kong, China
Mr. Anthony Manna	Orbital Sciences Corporation	USA
Mr. John Manock	T Soja & Associates	USA
Mr. Michael Marcovici	Lucent Technologies Inc	USA
Mr. William Margiotta	Wavelynx International, Inc.	USA
Mr. Jose Marques	WorldPort	USA
Mr. David Martin	Project Oxygen Ltd.	Bermuda
Mr. Michael Martin	Telesat Canada	Canada
Mr. Robert Martin	Office for Gov't Info & Comm Svcs.	Australia
Mr. A. Martinez	KDD America	USA
Mr. Pedro Martinez	Guam Telephone Authority	Guam
Mr. Robert Mascola	Guam-Philippines Cable LLP	USA
Mr. Rod Masterton	World Information Technologies	Hong Kong, China
Mr. Brian Masutani	GTE Hawaiian Tel	USA
Mr. James Matsui	DOE--Maui District Office	USA
Mr. Keith Matsumoto	PICHTR	USA
Mr. Kyle Matsumoto	Hawaii's Web & Internet News	USA
Mr. Takemichi Matsuno	Fujitsu Limited	Japan
Mr. Katsutake Matsuoka	Space Communications Corp.	Japan
Mr. Paula Mau	Deputy Secretary	Tonga
Ms. Alison Mazur	CIBC Openheimer Corp.	USA
Mr. William McAleer	ITM - Carrier Transport Services - Technology Support	USA
Mr. Paul McCann	Telstra	Australia
Ms. Dawn McCarthy	World Digitel Corporation	USA
Dr. William McCaughan	Texas Tech University	USA
Mr. Alexander McClain	SkyTiger Internet Services/USAsia Telecom, LLC	USA
Mr. Finn McClain	PacifiCom Corporation	USA

Ms. April McClain-Delaney	Sky Tiger Internet Services, Inc	USA
Ms. April McClain-Delaney	SkyTiger	USA
Mr. Stephen McClelland	Telecommunications International	United Kingdom
Mr. Brian McClintock	PT & T Telecom Inc.	USA
Mr. Kevin McConnaughey	Network Plus Inc.	USA
Mr. Paul McCoy	Heald College	USA
Mr. William McCrum	Department of Industry	Canada
Mr. Sean McDevitt	Cambridge Strategic Management	USA
Mr. Hamilton McDonald	PB Telecommunications	USA
Mr. John McGowan	PrimeTEC International, Inc	USA
Mr. Patrick McGranahan	Hawaii's Web & Internet News	USA
Mr. Michael McGrath	Macquarie University	Australia
Mr. Michael McGuirl	AT&T	USA
Mr. Peter McHugh	Viatel Global Communications	United Kingdom
Ms. Dawn McKay	Space Systems/Loral	USA
Mr. David McKendry	Stentor Resource Centre Inc	Canada
Mr. Thomas McKeown	Vista Group International	USA
Mr. W. McKibben	McKibben Communications, Inc.	USA
Mr. David McLeod	Cisco Systems	Australia
Mr. Jack McMaster	Qwest Communications	USA
Mr. David McNeill	American Institute In Taiwan	Taiwan
Mr. James Meadows	PrimeTEC International, Inc.	USA
Mr. Dan Meessmann	Motorola	USA
Mr. Barbar Mennah	OPTUS Communications	Australia
Mr. John Joseph Mercado	Isla Communications Co., Inc.	Philippines
Mr. John Mercogliano	Global Crossing	United Kingdom
Ms. Sharina Mesenburg	Space Systems/Loral	USA
Mr. Robert Mesloh	Tyco Submarine Systems Ltd	USA
Mr. Smail Metadjer	France Telecom	France
Mr. Henry Meyer	Kamehameha Schools	USA
Mr. Henry Meyerhoff	ITU Newsletter	Switzerland
Mr. Tedson Meyers	Coudert Brothers	USA
Mr. Christian Michaud	Teleglobe Interational Corp	Canada
Dr. Bruce Middleton	Asia Pacific Aerospace Consultants Pty Ltd	Australia

Mr. Alain Mignot	Cisco Systems Inc.	Australia
Mr. Tatuo Mikami	DDI Corporation	Japan
Mr. Randy Mikesell	ASEM Corporation	USA
Mr. Lowell Miles	Fusion Telecommunications	USA
Mr. Jerry Miller	Alcatel Submarine Networks	USA
Mr. Terry Miller	New Media Corporation	Hong Kong, China
Mr. Tom Miller	SBC Long Distance	USA
Mr. Richard Mills	Kamehameha Schools	USA
Mr. Daniel Miron	AMI Telecommunications (US) Inc.	USA
Mr. John Mitchell	Telecom New Zealand Limited	New Zealand
Ms. Zyola Mix	UH of Manoa	USA
Mr. Dan Miyamoto	Teleschool Branch, Dept. of Education	USA
Ms. Ellen Miyasato	HERN / DOE	USA
Mr. Yukio Mizuochi	Fujitsu Limited	Japan
Ms. Paula Mochida	University of Hawaii System	USA
Mr. Kozaburo Mochizuki	NTT Worldwide Network Corporation	Japan
Mr. Seiki Mochizuki	KDD Submarine Cable Systems Inc	Japan
Mr. Mo Modabber	COMPAQ Computer Corporation	Australia
Mr. Mike Moehle	PrimeTEC International, Inc	USA
Ms. Neda Moeini	ARC Phone Canada Inc. O/A Gold Line	Canada
Mr. Thomas Moffet	Amsterdam Pacific Securities LLC	USA
Mr. Thomas Moffet	Amsterdam Pacific Securities LLC	USA
Mr. Abdul Malek Mohamed	Telekom Malaysia Berhad	Malaysia
Ms. Cynthia Monsour	Hawai`i Pacific University	USA
Ms. Hanna Montgomery	International Telecom, Ltd.	USA
Mr. Gregory Moore	MG Capital	USA
Mr. Keith Moore	Lockheed Martin Co.	USA
Mr. Kevin Moore	BT Alex Brown Inc.	USA
Ms. Kori Moore	Telscape Internqtional	USA
Prof. Elizabeth More	Macquire University	Australia
Mr. Neil Morgan	North American Gateway	Canada
Mr. Toshiyuki Mori	AT&T Jens	Japan
Mr. Kazuhiro Morishita	Hitachi Ltd	Japan
Mr. Jon Morris	Cable & Wireless Plc.	Tonga
Mr. Stephen Morris	University of San Francisco	USA

Mr. Rick Mortellaro	Loral Skynet	USA
Mr. Anthony Mosley	GTE Pacifica - Saipan	CNMI
Mr. Daryl Mossman	Space Systems/Loral	USA
Mr. Rudy Mounayyer	TC2 International Ltd	USA
Ms. Cecilia Mukai	University of Hawaii	USA
Mr. Mark Mulcahey	Cambridge Strategic Management Group	United Kingdom
Mr. Michael Mulcahy	ESG Communications Inc	USA
Mr. John Mulhern	North American Cellular Network	USA
Mr. Kevin Mulholland	FSM Telecommunications Corp	Fed. States of Micronesia
Mr. Ken Munechicka	State of Hawaii DBEDT	USA
Mr. Derek Munn	Cable & Wireless Communications	United Kingdom
Ms. Monica Munro	UH Manoa	USA
Mr. William Munson	Oracle Asia Pacific	Malaysia
Mr. Kazuo Murayama	Japan Telecom Co., Ltd.	Japan
Ms. Roanne Muronaga	UH Manoa	USA
Mr. Daniel Murphy	U.S. Electrodynamics Inc.	USA
Mr. Tom Murphy	Pacific Gateway Exchange	USA
Mr. Michael Musa	Ameritech International	USA
Mr. Louis Muscarella	MilleCom, Inc.	USA
Ms. Jennifer Mutch	Pacific Telecom Cable Inc	USA
Mr. Roger Naff	Hughes Space & Comm Co	USA
Mr. Trevor Nagel	Shaw Pittman Potts Trowbridge	USA
Mr. Dominique Nagy	Royal PTT Telecom Netherlands	Netherlands
Ms. Sharon Nakama	Pacific Telecom Council	USA
Masafumi Nakamura		Japan
Mr. Yusuke Nakano	Forval International Telecom Inc	USA
Mr. Satish Nambisan	National University of Singapore	Singapore
Mr. William Nations	Space Systems/Loral	USA
Mr. Daniel Nauer	GTE	USA
Ms. Ludmilla Naumova	Lockheed Martin Intersputnik Ltd.	United Kingdom
Mr. H. Thomas Navasero	H.T. Telesis, Inc.	Philippines
Mr. Ronald Neal	Motorola	USA
Mr. Michael Nechamkin	BT Alex.Brown	USA

