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ABSTRACT

This proceedings includes the papers presented at the 2002 conference of the Pacific Telecommunications Council (PTC), with its theme "Next Generation Communications: Making IT Work." The PTC2002 annual conference seeks to focus on harnessing the complexities of the broadest range of communications technologies and services for the user. Discussion of ideas on issues included the use of information and communication services, and how social and cultural factors shape and are shaped by the new technologies. Questions included: What are the new applications and services developments for business, industrial, and consumer interests? What models of successful implementation are available? Other topics included: the status, plans, directions, trends, issues, dependencies and critical success factors for effective communication developments in the Pacific Islands, and East, South and Southeast Asia; new developments in wireless communications, network technology, digital technology, broadcasting, fiber optic cable systems and internetworking, and the relationship of these developments to the user needs; policy and regulatory formation as they affect e-commerce, digital divide, broadband deployment, Internet governance and trade in telecoms; and economic and financial views of the industry, including models for funding infrastructure construction, deployment of services, and ways to promote access to the global information infrastructure from developing nations. (AEF)

Next Generation Communications: Making IT Work

Pacific Telecommunications Council 24th Annual Conference Proceedings

Honolulu, Hawaii
January 13-17, 2002

Pacific Telecommunications Council
Conseil des télécommunication du Pacifique
El Consejo de Telecomunicaciones del Pacífico
太平洋電気通信協議会

24TH ANNUAL CONFERENCE

PTC2002

Next Generation Communications: Making IT Work

Organized by the
Pacific Telecommunications Council

www.ptc.org/ptc2002

13–17 January 2002
Hilton Hawaiian Village
Honolulu, Hawaii USA

Conference Sessions

Social/Cultural

Business & Applications

Country / Region

Technology

Policy / Regulatory

Economics & Financing

Monday 14 January 2002– Concurrent Sessions

1400–1530	1600–1730
M.1.1 Development Challenges for the Asia-Pacific Region	**M.2.1** Executive Skills Development in Telecom Industry
M.1.2 Distance Learning/Education	**M.2.2** Business Strategies–Getting to the Customer
M.1.3 Pacific Islands	**M.2.3** China
M.1.4 Network Convergence	**M.2.4** Future Wireless Systems
M.1.5 Fostering Competition	**M.2.5** Regulation in Converging Markets
M.1.6 Fostering and Sustaining an Innovation Economy in Washington State	**M.2.6** Alliances & Strategies for Corporate and National Development

Tuesday 15 January 2002– Concurrent Sessions

1100–1230	1430–1600
T.1.1 Social Shaping of E-Commerce	**T.2.1** IT Services
T.1.2 Existing & Emerging Networks	**T.2.2** Speech Technologies
T.1.3 East Asia	**T.2.3** South Asia
T.1.4 Satellite Delivery	**T.2.4** Future Networking
T.1.5 Universal Service	**T.2.5** Digital Divide
T.1.6 Strategic Issues of Submarine Cables and Network	**T.2.6** Quantitative & Qualitative Elements in Bandwidth & Spectrum Planning

Wednesday 16 January 2002– Concurrent Sessions

0845–1015	1400–1530	1600–1730

W.1.1 Communicating in an Electronic World	**W.2.1** Education, Business and Technologies	
W.1.2 Business Models for Tomorrow	**W.2.2** The Issues: Network Architecture & Knowledge Management	**W.3.2** Special Interest Group Federation of Regional Associations
W.1.3 Southeast Asia		**W.3.3** Oceania
W.1.4 Cable Network Architecture	**W.2.4** Next Generation Cables	**W.3.4** Other Wireless Sytems
W.1.5 E-Commerce	**W.2.5** Wireless & 3G	**W.3.5** Internet Governance
	W.2.6 Bridging the Digital Divide	**W.3.6** Pricing and Forecasting Issues

Social/Cultural

Monday, 14 January 2002
1400–1530
South Pacific III–IV

M.1.1 Development Challenges for the Asia-Pacific Region

Chair:
RICHARD NICKELSON, Senior Advisor, Pacific Telecommunications Council

Telecommunication development has been a central focus of ITU since it was constituted in its present form in 1947. The advent of all-digital telecommunications, including broadcasting and the Internet, has posed new challenges for development, but the digital world also offers unprecedented opportunities for more economical, efficient and reliable services. This session will examine how the new technologies may be applied in the Asia-Pacific region to accelerate the development process and the trade opportunities that arise as a result.

Speakers:

ITU Activities in the Region (View Abstract) (PowerPoint Presentation)

WILLIAM WITHERS, Senior Expert, International Telecommunication Union, Regional Office for Asia and the Pacific, *Thailand*

The speaker will present an overview of the results of the ITU Regional Preparatory meeting for the World Telecommunication Development Conference (Istanbul, March 2002). He will also deal with ITU's ICT/telecom development initiatives and challenges and opportunities in telecommunication development in the South Pacific.

The Importance of Information and Communication Technologies (ICT) in Development

PEKKA TARJANNE, Special Advisor to the Secretary-General of the United Nations on Information and Communications Technology (ICT), United Nations, New York, *USA*

Information and communication technologies (ICT) have attracted the attention of world leaders. The United Nations has responded by commissioning an in-depth study on how best to assure maximum benefit to developing countries. The speaker will present the current status of this work with emphasis on the Asia-Pacific region.

Important Development Initiatives in Asia-Pacific (PowerPoint Presentation)

RICHARD BUTLER, Chairman, AsiaSpace, WorldSpace Asia, *Australia*

With the advent of the WorldSpace system for direct satellite sound broadcasting, satellite communications is finally able to deliver those services for which it is best suited. The speaker will present the most recent developments in hybrid terrestrial/satellite services. He will also talk about the importance of the Volunteers in Technical Assistance (VITA) program for the region.

Post-WTO Opportunities in China's IT/Telecom Sector (PowerPoint Presentation)

DANIEL BRODY, Managing Director, US Information Technology Office, *People's Republic of China*

China has made remarkable progress in increasing teledensity during the past few years. Most remarkable is the number of mobile and Internet connections that have been established. This growth continues at an impressive rate. With the accession of China to the World Trade Organization (WTO), new opportunities arise for trade in telecommunication goods and services, in both directions. The speaker will provide an overview of the current situation in China, especially with respect to new business opportunities for U.S. companies in the world's largest and most rapidly growing market.

back to sessions

Abstract

Information infrastructure development from the 'bottom-up' is an essential ingredient for building a 'digital bridge' to cross the 'digital divide'. One process for identifying the key priorities for information infrastructure initiatives in developing economies is the consensus approach taken by the ITU.

Two essential ingredients for sound information infrastructure development are good governance - both government and corporate.

One of the key challenges confronting the small island states of the South Pacific is the need for more and cheaper international bandwidth, whereas one of the opportunities is the declining unit cost of wireless technologies to deliver basic access.

back to index

William J. Withers

William J. Withers is a senior expert on telecommunications sector reform and finance in the ITU's Asia-Pacific Regional office located in Bangkok, Thailand.

Prior to joining the ITU in 1994, Mr. Withers was president of Telecommunications Terminal Systems, a customer equipment distributor and service provider with its head office in Toronto, Ontario, Canada.

From 1981 to 1987, he held several senior management positions with a major Canadian telecommunications carrier.

From 1974 to 1981, Mr. Withers was the executive director of the province of Ontario's Telephone Commission. In addition, during this period he was appointed by the Canadian government on two separate occasions to participate in federal government telecommunication inquiries. He was also a member of the staff subcommittee on Communications of the National Association of Regulatory Utility Commissions of Washington, D.C. from 1975 TO 1981.

He has a BA in Economics and a MBA in Finance from York University in Toronto Canada.

http://www.itu.int

back to index

Pekka Tarjanne

Dr. Tarjanne is a Special Advisor for ICT to the Secretary-General of the United Nations since June 2001. He was the Vice-Chairman of Project Oxygen, Ltd., 1999-2000.

Dr. Tarjanne was the ITU Secretary-General for two terms, from November 1989 through January 1999. During his tenure, Dr. Tarjanne moved the Geneva-based United Nations organization towards greater involvement with emerging telecommunications technologies, such as the Internet, while strengthening its focus on solving the communications needs of developing countries.

Before joining the ITU, Dr. Tarjanne was the Director-General of Posts and Telecommunications in his native Finland, where he oversaw therestructuring of the telecom sector and the conversion of the government carrier into a commercial company. Earlier, he had been the Minister of Transport and Communications and also served as President of the Finnish Liberal Party, as a Member of Parliament and as Minister responsible for Nordic cooperation.

Dr. Tarjanne, born in 1937, has a PH.D. from the Helsinki University of Technology (1962). After graduation, he worked as a teacher and researcher in Denmark and the United States and taught theoretical physics in Finland at the University of Oulu and the University of Helsinki. In addition to Finnish, he speaks English, French, German and Swedish. He is married to Aino Kairamo and they have three children and three grandchildren.

back to index

Richard E. Butler

Richard (Dick) E Butler former Secretary General International Telecomunication Union (ITU) 1983 - 1989 (being Deputy Secretary General 1968 - 1982 and previously Senior Officer of the Australian Post and Telecommunications scene. He was the most Senior Australian in the United Nations system and the only one to be elected as Head of a United Nations Specialised Agency (ITU).

He has received world wide acclaim for his policy insights and effective leadership of the ITU - the global body for international regulation, standards, coordination and worldwide development of the various branches of telecommunications. Over the past four decades he has made a major contribution to the negotiations and decisions for greatly enlarged radio spectrum for all forms of space and terrestrial wireless communications; revised and simplified telecommunication regulatory frameworks, paving the way for the introduction of new service entrepreneurs and players, competitive and liberalisation of telecommunications; and to world wide access and development of telecommunication infrastructure and services. In 1988 Dick Butler was designation as the Lead Person in the top 25 Most Influential Person in the Telecommunication Sector by Communications Week International.

He has been one of the lead pioneers in seeking understanding of the importance of the communications infrastructure to national economic efficiency and social development - but presenting new challenges in the new Millennium. Since returning to Australia he has continued activity in policy research, telecommunication reforms and new applications.

Current appointments include -
Member of the distinguished Board of Advisers PTC, Advisory Boards and Bodies India and Korea and of CIRCIT (Centre for International Research on Communications and Information Technologies -RMIT University, Melbourne), Member of the Board of VITA (Volunteers in Technical Assistance Inc. USA), Chairman and Member of the Board of AsiaSpace Limited and being Member of the Advisory Board of Sky Station International Inc.

back to index

Daniel J. Brody

Daniel J. Brody serves as Managing Director of the U.S. Information Technology Office (USITO) and is based in Beijing. In his role as Managing Director, Mr. Brody tracks developments in the Chinese information technology (IT) sector, and writes industry analyses on a regular basis. Dan interfaces with Chinese industry and government officials, USITO member companies, and assists with the planning and implementation of all USITO programs in China.

Mr. Brody has over 5 years of experience in China since first coming in 1994, and has studied Chinese since 1988. Formerly working as a human resource management consultant with Hewitt Associates in Beijing, Mr.Brody joined USITO in May 2000. Previous positions in China include a stint with the Financial Times (of London), as well as a research fellowship at China's Foreign Affairs College, a state-owned research institution under the Ministry of Foreign Affairs. Graduating from Georgetown University with a B.S. in Foreign Service in 1996, Mr. Brody was born and bred in Washington, DC, and worked for a time after graduation on Capitol Hill at the US-China Policy Foundation. Mr. Brody is fluent in written and spoken Mandarin Chinese.

back to index

Social/Cultural

Monday, 14 January 2002
1600–1730
South Pacific I - II

M.2.1 Executive Skills Development in Telecom Industry

Chair:
HYON-SOOK (SUE) DAMEN, Director, A.T. Kearney Executive Search, *USA*

Speakers:

Executive Skills Requirements from HR Perspective (PowerPoint Presentation)
LEW WALKER, Vice President, Human Resources, Cingular Wireless, *USA*

Evolution of the 21st Century Executive (View Abstract) (PowerPoint Presentation)
JEANNIE DIEFENDERFER, Group President, Verizon Advanced Networks, *USA*

Individual and Organizational Competencies for Successful Strategic Customer Mangement (View Abstract) (PowerPoint Presentation)
LISA NAPOLITANO, President and CEO, Strategic Account Management Association, *USA*

The human development factors are very important, particularly to the telecom carrier executives in the ever-increasing competitive environment as de-regulation and liberalization progress. The human aspects are starting to far surpass the importance of the technology. Many network operators no longer build, deploy and own networks. Instead, they are focusing on "owning" customers. The managerial and executive skills required in this new environment significantly differ from the "monopolistic," traditional carrier environment. Furthermore, the customer base is becoming more and more diverse and, consequently, the people serving these customers will need to have a better understanding of diverse requirements to be successful.

The speakers in this session will go beyond the "engineering" perspectives and will address the human resource requirements and development aspects from multiple viewpoints. They will discuss the more socially-oriented, customer-focused environment and propagate the understanding of diverse needs of the customer base.

The new business model will put a significant stress on human resources in the business. Executive skills requirements for today's operators are significantly different from a traditional facility-based operator. They have to be very customer-oriented. Also, they have to establish strong partnerships with the other network operators whose networks they will entrust their customers.

The session speakers will also address in the panel discussion the changing nature of communications and the impact of the technological advances on the way people communicate.