Mr. Stanley Neijd	Telia	Sweden
Ms. Billie Nejedly	Power Conversion Products LLC	USA
Ms. Louisa Ng		USA
Ms. Mary Ng	Hongkong Telecom	Hong Kong, China
Mr. Danny Ngai	Startec Global Communications	USA
Mr. Jimmy Nguyen		USA
Mr. Lo Chi Nguyen	Lucent Tehnologies	USA
Mr. Richard Nickelson	Pacific Telecomms Council	USA
Mr. Katsutoshi Nidaira	NTT Wireless Systems Laboratories	Japan
Mr. Wayne Nielsen	SAIC	USA
Mr. Gijsbert Nieuwenhuijs	C & C Technologies	Hong Kong, China
Mr. Dennis Niimi	GTE Hawaiian Tel	USA
Dr. Yasuhiko Niiro	KDD Submarine Cable Systems Inc	Japan
Mr. Tetsuya Niki	StarHub Pte. Ltd.	Singapore
Mr. Ronald Nishi	GTE Hawaiian Tel	USA
Mr. Keith Nissen	Network Technologies Int'l Inc	USA
Mr. Kunihiko Niwa	NEC Corporation	Japan
Mr. Bob Nobis	SSE Technologies	USA
Mr. Dennis Noe	Heald	USA
Mr. Masafumi Nogawa	NTT Network Service Systems Laboratories	Japan
Ms. Nancy Nolting	COMSAT World Systems	USA
Mr. Joakim Norlov	Hawaii Pacific University	USA
Ms. Dianne Northfield	CIRCIT	Australia
Mr. George Novelli	INMARSAT	United Kingdom
Mr. Jerry Nowicki	Janco Associates	USA
Ms. Daphne Nutter	Viatel	USA
Mr. Rick Nyman	IXC Communications, Inc	USA
Mr. Thomas O'Connor	Frontier Communications	USA
Mr. Jerry O'Loughlin	VIP Calling, Inc.	USA
Mr. Joe O'Neal	Teleglobe	USA
Mr. Jason O'Neil	Int'l Technologies Inc	USA
Mr. Brett O'Riley		New Zealand
Mr. Mark O'Shaughnessy	AT&T Corporation	USA
Mr. Norman OKAMURA	PEACESAT	

Mr. Charles Obichang	Palau National Communications Corp.	Republic of Palau
Mr. Toru Ogawa	Japan Telecom Co., Ltd.	Japan
Dr. Michael Ogden	University of Hawaii at Manoa	USA
Mr. Ei Sun Oh	University of California, Davis	USA
Mr. Hideo Ohkubo	Forval International Telecom, Inc.	USA
Mr. Darin Ohlandt	Iridium LLC	USA
Mr. Hajime Ohta	NEC Corporation	Japan
Mr. Tohru Ohta	KDD Submarine Cable Systems Inc	Japan
Ms. Deborah Okamura	GTE Hawaiian Tel	USA
Mr. Harold Okamura	PEACESAT	USA
Mr. Yasuo Okuyama	Japan Satellite Systems Inc.	Japan
Mr. Graham Oldreive	Cable & Wireless (Pacific)	Fiji
Mr. Jose Olives	ABS-CBN International	USA
Mr. Lionel Olmer	Paul Weiss Rifkind Wharton & Garrison	USA
Mr. Dean Olmstead	SES/Astra	Luxembourg
Mr. Jack Olson	FORTEC, Inc.	USA
Mr. Stefan Olsson	Telia Asia Limited	Hong Kong, China
Mr. Andrew Ong	Drew & Napier	Singapore
Dr. Ryota Ono	Nanyang Technological University	Singapore
Mr. Chaz Ontai		USA
Mr. Richard Orfalea	Kinko's International, Inc.	USA
Mr. Reynie Ortiz	Qwest Communications	USA
Mr. Donald Oswald	RSL COM Asia Pacific Ltd	Hong Kong, China
Mr. Steven Ott	ITXC Corporation	USA
Mr. Edward Outlaw	StarHub Pte Ltd	Singapore
Mr. Hao Ouyang	Legend Group Co.	People's Rep. of China
Mr. Phillip Overmyer	AT&T Corporation	Singapore
Mr. Edward Owens	Harvard Capital Group	USA
Mr. Albert P'an		USA
Ms. Sunyeen Pai	University of Hawaii	USA
Mr. Raman Palaniappan	StarHub Pte. Ltd.	Singapore
Mr. Virgil Palmer	Air Products & Chemicals Inc.	USA
Ms. Sonia Pamatmat	PhilCom Corporation	Philippines
Mr. Hui Pan	Information Gatekeepers Inc.	USA
Ms. Lola Pang	University of Hawaii	USA

Mr. Semisi Panuve	Tongasat	Hong Kong
Mr. Lawrence Paratz	Telstra	Australia
Mr. David Park	OneTel	Republic of Korea
Mr. Meyung Park	SK Telecom	Republic of Korea
Mr. Soo Jin Park	Hansol PCS Co. Ltd.	Republic of Korea
Dr. Tae-Woong Park	ETRI	Republic of Korea
Dr. Abdul Parker	Qatar Public Telecom Corp	Qatar
Ms. Margaret Parker	UH Manoa	USA
Mr. Robert Parker	Hughes Space & Comm Co	USA
Mr. Thomas Parkinson	The Boeing Company	USA
Ms. Elizabeth Parsons	Virtual Photonics Incorporated	Germany
Mr. Mike Pascoe	BT	Australia
Mr. Stefano Pascucci	ALPHA-TEL	USA
Ms. Marie-Vicente Pasdeloup	Arianespace, Inc.	USA
Mr. Edoardo Pastore	Telecom Italia	Japan
Mr. Andy Paul	ViaSat	USA
Ms. Arlene Paul	Global One	USA
Mr. Rudy Paul	Marshall Is Natl Telecom Auth	Rep of Marshall Islands
Mr. Chris Pearce	Iridium South Pacific	Australia
Ms. Jacolyn Peebles	J.D. Edwards & Company	USA
Ms. Hildegard Peltier	Alcatel Submarine Networks	France
Mr. Talitiea Pemila	Samoa Posts & Telecom	Samoa
Ms. Kellie Pendras	UH Manoa	USA
Ms. Medi Pepper	Lucent Technologies Inc	Philippines
Mr. Will Peratino	Defense Acquisition University	USA
Dr. M.W. Petruk	CCDIC University of Alberta	Canada
Mr. Alan Petts	OPTUS Communications	Australia
Mr. Ross Pfeffer	Southern Cross Cables Ltd.	New Zealand
Mr. Tim Pfeiffer	IXC	USA
Mr. Ed Pfund		USA
Ms. Erin Pham	Iridium LLC	USA
Mr. Robert Phillips	COMSAT Corporation	USA
Mr. Brian Piccioni	Frontier Communications Services, Inc.	USA
Dr. Mario Pietrogrande	NETPLAN	Italy
Mr. Russell Pipe	I-Ways	USA

Mr. Ted Pitman	Information Gatekeepers	USA
Dr. Eshwar Pittampalli	Lucent Technologies	USA
Mr. George Plucienkowski	Project Oxygen Ltd.	Bermuda
Mr. Honorio Poblador	Philippine Comm Satellite Corp	Philippines
Mr. William Pomeranz	Hughes Space & Comm Co	USA
Mr. Andrew Poole	StarGuide Digital Networks	USA
Mr. Clive Poolman	AAP Telecommunications Limited	Australia
Mr. Don Popadick	ATT Canada Enterprises	Canada
Mr. Barry Porter	Global Crossing	USA
Mr. Barry Porter	Sprint	USA
Mr. Mark Posen	Tongasat	United Kingdom
Mr. John Poston	BT	United Kingdom
Mr. Dan Powdermaker	VIP Calling, Inc.	USA
Mr. John Powell	ESG Communications Inc	USA
Mr. Kirk Powles	UH Manoa	USA
Mr. Anil Prakash	PTC India Foundation	India
Mr. Ivon Prasad	Pacific Telecom	Fiji
Mr. Samudra Prasetio	PT Telekom Indonesia	Indonesia
Ms. Jean Prewitt	Podesta Associates Inc.	USA
Mr. John Pricken	Bell Atlantic	USA
Mr. Jaime Prieto	TRW Inc.	USA
Mr. Gary Pulliam	The Aerospace Corporation	USA
Mr. Gilbert Pun	UsAsiaCom, Inc.	Hong Kong, China
Mr. Rafael Purificacion	I-Ways	USA
Ms. Terrey Quindlen	Space News	USA
Mr. Fred Radewagen	The Washington Pacific Report	USA
Mr. Fazlur Rahman	South Asia Multi Media	Bangladesh
Ms. Davinder Rai	BT	United Kingdom
Mr. Richard Ramlall	BECHTEL Telecommunications	USA
Mr. Rex Ramsden	Mensard Limited	United Kingdom
Mr. Richard Rankin	International Space Brokers	USA
Mr. James Ransom	TC 2 International	USA
Mr. Jagadish Rao		USA
Mr. Peter Rappa		USA
Mr. Kamal Raychaudhuri	Lucent Technologies	USA

Mr. Patrick Realis	Alcatel Submarine Networks	USA
Mr. Max Reardon	AT&T/ACC TeleCom	USA
Mr. Tony Recchia	Lucent	USA
Mr. G.A. Redding	Institute for Defense Analyses	USA
Dr. Nanendra Reddy	University of South Pacific	Fiji
Ms. Deanna Reece	TIRM	USA
Mr. Michael Reede	Gilbert & Tobin	Australia
Mr. Clifford Rees	Telegroup, Inc.	USA
Mr. Nakul Rege	MCI International Inc.	USA
Mr. Christian Reinaudo	Alcatel Submarine Networks	France
Mr. Tmeweng Rengulbai	Palau National Communications Corporation	Republic of Palau
Dr. John Renner	Edith Cowan University	Australia
Mr. Steven Richards	American Tower L.P.	USA
Mr. Steven Richards	MicroNet	USA
Mr. Montgomery Richardson	AT&T Canada	Canada
Mr. Andrew Riddle	Southern Cross Cables, Ltd.	New Zealand
Ms. Linda Ristow	Pacific Telecom Council	USA
Ms. Cynthia Ritchie	Lockheed Martin Intersputnik Ltd.	United Kingdom
Mr. Paul Rius	Com Tech International	USA
Mr. John Rivenburgh	Global Connect Partners LLC	USA
Mr. Keith Rivera	KnK Enterprises	USA
Ms. Pattie Rivera	Pacific Telecommunications Council	USA
Mr. Mohammad Rizal	PT Indosat	Indonesia
Dr. Eitel Rizzoni	NETPLAN	USA
Ms. Beth Robbins	Cable & Wireless USA	USA
Mr. Frank Robert	CommStrategies International	USA
Mr. Afa Roberts	American Samoa Telecom Authority	American Samoa
Ms. Jane Roberts	Shaw Pittman Potts & Trowbridge	USA
Mr. Alan Robinson	Cable & Wireless Global Business	
Mr. Martyn Robinson	Solomon Telekom Company Ltd.	Solomon Islands
Mr. Phil Robinson	Sonsub International	United Kingdom
Mr. Jacques Roelandts	Arianespace-Tokyo Office	Japan
Ms. Brooke Rogers	Fort Hays State University	USA
Mr. Dale Rogers	TCS-TeleCommunication Systems	USA

Mr. David Rogers	Micronesian Tel Corp	CNMI
Mr. Robert Rollman	Teleglobe International Corp	USA
Mr. Edward Roney	Motorola Inc	USA
Mr. Christopher Rooney	Cignal Global Communications	USA
Mr. Jeremy Rose	Communication Systems Ltd.	United Kingdom
Ms. Walda Roseman	CompassRose Int'l Inc.	USA
Mr. Marvin Rosen	Fusion Telecommunications	USA
Mr. Karl-Heinz Rosenbrock	European Telecommunications Standards Institute	France
Mr. Giovanni Roso	Centro Studl E Laboratori Telecommunicazioni	Italy
Mr. David Ross	Tyco Submarine Systems Ltd	USA
Mr. Karl Rossiter	Television New Zealand Ltd	New Zealand
Ms. Anne Rostock	Telenor Global Services AS	Norway
Mr. Jose Roxas	Eastern Telecoms Philippines	Philippines
Mr. Michael Ruddy	The Pioneer Report on International Telecom Networks	USA
Ms. Shirley Rudimch	Palau National Communications	Republic of Palau
Mr. Mike Rugala	ICO Global Communications	Singapore
Mr. Peter Runge	Tyco Submarine Systems Ltd	USA
Mr. Paul Rusby	NTL	United Kingdom
Ms. Linda Russell	Level 3 Communications	USA
Mr. John Rutherford	PACAMTEL, LLC	New Zealand
Mr. Ghassan Saade	TC 2 International	USA
Mr. Ron Sable	The Aerospace Corporation	USA
Mr. Kim Sabott	UNOCAL	USA
Mr. Michael Sacharski	GTE China	People's Rep. of China
Prof. Kenji Saga	PECC	Japan
Mr. Tetsuo Sagara	Guam-Philippines Cable LLP	Hong Kong, China
Mr. Henry Saiske	Palau National Communications	Republic of Palau
Ms. Jean Sakai	University of Hawaii - Student	USA
Mr. Koichi Sakata	Japan Telecom Co Ltd	Japan
Mr. George Salamy	TYCO Submarine	USA
Mr. Amer Salem	Lucent Technologies	Philippines
Mr. Geffry Salmon	Of. Des P&T French Polynesia	French Polynesia