Also, as the session participants have a variety of ethnic and cultural backgrounds, they will be uniquely positioned to blend in the social and cross-cultural issues touching the multinational telecommunication companies and draw the connection between a diverse customer base and managing the staff.

back to sessions

Hyon-Sook (Sue) Damen

As the Director of Technology Practice at A.T. Kearney Executive Search, Ms. Damen is responsible for recruiting outstanding future leaders in Telecommunication industry. Prior to joining A.T. Kearney, Ms. Damen has spent the past 15 years in Telecommunication industry, which includes positions with Motorola, Lucent, AT&T Bell Laboratories and Rockwell International.

Ms. Damen started her Telecommunication career in 1985 as a co-op student at Rockwell International. After graduation, she has joined AT&T Bell Laboratories as a Member of Technical Staff in 5ESS switching development. She joined Motorola in 1992 to lead Systems Engineering group to design and implement the cellular systems in Asia. During the course of her career at Motorola, she led multi-functional organization in the U.S and Asia with extensive international business experience. She took on positions of increasing responsibility and assuming assignments such as Sales Engineering Manager, an expatriate assignment in Korea - International Program Manager, responsible for implementation of Korea Telecom Freetel network-World CDMA Portfolio Senior Marketing Manager - Senior Account/Business Development Manager , responsible for business development for the North America and European Wireless Service carriers.

In 1998, Ms. Damen joined Lucent Technology as a Global Offer Marketing Manager responsible for putting together end-to-end marketing solutions for Voice and Data Over IP network.

She was born and raised in Seoul, Korea until she moved to the U.S. at age 15. She holds a Bachelor of Science degree in Electrical Engineering from University of Illinois at Chicago, and an MS in Computer Science from Illinois Institute of Technology.

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back to index

Abstract

Jeannie Diefenderfer will cover the issues relating to the continuing development of the executive workforce in the new, competitive business environment and especially the people skills development to grow the business and to retain customers. She will focus on how to develop those attributes (or skills or behaviors or a combination of all of these) of a telecom executive which are imperative for establishing, maintaining and enhancing customer relationships, as well as to plan and execute on a business strategy that gives sustainable success, rather than short term glory.

back to index

Jeannie Diefenderfer

As the group president of Advanced Networks, Jeannie Diefenderfer is responsible for the planning, engineering and deployment of Verizon's long distance voice and datanetworks. The group includes Global Networks Inc. (GNI) unit, as well the DSL network engineering and planning functions that were formerly a part of Verizon Advanced Data, Inc.(VADI). Prior to that, she was senior vice president of Corporate Sourcing, responsible for managing a $20 Billion buy for Verizon Communications across the United States.

Ms. Diefenderfer joined NYNEX in 1984 as a management trainee in the Equipment Installation department, responsible for supervising on-time installations of large telecommunications equipment. During the course of her career, she took on positions of increasing responsibility, assuming assignments such as Project Manager - Network Services, Director - EEO/AAP, Director - Engineering & Construction and Executive Director - Equipment Installation.

A native of Seoul, South Korea, Ms. Diefenderfer immigrated to the U.S. when she was 13 years old. She holds a Bachelor of Science degree in Chemical Engineering from Tufts University, and an MBA from Babson College. Ms. Diefenderfer serves on the boards of Citizens Funds, Tufts University College of Engineering, The International Center in New York and NYU's Center for Graphics Communications. Internal to Verizon, Ms. Diefenderfer has served on the boards of the Minority Multicultural Association of NYNEX, Association of Bell Atlantic Women, and the Asian Focus Group. She was featured in the 1999 Crain's New York Business "40 under 40," as one of the 40 NY's "rising stars" under 40 years old, and has been accepted as one of 14 NYC executives in the 1999-2000 class of the David Rockefeller Fellows Program. She lives in Stamford, Connecticut with her husband George, daughter Mia and son Derek.

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back to index

Abstract

No one would deny that marketplace dynamics of the late 20th century have created a brave new sales world. It is a world characterized by extremes - relentless web-based commoditization on the one hand, intimate, interdependent value-driven relationships on the other. Unremitting price pressure on the commodities end of the spectrum increasingly drives organizations toward alternate distribution approaches that do not include the hefty expense of a sales force. Sales resources, instead, are being re-allocated toward the strategic account value-driven end of the spectrum.

Sales in the context of building strategic relationships with customer's demands a whole new approach - the ability to look beyond each individual sales opportunity and manage the long-term relationship at the executive level. This means very different behaviors for the individual salesperson, as well as a very different model on how to work as a sales team within the sales organization. A sales organization's success depends upon developing and integrating skills and processes that support the building of long-term relationships based on value.

This presentation, based on research and best practices compiled by the Strategic Account Management Association, will identify characteristics, skills, and behaviors - both organizational and individual - critical to successful strategic customer management.

back to index

Lisa Napolitano

Lisa Napolitano joined the Strategic Account Management Association (SAMA) in 1991 as Executive Director charged with revitalizing the organization, which was founded in 1964.

Lisa serves as chief spokesperson for SAMA, which is an international, non-profit organization, and the leading information provider on the subject of strategic customer-supplier partnering. Her primary role is to enable SAMA to increase the body of knowledge on the complexities of enterprise relationship management, and to disseminate best practices and research data to business leaders around the world.

Lisa has guided a robust research agenda that includes exclusive studies in areas such as: Knowledge Management Practices within Global Customer Teams; Frameworks for Compensating Strategic Account Managers; Best Practices in Global Customer Management; Competency Models for Strategic Account Management Positions; Performance Improvement and Innovation within SAM Programs. Lisa has been Editor and contributing author to several books including Harnessing Global Potential: Insights into Managing Customers Worldwide (2001), The Trust Imperative: The Competitive Advantage of Trust-Based Business Relationships (1998), and Unlocking Profits: The Strategic Advantage of Key Account Management (1997). She also serves as Publisher of Velocity™, SAMA's Quarterly Magazine, and Focus: Europe™, a Quarterly supplemental newsletter.

Lisa received her Bachelor degree from Princeton University.

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back to index

Business & Applications

Monday, 14 January 2002
1400–1530
Honolulu Suite

M.1.2 Distance Learning/Education

Chair:
DAN WEDEMEYER, Professor, Department of Communications, University of Hawaii, *USA*

M.1.2.1 Corpus-based Multilingual Terminology for Online TCM (View Abstract)

LIANGYI CUI, Professor, Shanghai Jiaotong University, *People's Republic of China* and KAISU ZHUANG, Student, Brigham Young University – Hawaii Campus, *USA*

Presenter:
KAISU ZHUANG, Student, Brigham Young University – Hawaii Campus, *USA*

M.1.2.2 PEACESAT Celebrates 30 Years in the Pacific Islands: A Program Update and Look at Public Service Telecommunications in the Region (View Abstract)

CHRISTINA HIGA, Director, Pan-Pacific Education and Communication Experiments by Satellite Social Science Research Institute, University of Hawaii, *USA*

M.1.2.3 A Strategic Planning Approach to Technology Integration: Critical Success Factors (View Abstract)

SAM SHAW, President and JEFF ZABUDSKY, Dean, Technology and Curriculum Innovation, The Northern Alberta Institute of Technology, *Canada*

M.1.2.4 The Impact of Assistive Technology: Section 508 and You (View Abstract)

WILL PERATINO, Director, Advanced Distributed Learning (ADL) Initiative, Office of the Assistant Secretary for Policy, Department of Labor and G A Redding, DL Analyst, Institute of Defense Analyses, *USA*

back to sessions

Corpus-based Multilingual Terminology for Online TCM

Liangyi Cui
Shanghai Jiaotong University
P. R. China

Kaisu Zhuang
Brigham Young University - Hawaii Campus
USA

View Abstract

Introduction

TCM stands for the rich treasury of the old traditional Chinese medicine still in its long process of evolution, which contains its own physiology, pathology, pharmacology, acupuncture, moxibustion, qigongology and so on. Today, with its widespread in the world, continuing efforts have been made to combine TCM and WMM in theory and practice. The word of combine here is quite suggestive. I hold that it is concerned with analyzing, interpreting, and understanding the wealth of TCM's theory and experience characterized with systematization and uniqueness in a modern scientific way, i.e. to make it a system of knowledge covering general truths or the operation of general laws, ultimately as obtained and tested through scientific method. Its success depends heavily on the co-operation of TCM and WMM researchers. IT revolution has resulted in telemedicine. One of its most drastic scenes is that TCM or partly TCM Websites boomed and are booming in China, in the East and in the world. They vary widely in features, services and purposes. The orientation islands for TCM Websites are shown in Appendix: Spectrum of TCM Websites.

Multilingual Terminology for Online TCM

Today, we can find a great deal of TCM Websites, thus far more TCM contents than we know what to do with. Online TCM contents, which encompass a treasure store of data, information, and knowledge, are the richest and most valuable sources. Internet can spread them across the world with no limitation of space and time. The challenge is how to process the mountainous amount of the TCM contents. Too much of them remain to be made usable and used. Part of the problem has to do with the languages known as Babel. So, a multilingual terminological wizard seems to be essential to the globalization of TCM.

1. Multilingual Terminological Wizard (MTW)

The system of MTW was designed as a working tool to enable primary terminology services for TCM Webpage readers or surfers. Areas cover Theory of Ying and Yang, Theory of Five Elements, Theory of Viscera and Bowels, Theory of Qi, Blood and Body Fluid, Theory of Channels and Collaterals, Acupuncture, Moxibustion, Qigongology, Pharmacology, TCM History, TCM Who's Who, and TCM Health. An area includes further sub-areas; and a sub-area includes its sub-areas; and so on. For example, TCM Health includes nourishing, nutriology, cosmetology, andrology, mental health, herbology and etc. A TCM key term search will lead to multi-level cross-hyper -linked information. An example is illustrated as follows:

Level A: Key Term

simplified Chinese | traditional Chinese | Pinyin | English | German

Éö£¨Ôà£© | _(_) | shen (zan) | Kidney | Niere _

In TCM, kidneys do not purely mean a pair of vertebrate organs of humans, which are bean-shaped and lying behind the peritoneum in a mass of fatty tissue, and consist chiefly of nephrons by which urine is secreted, collected, and discharged into a main cavity whence it is conveyed by the ureter to the bladder. It is not that in the anatomical sense but a set of functions, which play a vital role in the growing, breeding and aging of humans.

Level B: Set Phrase

ÉöÎªÏÈÌìÖ®±¾ | Éö²Ø¾« | ¿ÖÉËÉö | ÉöÊôÒõ | Ö÷Ë® | ÉöÆøÓëÉö¾« | ÉöÒõÓëÉöÑô | ÉöÓëË¥ÀÏ | ÉöµÄ¾Âö | ÉöÓë¸Î | ÉöÓëÆ¢ | ÉöÓë·Î | ÉöÓëÐÄ | ²èÉöÖÐÒ©

Level C: Passage from the Supporting Corpus

The key terms of Heart and Kidney are hyperlinked.

Level A: Key Term

simplified Chinese | traditional Chinese | Pinyin | English | German

ÐÄ£¨Ôà£© | ÐÄ(_) | xin (zan) | Heart | Herz _

In TCM, heart does not purely mean a hollow muscular organ of humans that by its rhythmic contraction acts as a force pump maintaining the circulation of the blood. It is not that in the anatomical sense but a set of certain functions and blood in the TCM proverb Heart masters blood does not purely refer to the liquid of blood. It has to do with disposition, i.e. the emotional or moral as distinguished from the intellectual nature and compassion, i.e. innermost character, feelings, or inclinations

Level B: Set Phrase

ÐÄÎª³¾ýÖ÷Ö®èÙ | ÐÄ²ØÉñ | Ï²ÉËÐÄ | ÐÄÊôÑô | Ö÷»ð | ÐÄÓëºèÒº | ÐÄÓëÇé | ÐÄµÄ¾Âç | ÐÄ¸ÎÑªÐé | ÐÄ¸Î»ðÍú | ÐÄ·ÎÆøÐé | ÐÄÓëÐ¡³¦ | ÐÄ¿ªÇÏÓÚÉà | èÚÐÄ²¡ | ÐÄ²¡ÖÐÒ© |

Level C: Passage from the Supporting Corpus

[chinese]

2. Metadata

Metadata mean data about data. To make TCM data useful or used, it is necessary to know its name, author or source, location, time, data format, etc. Based on the hyperlinked Webpage technology, special data models are designed to contain definitions, examples, cross-reference pointers, glosses on usage, free text and etc, which are capable of computationally representing a terminological databank and amenable to flexible and efficient Web DBMS support.

3. Statistical

The principal of MTW key term selection is basically on observed frequencies and experiences. The data it contains are generally the result of statistics. For example, Yin, Yang, Jing, Qi, Shen, Water, Wood, Metal, Fire, Earth, Channel, Collateral, Heart, Lung, Spleen, Liver, Kidney, Gallbladder, Stomach, ...are at the top of the frequency list. The great number of set-phrases mostly in four Chinese characters such as imbalance between Yin and Yang are also taken into account. The strategy here is to select first a limited number of essential terms of TCM. So, the MTW terminology is far from being enough. For real world applications, it is of fundamental importance that it should be able to deal with hundreds of thousands of lexical items. The development of larger Web knowledge bases computational linguistics and artificial intelligence.

4. Multilingual

The most-frequently-occurring records of MTW contain entries in Chinese, English and German. A search is enabled for a TCM term from Chinese (simplified or traditional) to English or German. As TCM was brought long ago to Korea, Japan, and Southeast Asia countries and has become an integrated part of their traditional medicines. The inclusion of the languages of Japanese and Korean seems of importance, which relies on future international co-operation. Multilingual inputting/displaying is not a problem. It keeps getting easier thanks to high-performance software. For example, on Microsoft Windows 2000, the Global IMEs work in any application since that OS has full-featured East Asian input support built in. It enables keying in Chinese, Japanese or Korean occasionally without using a native Windows for the language in question. One can input combination of English and Japanese such as heart ?(???), heart-breaking ??(???) , heartbreak, ??(?????), heartburn ???(????), artificial heart ???? .... The multilingual barriers between

eastern and western medical researchers are breaking in a faster speed than ever.
Guidelines on term multilingual translation:

- translate literally if possible, or appeal to free translation, or their combination
- translate in light of modern medicine
- avoid 'brute force' translation or Chinglish (i.e. Chinese English)
- remain open to revision for standardization

5. Textual/Graphical

As is said, a picture is worth of a thousand of words. A recipe of Traditional Chinese Pharmacy is represented as follows:

[maybe should be an image...?]

<Recipe> ????Ú <Ingredients (most are medicinal herbs)>+
? <Administration>+
? <Modification>+
? <Cure-effects>+
Ü <Proprietary>
<For_Disease>??Ú <Pathogenesis>+<Symptoms>
where herbs are also illustrated with pictures.

[/maybe should be an image...?]

For a future version of MTW using virtual reality, one even could explore a botanical garden of herbs in a chair, donning a head-mounted display and using a data glove.

6. Corpus-based

The importance of hyperlinked TCM corpora and lexicons as an empirical support to MTW terminology is stressed here. They are used for further exploration of interesting TCM terms if desirable. Resource of TCM is classified into the following:

- Literatures of ancient TCM long ago
- Literatures in modern Chinese language later
- Literatures in Chinese and/or English in modern time.
- Fast growing bilingual TCM lexicons and books, such as <Chinese-English Terminology of TCM>, <Practical Diagnostics and Therapeutics of Integrated Traditional Chinese and Western Medicine>, <A Practical English-Chinese Library of Traditional Chinese Medicine> ... the list is endless. Of

course, there is the problem of copyright. They may be only available for academic research but cannot be made use of elsewhere, say, in commercial contexts.

7. Inter-Cultural Dimension

TCM proves profoundly effective and promising in the long term. There is much in it trending toward the modern science. However, it is, as a whole, still at the pre-scientific stage. On the theoretical side, it remains a challenge to analyze, explain and interpret the wealth of its theories and experiences characterized with uniqueness in a strictly scientific way. TCM should not be afraid of clashes with so-called common sense. It is only afraid of disagreement between any of its existing ideas and new experimental facts and if such agreement occurs TCM revises those ideas it has previously built up and raise our knowledge to a higher level.

Regarding philosophy --- It seems that there are some things that TCM can get from WMM, and that there are also some things that WMM can get from TCM. It would be unfortunate if mankind takes the same approach. And even if it is the best approach, a lot of different approaches need to be explored. The two approaches are complementary: they are digging the same tunnel from the opposite ends, and at some future time may meet somewhere in the middle. In fact, the two medicines will probably contribute to one another's success. The scientific spirit, breadth of mind, and new generation of IT will eventually break the barriers between different schools of TCM, different medicines and different cultures.

Conclusion

Multilingual terminology for TCM is beginning to emerge as a discipline in its own right. As is shown, MIW is designed to help the TCM-WWM researchers in surfing on the Internet. It will be evolving from a walking dictionary, a working tool, a dynamic wizard, hopefully, to an intelligent expert by taking advantage of IT and computational linguistics, and with the support of medical researchers from the East and West. It helps the users to focus on what should be their first concern and not be cluttered by irrelevant details. In this way, it is easier to accomplish their tasks in a relatively short time, where the medical results can be objectively measurable. The author does not intend to exclude from the happy union of TCM and WMM all other topics that remain unmentioned here; many of them deserve a place, particularly in the era of medical globalization. Microscopic in intensity and panoramic in scope, TCM-WWM combination will surely provide better medical care to the mankind --- especially in an effort to conquer diseases in which neither can succeed alone.

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back to index

Abstract

This paper illustrates multilingual terminology for online Traditional Chinese Medicine (TCM) with the design of a corpus-based Multilingual Terminological Wizard (TMW), an online working tool to provide primary terminology services to those who are devoted to the combination of TCM with Western Modern Medicine (WMM). Its real advantage lies in helping them study, explore, discuss or contribute to, in a cross-referenced way, TCM terms with facts (or forms of TCM contents) in Chinese, English and German. The author holds that it is fun and rewarding for medical researchers, from the East and West, to explore the TCM heritage and watch it interpreted and understood in a strictly modern scientific way. This system of MTW is highly upgradeable as it stands on the shoulder of the fast-growing software development tools.

back to index

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back to index

PEACESAT Celebrates 30 Years in the Pacific Islands: A Program Update and Look at Public Service Telecommunications in the Region

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View Abstract

1. Background

The year 2001 marks the 30th anniversary of the Pan Pacific Education and Communication Experiments by Satellite (PEACESAT) Program. The initial founding concepts of the program are the same today with a primary objective of providing public service satellite telecommunications to the Pacific Islands Region. Even with the advancement of technology and applications, the program is just as vital today as it was 30 years ago.

PEACESAT is currently using the National Oceanic and Atmospheric Administration (NOAA) GOES-7 satellite. From a single simplex circuit for voice teleconferencing and experimental packet data applications, current services include interactive video and voice teleconferencing and access to the Internet.

The technical solutions were available several years ago, however the forging partnerships among agencies contributed to the recent digital roll-out and enhanced programming. Cooperation and collaboration are key program elements that have been sustained for 30-years.

PEACESAT is committed to assisting in lessening the digital divide in the Pacific Islands. The PEACESAT network provides limited bandwidth capacity, however as other opportunities arise and Pacific Island entities migrate to commercial networks, the limited PEACESAT satellite capacity will be made available to the underserved and the very remote areas where telephone capacity may be limited or not currently available.

This paper provides an overview of the PEACESAT program development, current update and also covers prevailing issues regarding telecommunications in the Pacific Islands in particular the growing digital divide happening even within the region.

2. Looking Back by Decades

2.1 Birth: The 1960/70s

To set the stage we need to reflect back to what was happening in the world of communications in the mid-60's. In 1963, the first geosynchronous communication satellite was launched. In 1966, NASA's Application Technology Satellite (ATS-1) was launched to conduct weather information experiments that were completed in two years. The historians of Boeing Satellite Systems Inc. (formerly Hughes Space and Communications Company) note that ATS-1 although primarily a test satellite was used for communication "during the recovery operations for the flight of Apollo 11 in 1969, the spacecraft served as the primary communications link between the White House and President Nixon in the Pacific as the President witnessed the return of the moon-landing astronauts from the deck of the U.S. Navy carrier USS Hornet."[1]

Also in 1969, Dr. John Bystrom of the University of Hawaii responded to NASA's call for proposals for further innovative uses of ATS-1. In 1971 NASA approved Dr. Bystrom's proposal to initiate the PEACESAT Project "...to demonstrate the benefits of currently available telecommunication technology when applied specifically to the needs of sparsely populated, less industrialized areas."[2]

The early PEACESAT pioneers to join Dr. Bystrom included Dr. Paul Yuen of the University of Hawaii (UH) Engineering and Dr. Katashi Nose of UH Physics. Yuen and Nose designed and built the first PEACESAT earth stations that were approximately $3000 U.S. These systems used Yagi antennas, supported push-to-talk audio teleconferencing on a simplex circuit. By 1972 PEACESAT was the first educational satellite network in the world linking the University of Hawaii at Manoa, the University of Hawaii at Hilo, Maui Community College, Wellington Polytechnic and the University of the South Pacific. The PEACESAT network eventually grew to support more than 100 earth stations and incorporated sub-networks including the University of the South Pacific, Kangaroonet, Micronet and Ocean networks.

2.2 Reestablishment: The 1980-90s

In 1985 ATS-1's station keeping fuel was depleted. The PEACESAT program under the leadership of Dr. Donald M. Topping, Principal Investigator and Ms. Lori Mukaida, Director realized the importance of the services to the Pacific Island communities and worked tirelessly on a solution. In 1987, the U.S. Congress authorized $3.4 million U.S. to re-establish the PEACESAT program and stewardship assigned to the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce.[3]

A replacement satellite was a major concern. Ms. Mukaida, along with NTIA, led the PEACESAT User Groups and Technical Option Panels to determine user requirements, functional and technical specifications. NOAA's GOES-3 satellite met the requirements and in 1989 established an agreement with NTIA to approve PEACESAT's use of GOES-3.

Marine-Air Systems Ltd (MAS), a New Zealand company, developed analog based earth stations. These systems were capable of providing 9.6 Kbps data and audio teleconferencing.

In the 1993, Ms. Mukaida approached Dr. Norman H. Okamura of the UH Social Science Research Institute for assistance in improving data services. The PEACESAT users outgrew the 9.6 Kbps and required increased data rates and access to applications such as the World Wide Web. Dr. Okamura proposed a PEACESAT digital upgrade, now referred to as "digital PEACESAT." Dr. Okamura worked with MAS on a design that enabled the digital upgrade of existing earth stations.

By 1996 the PEACESAT network grew to include 53 earth stations in 22 Pacific Island economies.

3. The New Millennium: 2000/Present

3.1 Partnerships

One of the fundamental philosophies of PEACESAT that survived thirty years is that the program is built on partnerships. The initial design of the network and extensions to a variety of educational institutions and regional organizations created and fostered collaboration.

There have been a variety of funding agencies, too many to name here, that supported PEACESAT over the years, with NTIA as a primary source of support of the overall network and operations of the PEACESAT Headquarters at the University of Hawaii. Other programs have provided resources to develop segments of the network. In more recent years PEACESAT entered into a Cooperative Agreement with the Pacific Resources for Education and Learning (PREL) and their PRELStar program.

The PRELStar, a U.S. Department of Education funded program provides direct services to students, teacher training and certification, adult and family learning, technical expertise, and technology infrastructure in the rural Pacific region.

PEACESAT and PREL share overlapping service areas in the Pacific Island jurisdictions and share objectives particularly in improving access to telecommunication and information services and applications. PRELStar funded the end-user equipment required for video teleconferencing at the nine jurisdictions served by PREL. As the networks are developed locally, other public service organizations and health care facilities will also reap its benefits.

PEACESAT works directly with the Departments and Ministries of Health and Education in the Pacific Islands because telecommunications is a common need of these agencies and it is often a driving force for collaboration and cooperation.

3.2 Technology

3.2.1 Satellite

NOAA has provided PEACESAT with decommissioned satellites, PEACEAST's most important resource, at no cost. NOAA also provided for many years the navigational engineering support and services to keep the satellite in its correct orbit. PEACESAT contracts NASA for telemetry tracking and control.

GOES-2 was decommissioned in May 2001. GOES-7 was repositioned to 175 degrees West for optimal Pacific Island coverage and commissioned for PEACESAT's use on July 24, 2000. GOES-7 is a 12-year old environmental satellite that was used to collect environmental data sensed by river and rain gauges, seismometers, tide gauges, buoys, ships and weather stations and was used for international search and rescue missions. The GOES-7 satellite outperforms its predecessor, GOES-2, with more reliability and better power and will serve PEACESAT for approximately ten years.

3.3 Digital PEACESAT Services

The main attraction of the digital PEACESAT services is the video teleconferencing capabilities. The standard earth stations that are upgraded with digital modem interfaces, antenna autotrack controllers and digital modems are able to support digital carriers. The video codec and/or routers are connected to the digital modem using a V.35 interface. The data rates supported by these smaller antennas are up to 128Kpbs. Larger PEACESAT Hub earth stations ranging from 6m to 10m systems support data rates up to 384Kbps. The satellite has a hard limiting transponder and therefore due to the restricted satellite power budget, video teleconferencing sessions are generally supported at data rates of 128Kbps.

Digital PEACESAT also supports data services such as access to the Internet. At the UH, PEACESAT leases a T-1 and Internet service through a local telecommunication carrier to support non-UH agencies.

Currently there are a total of ten PEACESAT earth stations that have been upgraded for digital services. This was possible in part through the PRELStar agreement, the University of Guam's Rural Utilities Services Grant and local Ministries and Departments of Education and Health. Following is a list of the digital upgraded earth stations:

<u>Sites equipped with video teleconferencing, voice and data services:</u>

1. Hawaii - University of Hawaii at Manoa
2. Guam - University of Guam
3. Pohnpei, Federated States of Micronesia (FSM) - College of Micronesia and National Hospital
4. Kosrae, Federated States of Micronesia (FSM) - Department of Education
5. Yap, Federated States of Micronesia (FSM) - Department of Education
6. Chuuk, Federated States of Micronesia (FSM) - Department of Education
7. Palau, Republic of Palau - Ministry of Education & Emergency Management Office

8. Majuro, Republic of the Marshall Islands - College of the Marshall Islands
9. American Samoa - DELTA Consortium, operated by American Samoa Power Authority
   Site equipped with digital data services:
10. Fiji - Central Queensland University in Suva

The PEACESAT network today still supports analog services that are effective for the traditional mesh-type voice audio teleconferencing. The audio teleconferencing usage is important however video teleconferencing and email correspondence appears to have reduced the amount of audio teleconferencing traffic on the network.