Mr. Samuela Samuta	FINTEL-Fiji Int'l Telecom Ltd	Fiji
Mr. Enrique Sanchez	BellSouth International Access	USA
Mr. Wu Sandra		USA
Mr. Cirio Santiago	Eastern Telecomm Philippines	Philippines
Ms. Maureen Santiago	Capitol Wireless Inc	Philippines
Mr. Ramon Santiago	Philippine Long Distance Tel	Philippines
Mr. John Santos	IT&E Overseas Inc	Guam
Mr. Michael Santos	Hughes Network Systems	Philippines
Mr. William Santos	GTE Hawaiian Tel	USA
Dr. Eduardo Saravia	CTC Mundo	Chile
Ms. Lorie Sarmiento	Pacific Telecommunications Council	USA
Ms. Matina Sarris	COMSYS	United Kingdom
Mr. Steve Satir	Tyco Submarine Systems Ltd	USA
Mr. Hideki Sato	IBM Corporation	USA
Mr. Phil Saunders	Northern Telecom Limited	Canada
Mr. James Savage	GTE Service Corporation	USA
Mr. Bharaj Savjani	BT	United Kingdom
Mr. Katsuhito Sawada	Fujitsu Limited	Japan
Mr. Jack Scanlon	Global Crossing	USA
Mr. Joe Scattareggia	DirectNet Telecommunications	USA
Mr. Eric Schade	N.E.T.	USA
Dr. Richard Schaffzin	CPI Satcom	USA
Mr. Artur Schechtman	EMBRATEL	Brazil
Mr. Michael Scheele	New Global Telecom Inc.	USA
Mr. Jorge Reina Schement	Professor of Communications and Information Policy	USA
Mr. Robert Schiff	IDT Corporation	USA
Ms. Anne Marie Schlosser	France Telecom	France
Mr. George Schmelzer	GTE Business Development & Integration	USA
Mr. Dale Schoenberger	Institute for Defense Analyses	USA
Mr. Donald Schroeder	Neptune Communications LLC	USA
Mr. Jim Schueren	Hitachi, Ltd.	USA
Ms. Jeanne Schultz	The Estate of James Campbell	USA
Mr. Ward Schultz	Asia Access Telecom, Inc.	USA

Mr. James Schweigert		Singapore
Mr. Howard Schwiebert	Estate of James Campbell	USA
Mr. Adrian Science	North American Gateway	Canada
Mr. Michael Scogna	Ameritech International	USA
Mr. Mark Scully	New Global Telecom, Inc.	USA
Mr. Jeff Seal	PrimeTEC International, Inc	USA
Mr. Bruce Seaman	San Francisco Consulting Group	USA
Ms. Chrishanne Sebastiampillai	Hawaii Pacific University	USA
Mr. Dennis Seitz	Nortel Networks	USA
Mr. Michael Sellwood	Nortel Japan	Japan
Mr. Aleki Sene	American Samoa Telecom Authority	American Samoa
Mr. Terry Senft	Stentor Resource Centre Inc	Canada
Mr. Jung Uck Seo	SK Telecom	Republic of Korea
Ms. Shirley Serafini	Industry Canada	Canada
Mr. Roger Severance	Severance International, Inc.	USA
Ms. Diana Sharpe	Dibb Lupton Alsop	United Kingdom
Mr. Timothy Shea	Columbia Communications Corp.	USA
Mr. Jay Shedd	Guam Cellular & Paging	Guam
Ms. Virginia Sheffield	GTE Service Corp.	USA
Mr. Ching-Wen Shen	Chunghwa Telecom	Taiwan
Mr. David Sherrard	Stentor Resource Centre Inc	Canada
Mr. Hiroshi Shibata	International Digital Comms Inc	Japan
Mr. Andrew Shields	RSL Communications Ltd	USA
Dr. Jyh-Mou Shih	Suretone Communications Co., Ltd	Taiwan
Mr. Ernest Shima	PEACESAT	USA
Mr. Ted Shimizu	Hughes Electronics Japan Co.	Japan
Mr. Heon Cheol Shin	SK Telecom	Republic of Korea
Mr. Takeuchi Shinichi	Research Institute of Telecomm and Economics	Japan
Mr. Hiromu Shioyama	Ocean Cable Co Ltd	Japan
Mr. Dave Shirt	Gemini	United Kingdom
Mr. Mark Shlien	Loral Skynet	USA
Mr. Xiu Zhen Shu	Shanghai Institute of Architectural Design	People's Rep. of China
Mr. Tatsushiro Shukunami	Kobe University School of Business	Japan

Mr. Harley Shuler	Loral Skynet	USA
Mr. Sam Silverstein	Space News	USA
Mr. Robert Simek	The Boeing Company	USA
Mr. Andrew Simpson	Telesphere Pty Ltd	Australia
Mr. Tim Simpson	Siemens	USA
Ms. Wendy Simpson	Alcatel	Australia
Mr. Braham Singh	Teleglobe International Corp	USA
Mr. Joseph Singh	Telecom Fiji Limited	Fiji
Mr. Pratap Singh	Telecom Fiji Limited	Fiji
Dr. Supriya Singh	CIRCIT	Australia
Ms. Patti Singleton	Phil Singleton Research Pty Ltd	Australia
Mr. Phil Singleton	Phil Singleton Research Pty Ltd	Australia
Mr. Joseph Sinreakena	Telikom PNG	Papua New Guinea
Mr. Robert Sirko	The Boeing Company	USA
Ms. Heather Sirr	WCI Cable, Inc.	USA
Mr. Cesar Sison	Globe Telecom GMCR Inc	Philippines
Mr. Graciano Sitchon	Department of Transportation & Communications	Philippines
Mr. Daniel Sjoberg	Telia North America	USA
Dr. Edward Slack	COMSAT Mobile Communications	USA
Mr. Jeff Slater	TotalTel Carrier Services	USA
Mr. Stanton Sloane	Lockheed Martin Co.	USA
Mr. Ove Smidt	Tele Danmark	Denmark
Mr. Daniel Smith	Marshall Is Natl Telecom Auth	Rep of Marshall Isla
Mr. Fred Smith		USA
Mr. Henry Smith	Bellcore International	USA
Mr. Iain Smith	Cable and Wireless	United Kingdom
Mr. Ray Smith	Telecom Asia	USA
Mr. Scott Smith	McKibben Communications, Inc.	USA
Mr. Steven Smith	University of Alaska	USA
Ms. Priscilla Soalablai	Palau National Communications	Republic of Palau
Mr. Jin-Wha Soh	Hansol Telecom Co Ltd	Republic of Korea
Mr. Thomas Soja	T Soja & Associates	USA
Mr. Thomas Solitario	Space Systems/Loral	USA
Mr. Warren Soloduk	Alcatel	USA

Mr. Terry Somers	Galileo International	USA
Min-Zheong Song	Korea Telecom	Republic of Korea
Mr. Clyde Sonobe	Dept of Commerce & Consumer Affairs	USA
Mr. Chiang Soong	StarHub Pte. Ltd.	Singapore
Mr. Bruno Sorrentino	Orbit Telecommunications	Malaysia
Mr. Greg Soulages	Kinko's International	USA
Mr. Thomas Spacek	Bellcore	USA
Ms. Marsha Spalding	TYCO Submarine	USA
Mr. Earl Speaks	Bechtel Telecommunications	USA
Mr. Phillip Spector	Paul Weiss Rifkind Wharton & Garrison	USA
Mr. John Spence		Australia
Mr. Gerry Spencer	BT	United Kingdom
Mr. Mark Spencer	Utah Valley State College	USA
Dr. James Spilker	Stanford Telecommunications Inc	USA
Mr. Gene Spinelli	MCI International	USA
Mr. Ron Spithill	Alcatel	Australia
Mr. David Spitulnik	Motorola, Inc. - GTSG	USA
Mr. Richard Sprince	COMSAT	USA
Mr. Hossur Srikantan	Alliance Network Services	USA
Mr. Henry Stackpole	Asia Pacific Center for Security Studies	USA
Ms. Elaine Stafford	Tyco Submarine Systems Ltd	USA
Mr. Timothy Stamnitz	Global Photon Systems, Inc	USA
Mr. Dennis Standiford	Viatel	USA
Mr. Iain Steele	Concert	Australia
Mr. Daehn Steffen	Kinko's International, Inc.	USA
Ms. Janet Stenzel	PECC Telecomm Forum	USA
Mr. Peter Stenzel	TRW Telecommunications	USA
Mr. Carl Stepath	TIRM	USA
Mr. Bill Stephens	Viatel	USA
Ms. Sally Sterling	Heidrick & Struggles	USA
Ms. Mona Stevenson	Maui Community College/EOC	USA
Mr. James Still	Southwestern Bell	USA
Ms. Lucille Stoddard	Utah Valley State College	USA
Mr. Lee Story	PT & T Telecom Inc.	USA
Ms. Laurie Stovall	Nortel Networks	USA