3.4 Institutional and Human Resource Development

3.4.1 Technical Training

The focus on institutional and human resource development is emphasized. The technology deployed is increasingly complex and requires increased technical skills and support. PEACESAT and its parent umbrella organization, the University of Hawaii Telecommunications and Information Policy Group (UH TIPG) recognize the need for technical training on many levels including base support of PEACESAT earth stations to configuration of routers, servers and networks. There is a need throughout the region for information technology and telecommunication training. In the short-term PEACESAT provides technical training sessions via video teleconferencing and is working with many agencies in the region on a more comprehensive long-term program.

3.4.2 Technical Consultation and Design

In the recent years, other program areas that have significantly developed primarily with the leadership and technical assistance of Dr. Norman H. Okamura, current PEACESAT Principal Investigator, are technical consultation and strategic and cost-effective network design. Dr. Okamura is also responsible for many public service telecommunication network designs and implementation plans in the Pacific Islands. In the grand opening of the Commonwealth of the Northern Marianas Islands (CNMI) Partners in Distance Learning Network, the Special Assistant to the CNMI Governor described Dr. Okamura as the "Babe Ruth of telecommunications." Dr. Okamura has many years of experience in developing such networks. During his tenure as the State of Hawaii Director of the Information and Communication Services Division he built most of the major telecommunication networks in Hawaii that support government and education. Dr. Okamura is also the chief architect of the Hawaii State Telehealth Access Network (STAN) that is operated and managed by the UH TIPG.

3.5 Network Cross Connectivity

The UH TIPG network operations center (NOC) and the PEACESAT headquarters NOC are integrated.

TIPG is equipped with two multipoint video teleconferencing bridges and several ISDN lines. It serves as a bridge for interconnecting many networks including STAN, UH Hawaii Interactive Television System (HITS), State HAWAIIAN network, Departments of Education (Hawaii, Guam, American Samoa, CNMI) to the PEACESAT network. It is important to underscore the capability of connecting the PEACESAT sites to another location via ISDN for video teleconferencing because in many of the PEACESAT locations (excluding Hawaii, Guam and Fiji) there are no ISDN services off-island. In the Republic of Palau there are on-island ISDN services and in Guam the off-island rates are extremely pricey ($234 per hour for a 384Kbps connection to U.S. Mainland. This is a reduction from $900 per hour).[4]

The UH TIPG and PEACESAT have a very strong policy of open networks verses closed networks meaning it will enable the cross connection between any organization that meets the program objectives and mandates. The value of the network is increased if the opportunities for interconnection are kept open instead of restricted.

3.6 Program Areas

Program areas supported are: distance learning and training, telehealth/telemedicine, emergency management, research and economic development. The video teleconferencing services and the improved performance of GOES-7 enables improved program delivery using PEACESAT. The infrastructure for cross connecting numerous networks has also significantly increased the amount of available resources for program development and regional cooperation.

There are numerous programs and applications; these are a selected few:

- The UH Telemedicine Program, weekly grand rounds session. Participants include physicians in Hawaii, Guam and other Pacific Islands. The University of Hawaii is seeking authorization to provide continuing medical education credit outside of Hawaii.
- Institute for Telemedicine and Telehealth provides organizational updates, educational programs and workshops. For the first time ever health professionals in the Islands are able to participate in these sessions through video teleconferencing
- In 2000, the Shriners Hospital for Children conducted 1,248 out of state outreach clinics in the Pacific Islands. In total the hospital treated 19,568 children where 743 were referred from Guam, 403 from the Federated States of Micronesia, 412 from American Samoa and 273 from Saipan. Telehealth outreach clinics where the doctors can provide consultation and follow-up meetings with patients in their respective islands are conducted by video teleconference. These services are in great demand in the Pacific Islands particularly because they are offered at no cost to the patient. In addition to clinical evaluations and continuing medical education, Shriners have used PEACESAT for conducting administrative meetings and coordinating region wide telehealth associations (i.e., Nurse Practitioners, Physicians Assistants, Pacific Telemedicine Association, Pacific Telehealth Consortium, etc.)
- The National Weather Service Pacific Region Headquarters -Emergency Management Weather Information Network (EMWIN): The EMWIN system uses GOES-9 to broadcast weather

information such as warnings reports, weather graphics and satellite images, PEACESAT rebroadcasts this signal from GOES-7 to locations not currently covered by GOES-9.

- PREL Teacher Training Sessions: Adult Education, Distance Learning Techniques and Applications, etc.
- Various distance learning programs such as: "Building Relationships with secondary and post secondary schools in the Marshall Islands and Federated States of Micronesia" and "Viability of VTC for Distance Learning Opportunities in the Pacific, scheduled for San Diego State University.
- Programs on collaboration in grants and funding opportunities, i.e., "Minority Serving Institution Grant - status, plans, for implementation, and upcoming workshops and sessions."

4. Changing Environment

PEACESAT is a program that is based on providing non-profit telecommunications for public service applications because telecommunication services are cost prohibitive for the public sector in the Pacific Islands. There are many reasons for the high cost of telecommunications in the region including the large geographic areas, small populations, developing economies and monopolies. If the PEACESAT objectives were attained with complete success, there would no longer be a need for the program. PEACESAT's 30-year history is an indication that the need and environment remains the same.

Yet, there have been many considerable changes in public service telecommunications in various areas in the region. In U.S. Territories of American Samoa, Guam and the Commonwealth of the Northern Marianas Islands the E-Rate program of the Universal Services Fund has significantly improved telecommunication infrastructure. Each of these jurisdictions has at least a T-1 network link to Honolulu, terminating at the UH TIPG and PEACESAT network operations center. There is also very high-speed fiber connectivity on-island. For the PEACESAT network, the development of larger bandwidth connections supported by E-Rate means more capacity available on PEACESAT for even more rural and remote areas in the Islands. There are issues with the Rural Health Care Program rules. As written they currently do not benefit to the islands. This issue is under review by the Federal Communications Commission. Another major concern is the disproportionate amount of funding and development of public service telecommunications in the Region. The Freely Associated States (Federated States of Micronesia, Republic of the Marshall Islands and the Republic of Palau) are not eligible for U.S. Federal Universal Services Funds. The digital divide in these areas of the region along with the non-US affiliated locations are increasing rapidly.

The Freely Associated States developed a "Micronet Proposal" that would establish a robust public service network using satellite communications. This proposal is a regional effort and has been endorsed by the president of each respective country and submitted to the Government of Japan. The proposal development started long before the Japanese Government announcement of a $15 Billion U.S. fund to assist in closing the digital divide, however time was such that it is now being considered as one of these projects and potentially a US-Japan Common Agenda item.

5. Strategic Partnerships

Following is a brief summary of new domestic consortia for public service telecommunication networks. Each Pacific Island jurisdiction worked to seek expertise, combine resources and plan strategic partnerships.

5.1 ASG DELTA Consortium

The American Samoa Distance Education Learning and Telehealth Applications (ASG DELTA) consortium is made up of the all the major government agencies and educational institutions.[5] The American Samoa Telecommunication Authority donated for public service telecommunications a 384Kbps circuit from LBJ Tropical Medical Center to UH TIPG/PEACESAT NOC. The other consortia members contributed funds in developing on-island connections. On-island there are 21 video teleconferencing locations.

5.2 Samoa-American Samoa Link (SAS)

The Samoa-American Samoa Link (SAS) is a public service telecommunication connection, 960 Kbps, between Samoa (formerly Western Samoa) and American Samoa. The National University in Samoa and the National Hospital of Samoa is also connected to the connection for video teleconferencing and Internet.

5.3 Partner's in Distance Learning Network

The Commonwealth of the Northern Marianas Islands implemented a network that includes the Public School System, Office of the Governor, Electronic Data Processing Center and the Commonwealth Health Center. There is a T-1 connection from Tinian and Rota to Saipan. There are 18 video teleconference locations in CNMI.

5.4 Guam Education Network

The Guam Education Network will be implemented in early 2002 and will include the University of Guam and Department of Education. There will be high-speed on-island fiber connectivity. In Guam there is a potential collaboration with the National Guard and the Guam Memorial Hospital.

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5. The American Samoa Distance Education Learning and Telehealth consortium members include: Office of the Governor, American Samoa Telecommunication Authority, Power Authority, Community College, Department of Education, Department of Public Works, Department of Commerce, LBJ Tropical Medical Center, Department of Health, PEACESAT Headquarter/ UH TIPG

back to index

Abstract

The Pan Pacific Education and Communication Experiments by Satellite (PEACESAT) Program celebrates 30 years in the Pacific Islands. This paper provides an overview of the PEACESAT program development, current update and also covers prevailing issues regarding telecommunications in the Pacific Islands in particular the growing digital divide happening even within the region.

back to index

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http://www.peacesat.hawaii.edu/

back to index

A Strategic Planning Approach to Technology Integration: Critical Success Factors

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View Abstract

Introduction

Within most institutions of higher learning the typical approach to the integration of new information and communications technologies into the teaching and learning process has involved a heavy reliance on early adopters. This path of least resistance approach has provided organisations the opportunity to quickly claim a presence in the emerging E-learning world. However, the gap between these early faculty adopters and their majority colleagues remains a chasm. Research indicates that only about 5 to 10 per cent of faculty are using new technology in any way that meaningfully changes the teaching and learning process. (Geoghegan, 1994).

This paper argues that in order for new technology to make an institute-wide impact on teaching and learning practices it must be goaded from the backroom skunkworks to take its place on the organisation's mainstage. This means it must be resident in the vision and mission statements of the organization and consequently in its business planning activities and documents. This paper will demonstrate how The Northern Alberta Institute of Technology in Edmonton, Alberta, Canada has successfully reinvented its technology integration activities through a comprehensive strategic planning exercise.

The paper will begin by describing the visioning and strategic planning exercise that was undertaken across the organisation and then demonstrate how this exercise has brought about an infrastructure and culture of support that has lead to the proliferation of new learning technology activities. The paper will then explore a number of these technology initiatives to demonstrate their genesis in the strategic planning exercise.

Strategic Planning at NAIT

Background

The Northern Alberta Institute of Technology (NAIT) is a technical institute in Edmonton, Alberta, Canada that yearly serves 14,500 full-time program students, and over 40,000 continuing education students. In total, more than 55,000 learners come in contact with NAIT each year. NAIT is one of Canada's largest technical institutes and is Canada's largest apprenticeship training institution. It offers over 195 programs ranging from 1-year certificates, to 2-year diplomas, to 4-year applied degrees, as well as a range of customised training and short courses through its Continuing Education and International divisions. The programming mix is diverse ranging from business programs to highly technical specialisations such as Medical Laboratory Technology and Network Engineering Technology. Graduate placement remains high with a 91% graduate placement rate in 2000 within nine months of graduation. NAIT has over 85,000 alumni working around the globe. Internationally NAIT has training ventures in 22 countries around the world. NAIT has an annual operating budget of $155 million for 2001/02. NAIT has a staff complement of approximately 2200 full and part-time employees distributed over 5 campuses.

Strategic planning for the future

In 1997 NAIT undertook a comprehensive institutional visioning process that involved having a strategic dialogue using scenario planning. Traditionally, public educational institutions have relied on governments to define mandates and provide direction. Financial plans and capital budgets were developed internally but the role of colleges and universities was primarily externally defined. With shrinking government budgets, this has changed. Public institutions must define their own mandate, mission, vision and long term strategic plans in an environment of increased competition, accelerating change, less reliance on government funding and increased uncertainty.

Few educational institutions are equipped for this new reality. How do organisations develop long term plans in the face of future uncertainty? How do they build learning and adaptation into the process? How do they ensure understanding and commitment to change throughout the organization?

To meet this challenge, the Northern Alberta Institute of Technology (NAIT) undertook a four-stage planning process involving

1. development of strategic scenarios
2. creation of a new vision and set of key directions
3. refining of the vision and key directions
4. building the strategic business plan to achieve the vision.

The following section focuses on the process, outcomes and experiences at NAIT over a 16-month period.

The original trigger for the strategic planning project was a realisation that there was no long-term plan for the campus. This immediately raised questions about the long-term vision of the institution, its future role as a public institution and the way programs would be delivered in the future. Would NAIT even need a conventional campus in the future?

Visioning Design

It was evident that NAIT needed an in-depth review of its long-term future. A four-stage process was designed as shown in Figure 1. The ultimate objective of the project was to develop a long-term strategic plan for NAIT.

Project Design Stages			
1	2	3	4
Develop Strategic Scenarios	Formulation of Draft Vision	Vision Refinement & Approval	Strategic Business Plan Development

Project Design Stages

1. Develop Strategic Scenarios
2. Formulation of Draft Vision
3. Vision Refinement & Approval
4. Strategic Business Plan Development

Stage 1 of the project was to develop strategic scenarios. Scenarios are alternative descriptions of the future. They focus on identifying the major forces driving change and the key uncertainties facing NAIT as a basis for developing different stories about the future. Scenarios always encompass more than one future, are particularly concerned with structural rather than incremental change and require creative thinking to generate challenging futures for the organization. They are based on the perspective that the future is inherently uncertain and unpredictable. Indeed, to plan on the basis of a single forecast is dangerous.

An important aspect of scenario building involves the value of the process. A critical objective was to inject new thinking into NAIT's future role within society. The scenario process provides a vehicle for dialogue and strategic thinking. It is a highly participatory and intense learning experience. Key objectives of the process were to expand the envelope of thinking about the future, to develop shared understanding of the forces driving change and to identify the critical uncertainties facing the organization. Throughout the process NAIT chose the consultative approach of keeping all staff informed while at the same time inviting their participation and contributions to the scenario dialogue. At NAIT this was the beginning of what is hoped to be an ongoing strategic conversation with staff about NAIT's future.