Mr. Andrew Strunk	University of Wisconsin	USA
Dr. James Stuart	KITCOMM Satellite Comms. Ltd.	USA
Mr. Robert Stuart	CIBC Oppenheimer Corp	USA
Mr. Mark Sturza	3C Systems Company	USA
Mr. Ranjeet Sudan	Cisco Systems	USA
Dr. Minoru Sugaya	Keio University	Japan
Ms. Kyoko Sugimoto	Hawaii Pacific University	USA
Mr. Ryuichi Suguro	Japan Telecom Co., Ltd.	Japan
Ms. Paula Sullivan	Nortel Networks	USA
Mr. Scott Sullivan	North American Gateway	Canada
Mr. Ray Sulsh	SBC International Development	USA
Mr. Macy Summers	STM Wireless	USA
Mr. Libor Susil	AT&T Canada	Canada
Mr. Ewan Sutherland	University of Wales, Lampeter	United Kingdom
Mr. Kusolmongkol Suvarnakudht	Telephone Organization of Thailand	Thailand
Mr. Toshio Suzaki	Mitsubishi Electric Corporation	Japan
Mr. Daniel Suzuki	UH Manla	USA
Mr. Naoshi Suzuki	Japan Satellite Systems Inc.	Japan
Ms. Stacy Swann	StarTec Global Communications Corp	USA
Mr. Ray Sweeney	Columbia Communications Corp	USA
Mr. John Sweitzer	Nortel Network	USA
Mr. Theodore Swindells	WorldPort	USA
Mr. Emilio Taddio	EconoPhone, Inc.	Canada
Dr. Hidenori Taga	KDD Submarine Cable Systems	Japan
Mr. Neil Tagare	Project OXYGEN	Bermuda
Mr. Isao Takada	Toshiba Corporation	Japan
Mr. Sam Takagi	Takagi Consulting/Avirnex	USA
Mr. Jun Takahashi	KDD Corporation	Japan
Mr. Masayuki Takahashi	NTT-Nippon Telegraph & Telephone Corp	Japan
Mr. Nozomu Takasaki	Kanda University of Int'l Studies	Japan
Mr. Yoichi Takashima	NTT-Nippon Telegraph & Telephone Corp	Japan
Mr. Manuel Tamayo	DIGITEL	Philippines

Mr. Katsutoshi Tamura	Fujitsu Ltd. International Telecom Business Group	Japan
Mr. Alan Tan	Global One	Singapore
Mr. Bryan Tan	BellSouth International	USA
Mrs. Kah Rhu Tan	Singapore Telecommunications Ltd.	Singapore
Mr. Quincy Tan	UH Manoa	USA
Mr. Roy Tan	Union Telecom Limited	Hong Kong, China
Mr. Haruo Taneno	DDI Corporation	Japan
Mr. Leo Tang	AlphaNet Telecom Inc	Canada
Ms. Fipe Tanielu-Leitupo	Samoa Post & Telecoms	Samoa
Mr. Kisaburo Taniyama	Mitsubishi Electric	Japan
Mr. Rajeev Tankha	North American Gateway Inc.	Canada
Mr. Michael Tanouye	TIRM - UH Manoa	USA
Ms. Joyce Tao	Student-UHM	USA
Mr. Yong De Tao	San Jiang College	People's Rep. of China
Mr. Ramon Tarrago	Tricom, S.A.	USA
Mr. Robert Tasker	BCTel	Canada
Mr. Ken Tasogawa	KDD-Kokusai Denshin Denwa Co Ltd	Japan
Mr. Martin Tate	BT Global	USA
Mr. Sam Tawfik	PT-1 Communications Inc.	USA
Mr. Chek Khoon Tay	Consultant	Singapore
Mr. Donald Taylor	Tripler Army Medical Hospital	USA
Dr. Richard Taylor	Pennsylvania State University	USA
Mr. Okada Techitong	Palau National Communications	Republic of Palau
Mr. Lopati Tefoto	Tuvalu Telecom Corporation	Tuvalu
Dr. Majid Tehranian	Toda Institute	USA
Mr. Luis Tellez-Giron	REDSAT	USA
Ms. Philomena Temengil	Palau National Communications Corp.	Republic of Palau
Mr. Nobuyasu Teramura	Matsushita Communication Ind. Co. Ltd.	Japan
Dr. Nobuyoshi Terashima	Waseda University	Japan
Mr. Wade Teruda		USA
Dr. Yoshimi Teshigawara	Soka University	Japan
Mr. Manish Thakur	Ellipso, Inc.	USA

Mr. Le Nam Thang	Department General of Posts & Telecommunications	Vietnam
Ms. Emily Thatcher	GCI	USA
Mr. Michael Thio	BT Services	Singapore
Mr. Grete Thoger	Telenor Global Services AS	Norway
Mr. Jean Francois Thomas	France Telecom Japan Co. Ltd.	Japan
Mr. William Thomas	Telemobile Inc.	USA
Mr. Jeremy Thompson	Gemini	United Kingdom
Mr. Winston Thompson	Telecom Fiji Limited	Fiji
Mr. Carl Thorsen	Pricewaterhouse Coupen	USA
Mr. Phillip Thrash	Subic Telecommunications Company, Inc.	Philippines
Mr. Dean Thrush	Qwest	USA
Mr. Bhaskar Thyagarajan	Sprint	USA
Mr. Guodong Tian	China Great Wall Industry	USA
Mr. Laurence Tillett	Defense Information Systems Agency	USA
Mr. Tom Tilton	General Telecom	USA
Mr. Vaililo Timaio	Tuvalu Telecommunications Corp	Tuvalu
Mr. Jon Tingley	Global Crossing	USA
Mr. Clayton Tom	University of Hawaii	USA
Mr. Stephen Tom	Teleport Consulting Group Int'l LLC	USA
Mr. Gregory Tonner	MCI Worldcom	United Kingdom
Mr. Kenichiro Torigoe	Japan Telecoms Eng & Consl Svc	Japan
Mr. Barry Toser	Econophone, Inc.	USA
Mr. Gordon Townsend	NET	USA
Ms. Keiko Toyoshima	Forval International Elecom INc	USA
Mr. Ralph Tozier	CSM Satellite Comm. Services	Indonesia
Mr. Wilbur Trafton	International Launch Services	USA
Mr. Phillip Trapaga	Philippine Global Comms Inc.	Philippines
Dr. Patrick Trischitta	Tyco Submarine Systems, Ltd.	USA
Mr. Arjun Trivedi	Nokia Pvt. Ltd.	India
Mr. John Troy	Telecom Venture Group	Hong Kong, China
Mr. Siu Yan Tsan	Taiwan Fixed Network Co., Ltd.	Taiwan
Mr. Vincent Tsang		People's Rep. of China
Dr. Frank Tseng	SuperSat Telecommunications Inc	Taiwan