The output of scenarios is a set of stories describing a range of distinctly different possible future environments within which NAIT will need to operate. These different futures provide a context for defining a new vision for NAIT and identifying and evaluating alternative strategic directions.

Stage 2 of the project was to formulate a new vision for NAIT. The purpose of a vision statement is to articulate a desirable future state as a basis for marshalling enthusiasm and creating alignment. A powerful vision can motivate individuals and provide direction in ongoing planning and operational decisions. Many vision statements, however, become depreciated as unattainable motherhood statements.

In designing a process for developing a vision, which would be attractive and challenging yet feasible, a unique process was utilized that built the first draft of a comprehensive vision package from 7 key dimensions (mission, culture, technology, resources, funding, competition and constant change). This approach required consideration of trade-offs to ensure it was both realistic and challenging. Staff were invited to assess each of four identified futures developed from the scenarios against these 7 key dimensions and contribute their ideas. Over 1000 strategies and suggestions were contributed. From this process two alternate visions emerged. Through collaborative discussion with NAIT's Board of Governors, one vision was selected to be developed and refined. The goal was for the vision to be comprehensive and inclusive of a vision, mission, set of guiding principles and key directions.

Stage 3 of the project was to refine the draft vision package. A key thrust of this stage was to develop the vision so that it was comprehensive, achievable and supported. These three elements are essential to ensure effective implementation. Once developed, the vision package was analyzed through a gap analysis process to assess its plausibility. The draft vision package was then presented to a variety of staff and external stakeholder groups for input, refinement, to build consensus and support. Finally, the comprehensive vision package was presented to the Board of Governors for approval.

Stage 4 of the project was to develop a three-year business plan based on the Board approved comprehensive vision package and specifically the key strategic directions for the organization. The key direction statements define the overall strategic thrust for NAIT. They define four areas that NAIT needs to focus on to achieve the vision. The purpose is to guide the development of NAIT's three-year strategic business plan. NAIT titled this phase of the project From Vision to Action.

The intent was to ensure operating divisions and departments had wide scope in contributing their own strategies to support the strategic directions of the institution. The people most knowledgeable about department activities are the people working there. Specific goals during this stage were to engage staff in designing their own future, to open the process to their creative ideas, and to gain their support in the process of strategic change. To meet this goal, NAIT's President presented the comprehensive vision as well as 30 identified proposed expected outcomes, to over 1200 NAIT staff in 33 consultation sessions over two month period. Staff groups were then asked to meet and propose strategies to be included in NAIT's three-year business plan. Over 3000 strategies and ideas were submitted. These resulted in eventually 90 strategies selected for inclusion into NAIT's three-year business plan.

As these last statements suggest, a critical design criterion throughout the project was participation. This was critical yet challenging. At each stage, the process was designed to provide relevant and timely information to all of the 2000 faculty and staff and to solicit feedback and ideas. This put tremendous time pressures on the process. Each step in the planning process required timely communication with faculty and staff before the next step in the planning process. The scenario development process that NAIT utilized is included as Appendix A of this paper.

Summary of Strategic Planning Process at NAIT

The Northern Alberta Institute of Technology (NAIT) having less reliance on government funding and direction developed a response to looking into the next ten years using scenario planning as a basis. In the process of visioning a thread throughout the planning was a strategic dialogue with staff. NAIT unfolded a new way of planning in the face of uncertainty, by building learning and adaptation into the process, and ensuring staff understanding and commitment to change. Specifically NAIT undertook a planning process involving

1. development of strategic scenarios
2. creation of a new vision
3. identification of key directions to achieve the vision
4. development of a strategic business plan that takes NAIT from vision to action.

NAIT learned how to develop scenarios, dialogue with staff institute-wide, encompass a vision into business and budget plans, and manage expectations. NAIT in visioning did not try to predict the future but to answer, "How NAIT can anticipate and adjust to change". In answering this question NAIT must now go face the challenges of taking the journey towards 2010 from vision to action. A key theme that emerged through the planning process was the importance of technology in helping NAIT to achieve its goals to 2010. It is from this solid planning base that the importance of technology was identified and provides the rationale, credibility, and buy-in to achieve success in the technology initiatives to which we now turn our attention.

Technology Integration at NAIT

A Key Direction statement that emerged from the planning process described above requires NAIT staff to "Optimize The Use of Technology". A key project that takes this key direction to heart is known as the Logging Our Curriculum project. The first step in the project has involved an institute-wide course-by-course identification of learning outcomes for all courses at NAIT. The outcome statements have been fashioned in a consistent institutional format incorporating an accepted list of verbs that can be classified according to Bloom's taxonomy (Bloom, 1984). The resultant list of greater than 10,000 institute-wide learning outcomes was then moved into a database accessible through a web-based interface. Faculty now uses this database tool to construct digital Learning Outcome Guides that are associated with each and every one of the 10,000 learning outcomes. These Learning Outcome Guides meet an institutionally agreed upon instructional standard that provides the greatest confidence of successful student learning. (Grondland, 2000; Kolb, 1983; McCarthy, 1987, 1981; NAIT, 1998). The positive implications of this institutionally captured and owned digital curriculum are massive considering the challenges that are outlined above.

Industry Relevant Curriculum

A continuing challenge for NAIT programs has been the need to incorporate industry validation recommendations into its curriculum. The new NAIT process allows programs to generate a survey drawn from the curriculum database and distribute this survey to industry over the World Wide Web. The results of that survey inform further curriculum development. Because the curriculum is entirely built upon individual outcomes, the consequent granularity allows instructors to reconstruct courses without complete course overhauls.

Sharing Curriculum

Another advantage of the curriculum database is the opportunity that instructors have to share curriculum across the institution. It is well known that all programs teach to many of the same learning outcomes. For example, learning outcomes associated with basic computer skills, team building, conflict management and Ohm's Law are just a few of the learning outcomes that are critical to student success in many programs at NAIT. However, curricula designed to support these outcomes have traditionally been developed in isolation, program by program. As a shared resource available to all, the curriculum database will allow instructors to both submit their ideas and draw on the curriculum development expertise of their colleagues across the institution. The curriculum model that has been developed is sufficiently flexible to allow instructors to draw on a consistent curriculum framework while at the same time allowing them to bring to bear their own personal teaching artistry.

An Interdisciplinary Resource

Another benefit of the shared database is its interdisciplinary nature. While technological innovation drives a continuing march towards greater industrial technology convergence, technical institutions should naturally look to greater interdisciplinary activity. For example, the cabinet making industry has been revolutionized by the introduction of information technologies into its practices. It is incumbent on tertiary institutions to break down disciplinary walls and ensure that the reality of this convergence in industry is reflected in the form and content of the curriculum that students will encounter.

Avoiding Duplication

The curriculum database will ensure overlapping effort is kept to an absolute minimum. With an instructional staff that numbers 800, it is clear that instructors cannot possibly stay aware of what curriculum development is underway across the institution. The curriculum database provides an accessible means by which an instructor can make choices about what curriculum to develop and what curriculum already exists that they are entitled to use. This comprehensive knowledge management process will help NAIT avoid the unnecessary duplication of effort and at the same time act to magnify the intellectual capital that already exists. For example, the knowledge that a high quality module on Ohm's Law already exists frees an instructor to focus valuable curriculum development time on preparing new modules to meet the emerging demands of industry or on refining modules in areas that pose particular challenges for students.

Customized Programming

Finally, the curriculum database provides an invaluable resource for the business development unit of NAIT to design customized training for a myriad of industry clients. A large and increasing portion of NAIT's revenue comes through providing continuing education services to industry clients who demand a more customized and focussed approach to training. NAIT's outcomes-based format is ideally suited to designing a curriculum that can be quickly and effectively delivered in keeping with the just in time demands of many industry clients.

Broader Implications of the Logging Our Curriculum Project

The Logging Our Curriculum process has served to revolutionize curriculum development at NAIT. But its impact has not been limited to curriculum design processes alone. The information technology understanding required for users of the system is significant and, in fact, exceeded the skill-sets of many of NAIT instructors whose discipline areas were unrelated to information technology. To implement the project required a training regimen that allowed each and every instructor to meet a minimum set of competencies. A flexible schedule of training events was held throughout the academic year to provide upgrading opportunities for instructors. This training, with the expressed purpose of upgrading skill-sets to meet Logging Our Curriculum requirements, has actually served to move the collective IT knowledge of the faculty to an entirely new level. This knowledge is allowing faculty the opportunity to use new learning technologies in ways they never imagined they could as few as 2 years ago. Some of these collateral technology projects are summarized below.

Online Distributed Learning

Digital materials developed through the Logging Our Curriculum project are now easily incorporated into NAIT's Web-based learning management system: WebCT. This has resulted in an exponential two-year increase in WebCT student user accounts from 50 to in excess of 4000.

Mobility programs

The modularized, digital curriculum is ideally suited to student laptop programs. Since the curriculum project began, two NAIT programs have made the decision to require students to obtain laptops in order to for them to take full advantage of the new curriculum. In the case of NAIT's Forest Technology program, students are wirelessly connected through an 802.11b wireless network both in the main campus facility in Edmonton as well as in field facilities in Northern Alberta. This mobility is ideally suited to this highly project-based, and field oriented program.

Distance learning using streaming media

The initial limited move to online curriculum models brings with it the desire on the part of many programs and faculty to push further into the technology. The Realtime and Court Reporting Program at NAIT was one of the first to conclude its Logging activity. Following upon this success they have implemented more advanced Internet streaming technology into its delivery options. This program is now being accessed by students across North America who tune into lecture webcasts and are able to engage in live interaction with the local class. Students also have post class access to the lecture through an online archive of the webcast materials. Student satisfaction rates in this course have consistently been in excess of 90 percent.

Industry Partnerships

NAIT recently signed a 10-year strategic technology agreement with Compaq Canada Corporation that has a value of over $40 million. As an early commitment to the partnership Compaq has contributed $4.2 million toward the construction of a new $50 million information and communications technology centre. A key element of Compaq's interest in partnership was its acknowledgement of the significant, corporate commitment to information technology that is evident in NAIT's digital curriculum project.

Summary

NAIT has made extraordinary strides over the past three years in the integration of technology into teaching and learning practices and by any measure leads the way amongst similar institutions in Canada. This progress has not come about by default but rather through a deliberate planning process. The time for handing off these important shifts in pedagogical practice to a few early adopters has come and gone. The message for educators at the outset of the 21st century is very clear: Technology must play a prominent role in your service to students. The deployment of sound strategic business planning methods will position organisations to succeed in this new learning arena.

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back to index

Abstract

This paper will detail the environmental scanning and institute-wide visioning exercises that set the stage for technology integration that has become ubiquitous at The Northern Alberta Institute of Technology in Edmonton, Alberta, Canada. The paper will then describe a number of the technology integration initiatives that have come about as a result of the strategic planning exercise.

back to index

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back to index

The Impact of Assistive Technology: Section 508 and You

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View Abstract

Issues

Online education via the Internet is becoming the expected and preferred modality. The proper design and delivery of instructional material is critical to the success of the learning event or experience. In addition to the integration of proven instructional systems design (ISD) practices, new policies for access within the Federal government's electronic and information technologies must now be considered.

Section 508 went into effect in June, 2001 requiring all US Government on-line information to be accessible to users with a variety of sensory limitations. Given the scope of the Section 508 effort, agencies are literally all over the board in interpreting compliance - from ignoring it (not a good idea) to embracing literally every aspect. Unfortunately, literal interpretation and implementation of Section 508 is leading to greater inaccessibility. As guidelines are being developed and validated, the focus is on three online learning layers:

- Hosting Portal
- LMS/CMS
- Course

The Hosting Portal includes school/campus registration systems, one or more LMS systems, other online information. The Course Management System (CMS) or Learning Management Systems (LMS) host courses. They handle navigation & delivery of end-user course content. Courses are the product of Instructional Design and the focus of this presentation.

Contention in Layering

Be aware of the feature sets and limitations of the CMS/LMS and Hosting Portal in use (or contemplated) by your organization. There may be just one, or there may be several, used in different offices or divisions. Any accessibility you build into your course material needs to be compatible with accessibility provided by the CMS/LMS or it may be overridden by the CMS/LMS's lack of accessibility compliance.

Accessibility Defined

Central assumption: Accessibility means equal access to all learners to rich, engaging instructional experiences. This requires additional considerations in mapping course content. Simply tagging graphics for audio and adding captions to video is not enough. If you think electronic page turners are the bane of online learning, then imagine how difficult, and boring, uninspired production techniques must be to the disabled learners. They have few options and little recourse, but they should have just as rich a learning experience as non-disabled learners.

The Problem

Taking Section 508 too literally is a common problem. It becomes an excuse for establishing a technical link without considering the impact to content. Simply tagging all graphics, including those used for purely visual layout (i.e., eye candy graphics that are of no use or interest to visually disabled learners) provides little or no value to a disabled learner.

Designing all interactions for only the most disabled learner thereby creating a watered down learning experience for all learners. This may result in designing for a worse case scenario, effectively 'talking down' to the learner. Over captioning audio/video so that the experience for hearing impaired learners is often too cumbersome. Most of us find subtitling, either on a TV or in a movie theatre to be distracting, requiring us to focus on the motion video for affect, and lines of text for content.