Ms. Theresa Tsoi	Elephant Talk, Inc.	USA
Mr. Orton Tsun	University of Hawaii	USA
Mr. Takayuki Tsunoda	KDD Submarine Cable Systems Inc	Japan
Mr. Michael Tu	Gateway Telecommunications Inc.	USA
Mr. Taniela Tufui	Prime Minister's Office	Tonga
Mr. Sakaraia Tuilakepa	FINTEL-Fiji Int'l Telecom Ltd	Fiji
Mr. Herman Tuiolosega	Staff	USA
Mr. Salote Tuita	Tongasat	Hong Kong, China
Mr. Thomas Tulin	Telikom PNG	Papua New Guinea
Ms. Lucy Tupou	Tongasat	Hong Kong, China
Mr. Philip Turits	Fusion Telecommunications	USA
Mr. Barry Turner	Asia Satellite Telecomms (AsiaSat)	Hong Kong, China
Mr. Robert Twining	COMSAT World Systems	USA
Mr. Arthur Tymos	BC TEL International	Canada
Mr. Masayoshi Umeda	NTT Info and Communication Systems Labs	Japan
Mr. Masao Umeno	Avirnex	Japan
Mr. Paul Unger	A .T. Kearney Executive Search	USA
Dr. John Ure	Hong Kong University	Hong Kong, China
Mr. Antonio Urera	Infocom Communications Network, Inc.	Philippines
Mr. Tom Urmanowicz	Global Crossing	USA
Ms. Gloria Ushiroda	UHManoa - Student	USA
Mr. Raymond Uy	Isla Communications Co. Inc.	Philippines
Ms. Marie Vallee	Public Interest Advocacy Centre	Canada
Mr. Vu Van	UH Manoa	USA
Mr. Len Van Der Heyden	Hansol PCS Co., Ltd	Republic of Korea
Ms. Yvonne Van Der Ven	Telesat Canada	Canada
Mr. Paul Van Dorp	ROCOM	New Zealand
Mr. Duyck Van Gorder	Network Technologies Int'l Inc	USA
Mr. Gordon VanderBrug	VIP Calling, Inc.	USA
Ms. Jackie VanderBrug	VIP Calling, Inc.	USA
Ms. Virginia Vann	SBC Long Distance	USA
Ms. Jennifer Varnes	SBC International Inc	USA
Mr. Vernon Vasu	Telecom Authority of Singapore	Singapore
Mr. John Vavul	PTC	USA

Mr. Orlando Vea	Smart Communications Inc.	Philippines
Mr. Martin Veisame	Telikom PNG	Papua New Guinea
Mr. Mel Velarde	H.T. Telesis	Philippines
Mr. Oscar Velasquez	Guam Telephone Authority	USA
Mr. Rasool Verjee	Atlas Telecom Network	Canada
Mr. Leo Victorio	ABS-CBN	USA
Mr. Ronald Vidal	Level 3 Communications, Inc.	USA
Mr. August Viena	American Samoa Telecom Authority	American Samoa
Mr. Lawrence Vierra	RSL Communications Ltd	USA
Mr. Bernard Villagomez	Micronesian Telecomm Corp	CNMI
Mr. Alex Villamar	Philippine Global Comms Inc.	Philippines
Mr. Ted Villinski	Lockheed Martin Global, Inc.	Singapore
Mr. Richard Vincent	WORLDxCHANGE Pty Ltd	Australia
Ms. Marie Vincente-Pasdeloup	Arianespace Inc	USA
Mr. Nelson Vinck	Antillephone N.V.	Netherlands Antilles
Mr. Nestor Virata	Philippine Long Distance Tel	Philippines
Mr. Savenaca Vocea	PITA-Pac Isl Telecomm Assn	Fiji
Mr. Laszlo Vojnar	Transocean Ltd.	Hungary
Dr. Linda Volonino	Canisius College	USA
Mr. Chris Vonwiller	Atlas Travel Technologies Pty Ltd	Australia
Mr. William Wade	Asia Satellite Telecom	Hong Kong, China
Ms. Anita Wadhwani	PTC India Foundation	India
Mr. Joseph Wadsworth	Oceaneering International Inc.	USA
Ms. Jeri Wait	Global Connect Partners LLC	USA
Ms. Jeri Wait	Global Connect Partners LLC	USA
Mr. Hiroharu Wakabayashi	KDD Submarine Cable Systems Inc	Japan
Ms. Peggy Wakeman	Space Systems/Loral	USA
Mr. David Walker	Neptune Communications LLC	USA
Mr. Wayne Walley	Global Telephony	USA
Mr. Jan Wallinder	Telia Mobile AB	Sweden
Mr. Robert Walp	GCI	USA
Mr. Terry Walsh	Cisco Systems Austral8ia Pty. Ltd.	Australia
Mr. Tom Walter	Lucent	USA
Mr. Ed Walvick	San Francisco Consulting Group	USA
Mr. David Wang	MCI WorldCom	Taiwan

Mr. Jing-San Wang	Chunghwa Telecom Co. Ltd.	Taiwan
Mr. Jong Wang	Lee and Li Attorneys At Law	Taiwan
Ms. Ying Wang	Opentel Communications	USA
Mr. Taito Waradi	Telecom Fiji Limited	Fiji
Mr. Ed Ward	International Launch Services	USA
Mr. Kenneth Warnock	Bell Atlantic	USA
Mr. Richard Warren	GTE Information Systems Division	USA
Mr. John Warta		USA
Dr. Martyn Warwick	EMAP Business Publishing	United Kingdom
Mr. Joe Watson	AT&T	USA
Dr. Dan Wedemeyer	University of Hawaii	USA
Ms. Jennifer Wedemeyer	PTC	USA
Mr. Marlon Wedemeyer	University of Hawaii/HENC	USA
Dr. Stefan Weigand	Detecon Gmbtt	Germany
Mr. Larry Wein	AT&T Global Transit	USA
Mr. Fred A. Weismiller	Pacific Gateway Exchange	USA
Mr. Tom Welch	World Digitel Corporation	USA
Mr. Bill Weller	Space Systems/Loral	USA
Mr. Jone Wesele	FINTEL-Fiji Int'l Telecom Ltd	Fiji
Mr. Johan Westerberg	Ericsson	USA
Mr. Richard Westlund	General Communication Inc.	USA
Mr. David Whalen	Lockheed Martin Global Telecom	USA
Mr. Scott Wharton	VocalTec Communications, Inc.	USA
Ms. Misty Wheeler	Pacific Telecom Council	USA
Mr. Bill White	Netscape Communications Corp.	USA
Mr. Brian White	International Center for Comms	USA
Ms. Jianglan White	PEACESAT	USA
Mr. D Whitlow	MCI Worldcom	USA
Mr. David Wickham	Cable & Wireless	United Kingdom
Mr. Gunung Widodo	PT Indosat	Indonesia
Mr. Ken Wieland	Asian Communications	United Kingdom
Mr. I Made Harta Wijaya	PT Indosat	Indonesia
Mr. Ranjeet Wilkhu	Esprit Telecom UK Ltd.	United Kingdom
Mr. Scott Wilkinson	TRW Space & Electronics Group	USA
Mr. Stephen Wilks	OPTUS	Australia