Implementing 508 Policy

The existing policy is based on (today's) technology, not true accessibility. Decisions on implementing Section 508 policy are being made based on a strict view of Section 508 and of technology rather than thinking through what it means for learning to be accessible. Unfortunately, many are implementing Section 508 to avoid lawsuits, leading to a tendency for over-compensation to avoid lawsuits that have little to do with optimal instructional design. Since the only enforcement for Section 508 is litigation, agencies are over-compensating for Section 508 to avoid legal action. To some extent uncharted water, but this over-compensation is causing more problems than solutions to providing accessibility.

Myths & Misinformation

- Text-Only version of websites are required
  - False - Required ONLY if accessibility cannot be achieved any other way

- No video, JavaScript, Java Applets, or plug-ins are permitted
    - False - They just need to be made accessible
- All legacy content must be accessible
    - False - Legacy content is at your discretion
- All legacy content must be converted to HTML
    - False - Native formats can remain native format

Bureaucratic Issues

Section 508 is an un-funded mandate. All cost associated with developing and delivering Section 508 materials are the responsibility of the sponsor. If you can get others to fund your programs, fine, but there is no pot of Federal money to compensate each and every education or training office. This has caused no end of grief more many content developers already existing (barely) on very tight budgets. And in many cases, third party producers are equally at a loss on how to (accurately) charge for these additional features in the course materials they might be developing for a Federal client. In addition to developing content, updating legacy content: this must also be done at your own discretion and with your own budget. There is no set rubric for estimating costs of updating - when to update as well as what to update.

Effecting Solutions

Instructional design drives the solution. Actually this is how is should be for all courseware, but its even more critical in affording accessibility. Accessibility must be integrated as part of the design process, from the beginning, not as an afterthought. Forget about 11th hour fixes. Actually, the better the instructional design, the easier it is to make it accessible - perhaps a positive if not unintended consequence. The key point is not to simply make all interactions accessible but rather to design educationally equivalent interactions for various needs.

Three Types of Content

Surface Content

This is decorative content or "eye-candy." It exists simply to make the page visually more appealing. The same is true of any background sounds that serve no purpose other than to act as decoration.

Contextual Content

This is middle-ground content. It isn't pure decoration nor is it instructionally critical. Rather, it is framing content, or mood-setting content. It sets the stage, frames the learning content, and is necessary to provide a context for the learning itself. Whether this content is made accessible (and, if so, how) is at the discretion of the instructional designer.

Academic Objectives Content

The content represents the academic rigor of the curriculum. This is the material being taught and this is the content that needs to be made accessible in full.

Online learning pedagogies need to be able to adapt to different learning styles. After all, what is a disability but a different learning style? Highly adaptable learning content allows learners of differing abilities to all learn from the same material. Its been a basic tenet that some learners are more auditory or visual in nature and others prefer extended textual descriptions. Teachers have been designing courses with these predispositions in mind for years. And now Section 508 will place even more emphasis on well-designed content that takes this into account and adapts to all learner's needs.

In Sum, Adaptability is Key

- Adaptability means accessibility
- Disabilities manifest themselves as different learning styles.
- Good instructional design and pedagogy supports adaptability to different learning styles.
- The issue is not how to take a given web page, video, graphic, or quiz and make it accessible but rather how does one create learning content that works for all learners?
- Disabilities are different learning styles, and instructional design that includes adaptability for different learning styles is better, and easier to make accessible. Section 508 should be carefully applied to instructional content to avoid creating obstacles to accessibility - the desired goal.

back to index

Abstract

In 1998, Congress amended the Rehabilitation Act strengthening provisions covering access to information in the Federal sector for people with disabilities. As amended, Section 508 of the Rehabilitation Act requires access to the Federal government's electronic and information technology. The law applies to all Federal agencies when they develop, procure, maintain, or use electronic information technology. GSA and the Access Board are charged by Congress to provide technical assistance concerning the Section 508 requirements. The assistive technologies are also embraced internationally and codified in multiple governmental directives.

The Advanced Distributed Learning (ADL) Initiative is a joint effort of the Department of Defense (DoD), the Department of Labor (DoL), and the National Guard Bureau (NGB). The ADL Initiative supports partnerships between the Federal government, private-sector technology suppliers, and the broader education and training community for formulating guidelines for making learning software accessible, interoperable, durable, reusable, adaptable and affordable.

This session will focus on understanding the intent and standards of Section 508, and how to make provisions for assistive technologies key at distributive learning (DL) applications. The presentation on assistive technology will include demonstrations of both compliant and non-compliant materials. The presentation will also address the challenges and solutions for applying Section 508 accessibility standards to on-line education. Recent advances in adaptable learning content and robust instructional design provide the basis for accessibility. Disabilities – whether visual, hearing, or motor skill — are extensions of learning styles for which we have proven solutions.

back to index

Will Peratino

Will Peratino directs the distributed learning program for the US Department of Labor, developing and coordinating programs for America's Learning Exchange – lifelong learning to provide training, education, and technologies for career advancement and development within the US workforce.
Prior to joining the Department of Labor, he managed the design, development and fielding of more that 70 distance learning courses at the Acquisition University (DAU), and over 48 multimedia courses for the U.S. Naval Health Sciences Education and Training Command.

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back to index

G.A. Redding

G. A. Redding is an adjunct staff member at the Institute for Defense Analyses (IDA), and independently consults on multimedia strategies for military education and training.

In 1985 he joined the Secretary of Defense's Audiovisual Policy Office, developing policy to manage DoD audiovisual resources, including multimedia technologies; videodisc-based training systems, CD-ROM applications, and teleconferencing architectures.

Present affiliations include the: Radio and Television News Directors Association, Society of Satellite Professionals International, Broadcast Education Association, Society of Professional Journalists, American Society for Training & Development, US Distance Learning Association, Pan-Pacific Distance Learning Association International Society for Technology in Education, Association for the Advancement of Computing in Education, and Disabled American Veterans.

Both presenters have been with the Advanced Distributed Learning Initiative since its inception as member of the ADL Core Team and are past presenters at PTC.

www.adlnet.org

back to index

Business & Applications

Monday, 14 January 2002
1600–1730
South Pacific III - IV

M.2.2 Business Strategies—Getting to the Customer

Chair:
MITESH DESAI, Vice President, Telecom Solutions, Compaq Telecom, *USA*

M.2.2.1 InteractiveTelevision Over Broadband Networks-Can Anyone Make Money From It? (View Abstract)

JEREMY GODFREY, Member of PA Management Group; VIRAT PATEL, Managing Consultant; DAN DODSON, Principal Consultant; MARK NEILD, Consultant and CATHERINE TSUI, Principal Consultant, Telecoms & Interactive Media Practice, PA Consulting Group, *Hong Kong SAR, China*

M.2.2.2 Breaking Out of the Telecom Value Trap—Not All Customers are the Same (View Abstract)

GUY TEMPLETON, Global Head, Telecommunications & Interactive Media & Member of PA Management Group; JACKSON KAM, Principal Consultant, Telecommunications and Interactive Media, PA Consultant Group, *Hong Kong SAR, China* and KATE WATERHOUSE, PA Consulting Group, *Australia*

Presenter:
ALAN KOLNIK, Member of the Management Group, PA Consulting Group, *USA*

M.2.2.3 An Intensive Use of Satellite Weather Information for Agriculture (View Abstract)

TAKAO HARA, General Manager, Regional Information Systems Division; SUSUMU WATANABE, Manager, Science Systems Division and KOUICHI YAMAKAWA, Manager, Dept. of Satellite Communication Systems, Fujitsu Limited, *Japan*

Presenter:
KOUICHI YAMAKAWA, Manager, Dept. of Satellite Communication Systems, Fujitsu Limited, *Japan*

back to sessions

Mitesh Desai

Mitesh Desai, Vice President of Global Telecom Solutions, is responsible for managing the worldwide Marketing and Sales Support activities for Compaq's Telecommunications business. Mitesh provides leadership in shaping and driving Compaq's strategies for the Telecommunications industry, directs the development of integrated solutions in the Service Provider space, and develops and manages partnerships with Network Equipment Vendors and Value Added Software Vendors. He was named to this position in August 2000.

Mitesh has over twenty years of communications industry experience. Before joining Compaq, he spent more than fifteen years at Nortel Networks where he most recently directed the strategic business development for their Emerging Service Providers segment, focusing on emerging Data Service Providers. Prior to this, he was based in Europe driving the product and business strategies to expand Nortel's presence in the Voice and Data Service Providers. During his tenure at Nortel Networks, Mitesh served in several other capacities with responsibilities including international marketing in Japan, Asia Pacific and Europe and the development of an Intelligent Networks software business strategy. He also led development teams in the design of communication systems, both at Nortel Networks and Siemens Communications.

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back to index

Interactive Television Over Broadband Networks – Can Anyone Make Money From It?

Jeremy Godfrey, Virat Patel, Dan Dodson, Mark Nield and Catherine Tsui
PA Consulting Group
Hong Kong

View Abstract

1. Is consumer broadband just wishful thinking?

Many companies would like to see consumer broadband succeed. . .
For the last few years, incumbent telecom companies have been searching for the 'next big thing' – for a business, which will replace the declining revenue, and margins from traditional money-spinners such as long-distance and second line voice lines.

Potential new entrants cannot see a return from these markets and are also looking for a new way to compete.

At the same time, network vendors have developed new ways of deploying high-bandwidth core networks and access networks using technologies such as IP over DWDM, Gigabit Ethernet, and DSL.

While these new technologies make broadband networks more cost-effective than in the past, the deployment costs are still significant and companies are rightly wary of a technology-driven deployment without knowing where returns are coming from

1.1 Early experience with interactive television has been disappointing

Television-based services have long been seen as the application with the greatest potential for successful commercial exploitation of broadband networks. These include traditional and enhanced broadcast channels, video on demand, t-commerce and interactive advertising. Telecom companies, cable TV companies and pure-play interactive TV companies such as the UK's Video Networks have all been involved in technical trials and limited commercial launches. Yet the early experience has been disappointing and no-one has yet found a way to be profitable (see Figure 1).

FIGURE 1. EARLY EXPERIENCE OF INTERACTIVE TELEVISION HAS BEEN DISAPPOINTING

Company	Interactive TV experience
UPC (Europe)	Stopped iTV trial with Microsoft
NTL (UK)	Reduced headcount in interactive division by 50
PCCW (Hong Kong)	Closed down content production on Network of the World. Video on demand service has had very disappointing take-up
AT&T (US)	Dropped plans to roll out interactive TV with Microsoft
Video Networks (UK)	13,000 customers after seven years
US West (US)	Trial of movies on demand, home banking and interactive games ended after two years

Given the limited success of the forerunners, the question 'Can interactive television services be profitable and how?' seems to be even more important at a time when developing new revenue source is crucial to the very existence of telecommunications and cable TV operators.

1.2 Is there a way to profit?

Recent analysis conducted by PA Consulting Group shows that interactive television services can be profitable by building a customer-focused service business, which serves the best customers with multiple services.

Our proposed winning strategy is for providers to:

- Separate service provision from network ownership
- Focus on customers who will buy multiple services
- Choose technology, which can deliver multiple services over the same IP connection.

2. Providers should separate service provision from network provision

It is very risky to be integrated

We believe that it is very risky for companies to seek to integrate broadband network provision and interactive television service provision. With very high upfront costs, the economics of network provision depend on scale economies. If a network owner depends solely on an in-house service provider to provide these scale economies, then the company becomes completely dependent on achieving a high market share in service provision.

There are two possible outcomes for an integrated company – neither of which is likely to generate acceptable returns for its shareholders:

- Its in-house service provider may simply fail in the marketplace – very different core competencies are required for success and a company which is good at optimizing network construction and operation may well lack the consumer marketing and customer service skills which are critical to successful service provision

- The in-house service provider may win share in the marketplace but will have done so at a cost to its own profitability: because it will be desperate to build a very high market share, it will have to:

  - enter 'must-win' bidding wars to acquire exclusive rights to the best content such as live sport, local language movies and popular TV shows

  - engage in widespread marketing campaigns, which result in high customer acquisition costs and low average revenue per user (ARPU).

2.1 There are no broadband monopolies

Operators are very unlikely to be protected from these risks by a monopoly position. Even where there is only one provider of a true two-way broadband network, television services offered over this network will still need to compete with services delivered over other platforms such as analogue broadcast, DTT and DSS. The success of such services could limit demand for capacity on the two-way broadband network.

2.2 Separating network and service provision reduces risk

In contrast, a network owner can mitigate his risk by offering wholesale services, which are attractive to multiple service providers. He can then achieve economies of scale by aggregating the market shares of all the service providers who use his network. If he has an in-house service provider, then the provider can afford to adopt a more targeted strategy, aiming only at customers who can be served profitably. Other niche service providers may be able to use the network provider's bandwidth in a complementary way.