Mr. Bruce Willey	MCI International	USA
Mr. Ben Williams	Motorola Satellite Communications Division	USA
Mr. Charles Williams	SBC International Operations Inc.	USA
Mr. Glen Williams	Infonet Services Corp.	USA
Mr. Larry Williams	AAP Telecommunications Limited	Australia
Mr. Dick Wilson	Avirnex Communications Group	USA
Mr. Kenoll Wilson	World IT	Australia
Mr. Mark Wilson	Cisco Systems, Inc.	USA
Ms. Jenifer Winter	University of Hawaii	USA
Mr. Terje Winther-Hansen	MITEL Enterprises	USA
Mr. Eric Wiswell	TRW Inc.	USA
Mr. John Witherspoon	Western Cooperative for Edu Telecom	USA
Ms. Alice Witt	COMSAT World Systems	USA
Mr. Dag Wold	The Aerospace Corporation	USA
Mr. Jim Wolf	Reuters	USA
Dr. Patrick Wolfe	Barrow Communications Corp	Japan
Mr. Dan Wong	ITELSA	USA
Mr. David Wong	New World Telephone Ltd	Hong Kong, China
Mr. Denis Wong	Denis Wong & Associates	USA
Mr. Jeff Wong	Bell Atlantic	USA
Ms. Margaret Wong	UH Manoa	USA
Mr. Stephen Wong	Williams Global Access Services	Singapore
Mr. Victor Wong	Tyco Submarine Systems Ltd	Singapore
Mr. John Wood	Open Technology	Australia
Ms. Kristine Woodall	Pacific Telecomm Council	USA
Mr. Derek Woods	Stratos Global Corporation	Canada
Mr. Robert Woog	IXnet	USA
Mr. Michael Wooster	Space Systems/Loral	USA
Mr. Bill Wright	Space Systems/Loral	USA
Ms. Robin Wright	Global Crossing	USA
Mr. Mahan Wu	Clarent Corporation	Taiwan
Mr. Robert Wu	Associates & Wu, LLC	USA
Mr. Wei Wu	Li-Ya Company	People's Rep. of China
Mr. Xiaoyun Wu	Nankai University	People's Rep. of China

Mr. Charles Xu	Corning Inc	USA
Mr. Yan Xu	Hong Kong University of Science & Technology	Hong Kong, China
Mr. Florencio Yamada	Palau National Communications	Republic of Palau
Mr. Yoshihiro Yamada	KDD Submarine Cable Systems Inc	Japan
Mr. Shu Yamamoto	KDD R&D Laboratories Inc	Japan
Mr. Takaomi Yamamoto	KDD-Kokusai Denshin Denwa Co Ltd	Japan
Mr. Makoto Yamazaki	NTT Worldwide Network Corporation	Japan
Mr. Hidekata Yanagawa	Japan Asia Network Consulting	Japan
Dr. Chung-Chuan Yang	Nat'l Institute of Tech At Kaohsiung	Taiwan
Mr. Jimmy Yang	Elephant Talk, Inc	USA
Mr. Lionel Yee	Amalgamated Telecom Holdings Ltd.	Fiji
Mr. Michael Yee	GTE Hawaiian Tel	USA
Ms. Yvonne Yee	Pacific Telecom Council	USA
Mr. Lindsay Yelland	Telstra Corporation Limited	Australia
Mr. Chain-Chin Yen	Chunghwa Telecom Labs	Taiwan
Mr. Hsin Yen	IDX International, Inc.	USA
Mr. Wayne Yeung	Teleplus Information Systems Ltd	Hong Kong, China
Mr. Koray Yilmaz	World-Link, Inc.	USA
Mr. Charles Yin	Innosys dba Callsave Telecom	USA
Mr. Edward Ying	Globe Telecom GMCR Inc	Philippines
Mr. Simon Yip	University of Hawaii	USA
Mr. Yoshiki Yokoe	Mitsubishi Electric Corporation	Japan
Mr. Hiyoshi Yokogawa	InfoCom Consultancy Int'l, Ltd	Japan
Mr. Thomas Yoon	Seoul Mobile Telecom, Inc.	Republic of Korea
Mr. Takuya Yoshida	Japan Satellite Systems Inc.	Japan
Mr. Kazu Yozawa	NTT America, Inc.	USA
Mr. Sing-Yau Yu	AT&T Corporation	USA
Mr. David Yuan	Opentel Communications	USA
Mr. Fuyin Yuan	Asia-Pacific Mobile Telecom Satellite (APMT)	Singapore
Dr. Tao Yun	Xindeco-Cenpo Network Company	People's Rep. of China
Mr. Jimmy Yung	FLAG Telecom Asia Ltd	Hong Kong, China
Mr. Stanislaus Yung	UH Manoa	USA
Mr. Randy Zadra	Teleglobe International Corp	USA

Mr. Reinhold Zanoth	Societe Europiennes Des Satellites	Luxembourg
Mr. Chengyong Zhang	World Digitel Corporation	USA
Mr. Kai Yuan Zhen	Southeast University	People's Rep. of China
Mr. Youjing Zheng	CIIED - Chinese Academy of Social Sciences	People's Rep. of China
Mr. Wei Xin Zhong	Environment Supervision & Test	People's Rep. of China
Mr. Scott Zimmer	Educating Everyone Inc.	USA
Mr. Ken Zita	International Telecoms Advisory	USA
Mr. Jack Zsakany	TYCO Submarine	USA
Mr. Chris Zull	Cutler & Company	Australia

PTC'99 Sponsors

ORACLE® Enabling the information gap. http://www.oracle.com

AT&T

AT&T is the world's premier voice and data communications company, serving consumers, businesses and government. AT&T is committed to provide a new generation of universal communications services that put our customers in touch with the people or information they need, whenever they want, wherever they are, in the form most useful to them, at a competitive price. http://www.att.com

HUGHES

Hughes Space & Communication is the world's leading manufacturer of geostationary commercial communication satellites, and is also a major supplier of spacecraft for communications and space exploration to the U.S. government and a builder of weather satellites for the United States and Japan. http://www.hughespace.com

LOCKHEED MARTIN

Lockheed Martin Telecommunications is a leading provider of space-based telecommunications systems and services for the commercial market. Lockheed Martin Management & Data Systems is a leader in systems integration, systems engineering and ground system development for a growing community of commercial organizations. http://www.lmco.com

MCI WORLDCOM

MCI is a leading provider of local-to-global communication services to business, government and residential users. MCI operates one of the world's largest and most advanced digital networks, connecting local markets in the U.S. to hundreds of locations worldwide. The merger between MCI and WorldCom will create MCI WorldCom, a company uniquely positioned in the U.S. local and long distance markets as well as the global data and Internet markets. http://www.mciworldcom.com

NEC

Founded in 1899, **NEC Corporation** is a leading international supplier of electronic products that comprise primarily communications systems and equipment, computer and industrial electronic systems, and electronic devices.
http://www.nec.com

The emerging **City of Kapolei** is a dynamic 21st-century city designed to take forward-thinking businesses into the information age.

There are now 14,000 jobs in the Kapolei area and more than 450 businesses, many of which h are directly linked by fiber optic cable to their offices in downtown Honolulu, the U.S. mainland and Asia.
http://www.kapolei.com/

TELEGLOBE

Teleglobe Communications Corporation is the global carrier unit of Teleglobe Inc., recognized as a world leader in the global intercontinental telecommunications industry. The Teleglobe network includes submarine cable and satellite facilities linking North America with over 240 countries and territories, meeting the global connectivity needs of established and emerging carriers from around the world, as well as those of Internet Service Providers, multinational corporations and broadcasters.
http://www.teleglobe.com

REDCOM LABORATORIES, INC.

REDCOM LABORATORIES INC. is a design, consulting, and manufacturing company specializing in digital telecommunications' cost-to-performance ratio.
http://www.redcom.com

SK Telecom

In 1996 **SK Telecom** successfully launched the first CDMA commercial service in the world. As the 8th largest cellular provider it is ready to make new contributions to global telecommunication development and operations based on its expertise in wireless communications accumulated over the past 15 years, and to leap into the world of total information and telecommunication as a first-class enterprise in the upcoming millennium of the global information society.
http://www.sktelecom.com

中華電信股份有限公司
Chunghwa Telecom Co., Ltd.