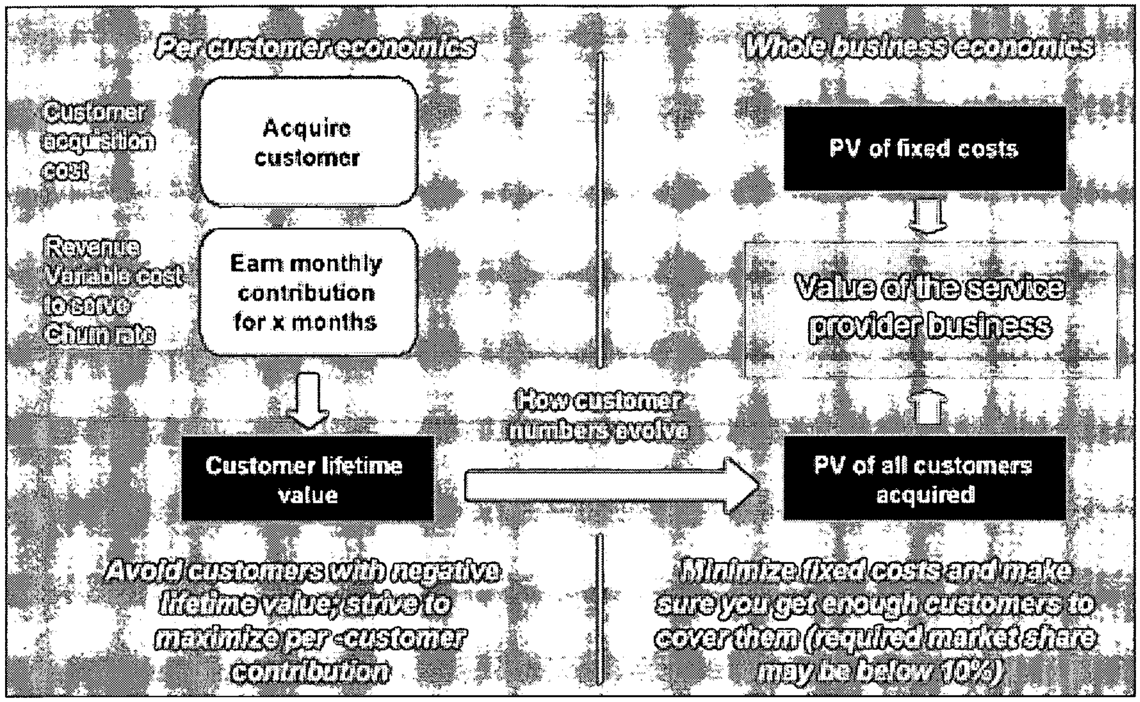
3. Service providers must focus on customers who will buy multiple services

The business case depends on per-customer economics

A pure service provider will be able to minimize upfront costs by purchasing network connectivity on a per-customer basis from a network provider. Fixed costs are limited to the costs of video servers, customer care and billing facilities and minimum commitments made to content providers.

This makes it important for service providers to focus on per-customer economics, ensuring that every customer contributes positive NPV. The drivers of shareholder value are summarised in Figure 2.

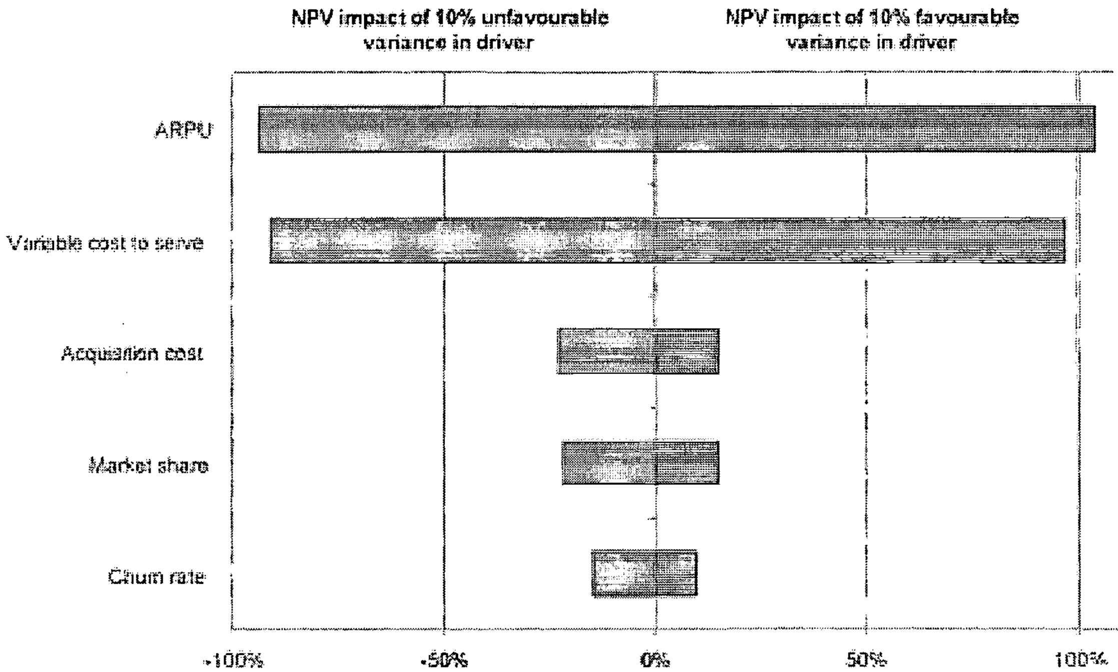
FIGURE 2. HOW TO CREATE SHAREHOLDER VALUE AS A SERVICE PROVIDER



In this sort of business, shareholder value is much more sensitive to small changes in the drivers of the lifetime value of each customer acquired, than it is to changes in market share. Our work in this area shows that a business can cover its fixed costs and generate positive NPV with a relatively small number of customers, provided that the drivers of lifetime customer value are carefully managed. This means driving up ARPU, reducing acquisition cost and cost to serve and driving down churn.

Figure 3 shows the output of a sensitivity analysis on a typical service provider business plan. A small increase in ARPU or a small decrease in variable cost per customer significantly improves the NPV of the business. In the near-term, customer acquisition costs may include the cost of giving away or subsidising a set-top box. With costs varying from under US$100 to over US$500 depending on capability, choosing a set-top box at the right price/performance point is fundamental.

FIGURE 3. DRIVERS OF LIFETIME CUSTOMER VALUE ARE MORE IMPORTANT THAN MARKET SHARE



3.1 The winning strategy is to focus first on high-value customers

Service providers who distribute over broadband networks face competition from providers who use DTT or DSS. Such competitors have lower per-subscriber distribution costs but cannot provide as wide a range of services. Broadband-based service providers need to exploit this advantage to deliver superior value to customers.

This means they must follow a marketing approach, which enables them to:

- Target high value customers who will take multiple services, for instance Internet access as well as high-end pay TV/VOD packages
- Acquire customers who purchase a low-end TV package only of there is a reasonable prospect of cross-selling additional services – unless and until declines in network costs and acquisition costs make this an economical proposition – in the near term these customers typically have an ARPU which is too low to pay for the cost of acquiring them
- Retain customers, drive up their usage and spend and cross-sell additional services.

They also need to ensure that they strike deals with content providers, network providers and set-top box manufacturers that enable them to manage variable cost to serve and acquisition costs.

Specific actions that we recommend include:

- Launch with multiple proven services, for example broadcast TV, movies on demand and 1.5Mbps Internet services and use customer preference modelling to optimize bundle design
- Target the marketing of standalone pay TV service to customers whose profile suggests they are likely prospects for broadband Internet and have a contingency plan for switching to a bundle-only

marketing strategy if conversion rates for cross-selling broadband Internet are lower than target
- Monitor the effectiveness of customer acquisition programs and ruthlessly eliminate those programs that do not recruit customers with the right value profile
- Regard other services such as t-commerce, games and interactive ads as speculative upsides[1], introducing them over time but never relying on them to justify the business until they are proven
- Plan to introduce voice services into the bundle as soon as home devices emerge which make it cost-effective to provide voice over the same network as TV and broadband Internet
- Use leading edge CRM techniques and complementary marketing efforts to drive up usage and reduce churn – for instance by personalizing the electronic program guide to promote premium content similar to content already watched by that customer
- Monitor the potential lifetime customer value of market segments with lower revenue potential and be prepared to address them as soon as reductions in network costs and acquisition costs make this viable
- Establish a management dashboard with accurate information about fixed costs, acquisition costs and variable costs and about success rates of cross-selling into different segments
- Exploit the growing trend towards multifunction home devices and work actively with the consumer electronics industry to enable customers to have a wide choice of their own plug-and-play set-top boxes in the long run and hence drive down acquisition costs.

4. Providers must choose the right technology to deliver multiple services over the same IP connection

Technology decisions have critical implications for service providers and network suppliers

The business case for service providers is very sensitive to technology costs, in particular the cost of set-top boxes and broadband lines. It is also sensitive to the ability of the technology to support delivery of multiple services (such as broadcast TV, VOD, Internet access and voice), to end-users.

This means that service providers need to be very careful in their technology choices and network providers must deploy technology, which enables their service provider customers to be profitable.

The right technology needs to be chosen for the home, the delivery network and the server. Inevitably, the technology issues are inter-dependent. We examine a selection of the key technology issues below.

4.1 The problem with ATM virtual circuit

In the near term, until all-IP based solutions with acceptable QoS are available, service providers will need to live with ATM based solutions.

ATM based devices for the home (eg set-top boxes) and the network are relatively complex and expensive. For example, to access video-on-demand a connection needs to be established between the set-top box and the server over the ATM based delivery network. In principle, several options are available – eg server to set up the virtual circuit to set-top box, DSLAM to set up the virtual circuit, or set-top box to set up the virtual circuit to the server. A leading operator in Asia has implemented the latter option. The implication is that set-top box requires additional ATM functionality that tends to increase its cost by 30%. Given the cost of the set-top box is one of the most significant capital cost items, the business case is very sensitive to variation of its value.

4.2 Migrating from ADSL to Fast Ethernet

Service providers wishing to deliver multiple services, eg broadcast TV, VOD, Internet access, and voice telephony can use ADSL technology. Although we have come across implementations of 6Mbps ADSL implementations, which can support MPEG2 video together with broadband Internet access and other services, 1.5Mbps and even 1Mbps implementations are more the norm. At these lower rates, the service provider is unable to deliver high quality video bundled with other services like broadband Internet access. A number of operators are looking into deploying Fast Ethernet (10Mbps and later 100Mbps to the home) over the next few years. Service providers should be aware of the implication for the home device – if the ADSL modem is built into the set-top box, ensure that it is modular (on a card) such that the ADSL card can be replaced by the Fast Ethernet card. This technology upgrade, as well as the cost of upgrade will inevitably drive the service provider's timing to adopt the new technology.

4.3 Home devices need to be simple

To support the range of services, e.g. Internet access and broadcast TV, VOD and voice, home devices are likely to be complex; they will require:

- Single purpose and easy to use - logging in, typing, synchronizing and crashes have no place in a home device
- A mechanism to manage the bandwidth contention to ensure that a movie can be watched, the web can be surfed and a voice call can be made simultaneously, without degrading the quality of service
- Ability to be managed remotely (say using SNMP) and for their software to be upgraded remotely.

At the same time, there are inherent complexities in interfacing to a Quality of Service enabled IP network. 'Residential gateways' are emerging to address this need. They typically include basic functionality in the base module together with expansion modules to support the range of service requirements.

4.4 Home wiring needs to be neat and minimal

Service providers should carefully address the aesthetic aspects of their solutions. This particularly affects the home devices – the number of devices as well as their shape, size and color – but also the wiring. Fat and ugly cables will not work – here category 5 cable has an advantage over coaxial. We believe the deployment of cost effective wireless LAN (802.11b and later versions) solutions will play a critical role in the home. Even if wireless LANs only address the need of a subset of services e.g. Internet access, they will serve to reduce the amount of wiring in the home.

5. Implications for residential broadband players

There are important implications for all the different players in the industry.

5.1 New entrant service providers need to be customer-centric

Many new entrant service providers have a media background and see their mission as to launch interactive entertainment services. However these services alone will not be sufficient to pay for two-way broadband network costs.

Service providers need to rethink their strategies and see themselves as providers of a range of services over the same broadband connection. They will need to add skills in product management of services such as Internet access and voice; they will need to become expert at designing product bundles; and they will need to become leading edge in their use of CRM to drive usage.

In many markets, service providers are currently unable to buy the network services they need. There is a case for service providers to enter the network business in order to ensure that the right network services are provided. But they should not do so purely in order to self-provide network. They need to see the network business as a stand-alone, arms-length, business with third party customers as well as the in-house services provider. As the market matures, the case for spinning off the network business unit will grow.

5.2 Network operators need to develop a suite of wholesale products to attract multiple service providers onto their networks

Despite their desire to see residential broadband succeed, many network owners act in a way, which stifles the development of the industry rather than stimulates it.

Common mistakes they make are:

- Establishing an in-house service provider and trying to promote by refusing to offer wholesale services to third parties – or by overpricing them
- Failing to offer pricing structures which reward service providers for contributing to their economies of scale or for mopping up otherwise unused bandwidth
- Insisting on using legacy ATM investments even though these make it hard for service providers to become profitable
- Refusing to offer IP QoS, to enable acceptable-quality voice services.

Such operators need to rethink their approach. If they hold back the development of residential broadband in the short-term, the opportunity may be lost forever as consumers sign up for digital satellite and digital terrestrial television services.

5.3 Existing integrated operators such as cable TV operators need to re-organize into two separate network and services businesses – and then follow the above strategies

Cable companies looking at the business case for digitalization can see the expense of the network upgrade, as well as revenue upsides from providing enhanced entertainment services and Internet access and from reducing signal theft.

The cable company will be taking undue risk if it remains completely integrated. It will be more likely to earn a return on its network investment if it opens it to third parties. And the service company may be able to provide service in a wider service area cost-effectively and with lower risk by exploiting network supplied by other companies.