Beginning from July 1, 1996, **Chunghwa Telecom Co., Ltd.** (Chunghwa Telecom) succeeded the Directorate General of Telecommunications (DGT) to perform its services operations as a state-owned company, while DGT was restructured to act as a regulatory body only. Such reorganization is intended to implement government liberalization policies, to upgrade service quality for the rapidly growing demands in local telecom markets, and to explore overseas telecom market niches. http://cht.com.tw

Startec Global Communications Corporation is a rapidly growing, facilities- based long distance carrier which markets its services to select international communities that have significant international long distance service usage. http://www.startec.com/

GTE Hawaiian Telephone Company Incorporated, a wholly-owned subsidiary of GTE Corporation (GTE), is a full-service telecommunications provider in Hawaii, the Pacific and Asia. http://www.gte.com/HI/

By, 2001 global telecommunications revenue is expected to reach $106 billion, driven by an increase in minutes, falling prices, and competition. Today, we are the leader in digital switching lines installed in North America, and are second globally. Let us help you succeed in your part of the world. http://www.nortel.com/

Alcatel A world leader in telecommunications systems and equipment as well as related cables and components activities, Alcatel operates in over 130 countries. Alcatel provides complete solutions and services to operators, service providers, enterprises and consumers, ranging from backbone networks to users' terminals. http://www.alcatel.com

Compaq: committed to providing industry-leading solutions for the communications industry, to help you take advantage of the Internet and other new technologies that are reshaping the world of telecommunications. http://www.compaq.com/solutions/telco/

Space Systems Loral Space Systems/Loral is a full-service provider of commercial communications satellite systems and services, including the procurement of insurance and launch services, and mission control operations from its Palo Alto, CA head-quarters. http://www.ssloral.com

AlphaNet Telecom Inc. is a pioneer in the field of digital communications. As a telecommunications provider, our focus is to develop innovative technologies and services that will redefine our industry. http://www.alphanet.net/

Freedom to communicate anytime, anywhere. http://www.iridium.com/

VoiceStream Wireless, Hawaii's premiere digital communication company combines the mobile phone, page, and answering machine in one pocket-sized affordable handset. VoiceStream Wireless was the first to offer Personal Communications Services in the nation. Roam in the United Kingdom, France, Germany, Switzerland, Spain, Italy, Netherlands, or Hong Kong, China. With VoiceStream you "Get More From Life". http://www.voicestream.com/

SBC Communications Inc.

SBC Communications Inc. is a global leader in the telecommunications industry, with more than 36.9 million access lines and 6.5 million wireless customers across the United States, as well as investments in telecommunications businesses in 11 countries. SBC, through its subsidiaries, offers a wide range of innovative services, including local and long-distance telephone service, internet services, wireless communications, paging, and messaging, as well as telecommunications equipment, and directory advertising and publishing. http://www.sbc.com/

CABLE & WIRELESS

Cable & Wireless Global Marine is the world's most experienced marine engineering service company specialising in the planning, installation and maintenance of undersea fibre optic cable systems. The origins of Global Marine can be traced back over 150 years when the first telegraph cable was laid between England and France in 1850. http://www.cwglobalmarine.com/

GST Telecommunications, Inc. headquartered in Vancouver, Washington, provides a broad range of integrated telecommunication products and services-including local dial tone, long distance, Internet, and enhanced data services. http://www.gst.net/

What is PTC?

PTC Meetings Information at PTC99

PTC99 Conference Committee

PTC Leadership

Introduction
The Pacific Telecommunications Council is an international, non-governmental, non-profit organization. The council is regional in nature, embracing members from all countries that play a role in the development of Pacific Telecommunications. Its 600+ members from industry, academia, and government are dedicated to promoting the understanding and beneficial use of telecommunication throughout the entire Pacific Hemisphere—North, Central, and South America, East, South and Southeast Asia, Australia, New Zealand, Melanesia, Micronesia and Polynesia.

Becoming a member of the PTC
Membership is open worldwide to anyone or any entity interested in the Pacific hemisphere and involved with telecommunications, broadcasting, informatics, or digital media and associated fields, within the following categories:

For-Profit Entities[1] are organizations of an essentially commercial nature.

Non-Profit Entities[1] are defined officially as such within their country of origin. Examples include government ministries and departments, educational institutions, foundations, international organizations, associations and charities. Public or parastatal corporations such as PTTs are not considered non-profit entities. If you are unsure of whether your organization fits into this category, contact the PTC office for clarification.

Individual[2] members include professional researchers, academics and retired telecoms professionals who have made a notable contribution to the telecoms field. If your organization is already a PTC member, you may become an individual member in addition to your entity's membership.

Affiliate[3] membership is available to organizations which are unable, because of by-laws or other restrictions, to become full PTC members. Such entities may become affiliate members of the PTC, if eligible. Affiliate members may neither vote in PTC elections nor hold office, but they may enjoy all other benefits of membership.

Student membership is open to bona fide full-time students at reduced rates. Proof of student status is required upon application and for each renewal.

Benefits of PTC Membership

In addition to being a part of a vital and growing organization, members hold voting rights in the Council and receive invitations to attend all Council activities and board meetings. There are special reduced members' rates for the annual PTC conference and PTC publications. PTC has limited office space for members to use when visiting Hawaii. Members receive regularly the Members' Bulletin, the quarterly PTR®, and information on the availability of various reports and studies. Membership dues may be tax deductible. The Council is a tax-exempt organization under section 501 (c) (3) of the US Internal Revenue Code.

Membership Year

The PTC membership year is from 1 February through 31 January. New members must pay one full year's dues in advance. Their first annual renewal on the following 1st of February is adjusted accordingly. Membership for applications received between 1 and 31 January will become effective on 1 February, following review of qualifications and payment of a full year's dues.

1 An entity must have a major interest in the Pacific hemisphere or be able to show a relationship to and interest in the development of telecommunications in the area.

2 An individual member may represent neither an entity nor his or her own firm. Individual membership is open neither to a person who is an officer or owner of a profit-making operation which is not an entity member of the Council, nor to a person who is in a policy-making position with the capability to influence an organization to become a member of PTC.

3 Proof must be presented that the applicant or the applicant's organization is not legally qualified to apply for membership in one of the other categories.

PTC'99 Meeting Schedule

January 16, 1999
PTC Executive Board Meeting

January 20, 1999
PTC Board of Trustees' Meeting
PTC Members' Meeting

January 21, 1999
PTC Committee Meeting
PTC Coordination Meeting
PTC Strategic Planning Committee
PTC Executive Board Meeting

PTC Conference Committee

PTC Conference Committee Chair
ROBERT WALP,
GCI

Vice Chairs
LEIGH BAKER,
Oracle Corporation
MICHAEL FLECK,
Global Vision Satellite Services
ANTHONY GARDINER,
Kensar Telecoms Ltd.
EITEL RIZZONI,
NETPLAN
JIM SAVAGE,
GTE Service Corporation

Committee Members
MUTSUYA ASANO,
IBM Japan
GREGG DAFFNER,
Lockheed Martin Intersputnik
GEORGE DARBY,
Teleport Asia
ROBERT DIMEO,
Digital Equipment Corporation
PAUL GABLA,
Alactel Submarine Networks
JAMES HEBERLE,
MTT, Inc.
AMB. BRADLEY HOLMES,
Bradley P. Holmes & Associates
MARK HUKILL,
Nanyang Tech. Univ.
JAMES JOHNSON,
Attorney at Law
EUI KOH,
INTELSAT-Asia Pacific
DAVID LASSNER,
University of Hawaii
GEORGE LISSANDRELLO,
JMS North America, Inc.
WILLIAM MCCAUGHAN,
Texas Tech University
EDWARD SLACK,
COMSAT Mobile Coms
SUPRIYA SINGH,
CIRCIT
JAN WENDT,
INTELSAT

PTC'99 Leadership

NOTICE

REPRODUCTION BASIS

- [x] This document is covered by a signed "Reproduction Release (Blanket) form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

- [ ] This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").

EFF-089 (9/97)