There will be significant tensions in following this strategy unless the cable company reorganises into two arms-length business units. Ultimately one of them may even be spun-off. There may be substantial cost synergies from merging different service providers together, or from merging adjoining network operators. In contrast, keeping service providers and network providers integrated creates no synergy and merely adds to the risk.

Glossary

ADSL – Asymmetric Digital Subscriber Line is a technology that increases the capacity of ordinary telephone lines (the local loop) into the home or office. Line speed is dependent tied to the distance between the customer and the telco central office – downstream speeds of 1.5Mbps are typical (although up to 8Mbps are possible); upstream speeds of 256Kbps are typical (although up to 640Kbps are possible).

ARPU – average revenue per user.

CRM – customer relationship management is a term for methodologies, software, and usually Internet capabilities that help a company manage customer relationships in an organized way. For example, an enterprise might build a database about its customers that described relationships in sufficient detail so that management, salespeople, customer service staff could access information, match customer needs with product plans and offerings, remind customers of service requirements, know what other products a customer had purchased, and so forth.

DSS – digital satellite services are broadcast from a satellite to a dish belonging to a subscriber or shared amongst the residents of an apartment building. The signal is digitally encoded, which enables more channels to be broadcast using the same amount of spectrum and enables limited interactive services using broadcast content and a small amount of computing power in the set-top box. Further interactivity may be enabled by connecting the set-top box to a telephone line, providing a narrowband connection for sending data from the user back to the provider.

DTT – digital terrestrial television is broadcast from traditional TV broadcasting towers but the signal is digitally encoded rather than analogue. This has the same advantages and limitations as DSS, although spectrum constraints mean that there are typically fewer channels available on DTT than on DSS.

Enhanced TV services – interactive content linked to video programming. A user can access additional text or graphic-based program information, or choose amongst several options for viewing the television broadcast (e.g. choosing to follow the fortunes of a particular player in a golf championship, or to watch the highlights of the round so far).

Fast Ethernet – Ethernet, or the IEEE 802.3 standard, originally a standard for LANs is now becoming popular for MANs (see below). Devices on the Ethernet network share the available bandwidth, which comes in various speeds – 10Mbps (Ethernet), 100Mbps (Fast Ethernet) or 1000Mbps (Gigabit Ethernet).

Gateway – a device used to connect two separate networks that use different communication protocols.

Interactive TV (iTV) – a generic term used to describe a wide variety of new TV related technologies. In general it refers to any of a combination of web access on TV, video on demand, and non-web data transmission to and from the TV.

LAN – a Local Area Network is contained within a building or complex whilst a MAN (metropolitan area network) generally covers a city or suburb.

MPEG2 – Motion Pictures Expert Group -2 is an internationally agreed standard for compressing video signals. It supports a wide variety of audio/video formats, including legacy TV, HDTV and five-channel surround sound. It provides the broadcast-quality image of 720x480 resolution that is used in DVD movies. MPEG-2 typically requires bandwidth of 3 to 6 Mbps.

Set-Top Box (STB) – the generic term for a device that connects a media transmission infrastructure (satellite, cable or ADSL) to a TV. It is called the Set-Top Box because many customers place the unit on top of the TV set. Digital STBs typically are enabled with MPEG-2 decoders, processors, memory, graphics capability and a communications interface to its transmission infrastructure.

SNMP – Simple Network Management Protocol is a protocol for governing network management and monitoring of network equipment. Traditionally used in the private (enterprise) networks, it is now increasingly used in telco networks.

T-commerce – t-commerce is the same as e-commerce except done over a television. t-commerce may be linked to broadcast content – e.g. by inviting viewers of a movie to order spin-off products via the TV set, or by inviting viewers of a sports event to bet on the outcome.

Video on demand (VOD) – VOD refers to the process of storing video content on storage devices, typically large computer disk drives, in order for it to be played by a consumer at any time. Consumers are typically able to pause and rewind VOD content.

Endnotes

1. According to BMRB research, only four percent of digital viewers consider interactive services are a major benefit. And in a MORI survey commissioned by Kesslers International, over a third of the

digital viewers said they will never purchase products or services using digital TV

back to index

Abstract

Media companies are increasingly producing content, which adds limited but easily-usable and highly-popular interactivity to the broadcast TV experience. These services can be delivered cost-effectively over digital satellite, digital terrestrial television and one-way digital cable networks - supplemented by a dial-up link or other narrowband return path.

Other companies have been trying to add greater interactivity, especially true video-on-demand, and see this "highly interactive television" as the application that will pay for the roll out of broadband networks. But the early experience is not encouraging and costs for fully interactive services still seem too high for this to be a viable business.

The paper proposes a three-fold winning strategy and sets out the implications for residential broadband players.

The proposed winning strategy is to:

- Separate service provision from network ownership
- Focus on customers who will buy multiple services
- Choose technology, which can deliver multiple services over the same IP connection.

The implications for residential broadband players are:

- Pure service providers (e.g. new pay TV licensees) need a business strategy which incorporates other services besides pay TV and video on demand, e.g. Internet access, voice, etc
- Network operators (e.g. incumbent telecom operators) need a suite of wholesale products to attract multiple service providers onto their networks
- Integrated operators (e.g. cable TV operators or telecom operators with an interactive TV service subsidiary) need both of the above, and they need to re-organize into separate wholesale and retail functions.

back to index

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Prior to joining PA, Jeremy spent 9 years with Cable & Wireless Group in a variety of strategic planning and marketing roles in the UK and Hong Kong, and joined PA from Hong Kong Telecom where he was Director of Strategic Planning and then Director of Marketing.

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back to index

Breaking Out of the Telecom Value Trap – Not All Customers are the Same

Guy Templeton, Jackson Kam & Kate Waterhouse
PA Consulting Group
Hong Kong & Sydney

View Abstract

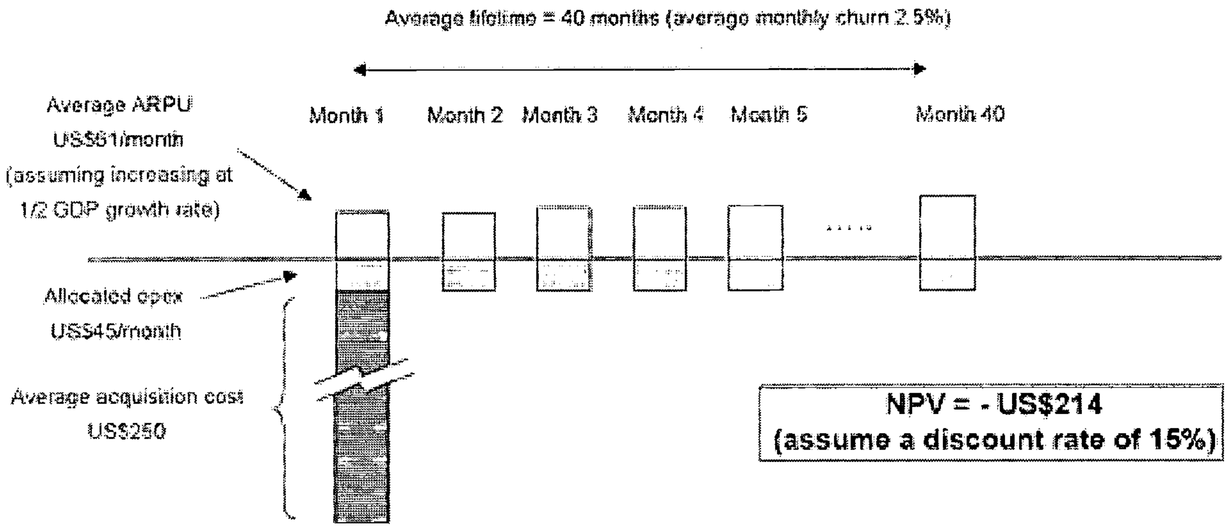
1. The Case for Focusing in High Value Customers

The mobile industry has enjoyed very healthy growth in the number of subscribers over the last few years, with penetration levels reaching 80% in the more developed markets. At the end of 2000, there were over 650 million mobile phone customers in the world, up by over 100% from the end of 1999. Many mobile operators have focused on market share of customers as the primary measure of success. Valuations are often quoted in terms of US$/subscriber, with many operators responding by gleefully adding new customers – whatever their quality – in the hope of boosting their valuations.

Looking beneath the surface of the apparent success, the outlook of the mobile sector is worrying. Valuations of telecom companies have fallen by an average of 50% over the past 12 months[1] as investors increasingly doubt that customer growth in itself is sufficient to create long-term value. The high prices paid for 3G spectrum, particularly in Europe, have depressed the valuations of many operators even further. Competition has intensified to a stage where operators are waging destructive price wars; basic mobile services are quickly becoming commodities; Average Revenue Per User (ARPU) continues to fall; significant revenue from mobile data services are yet to come; profitability has reached record low (negative for many operators); customers are becoming more demanding and less loyal; churn rates are high and mobile number portability (MNP) is worsening the situation.

In fact, many low-value mobile customers are actually NPV-negative (see Figure 1). Some mobile operators accept these low value customers in the hope that they will become the high value customers of tomorrow. However, loyalty is too low in most markets for this to be a winning strategy, in the same way that retail banks have finally acknowledged that it is better to charge account keeping fees for the lowest value customers than to patiently wait for them to become profitable. If nothing is done to rectify the situation persisting in many mobile operators, the destruction in shareholder value over the past year will be difficult to recover.

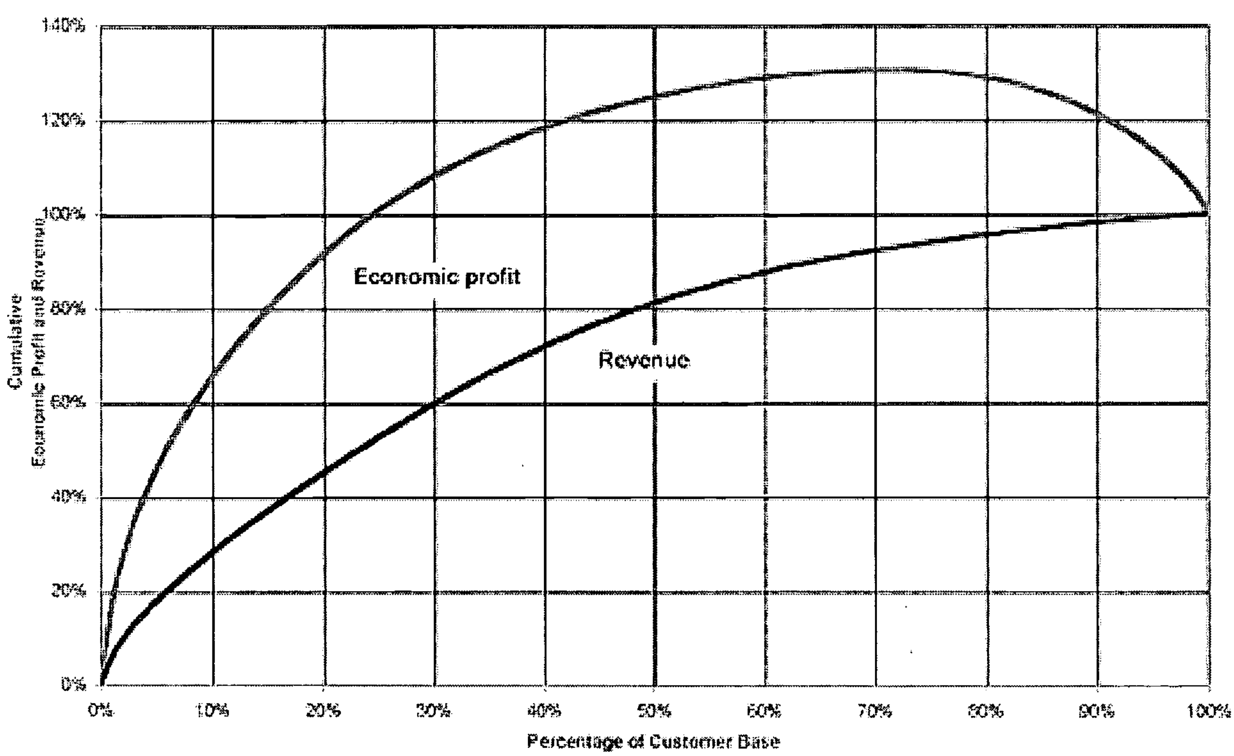
FIGURE 1. ESTIMATED AVERAGE NPV OF SUBSCRIBERS ACQUIRED BY MAJOR OPERATORS IN 1999/2000



Note: All figures are averages of the data or estimates of ten leading mobile operators (AT&T Wireless, Telstra Mobile, Sprint PCS, Telenor, Sonera, Vodafone, SingTel, NTT Docomo, Taiwan Cellular and SK Telecom)

Moreover, the Holy Grail of mobile data revenues enabled by 3G is dependent on business from high value customers, so operators really have little choice but to improve their attraction and retention of the cream of the mobile users. Profits are improved by increasing the proportion of high ARPU customers who generally deliver a higher gross margin percentage (e.g. due to high-margin roaming usage) and exhibit lower churn when correctly served. Note that the lifetime value of a high-value customer can be around 30 times higher than a low-value one[2]. In our experience, many operators have a portion of their customer base who are not profitable at all. Figure 2 shows a typical profile of customer revenue and profit.

FIGURE 2. TYPICAL MOBILE OPERATOR CUSTOMER REVENUE AND PROFIT DISTRIBUTION



Improvements in the acquisition and retention of HVCs can therefore have a disproportionate effect on the value of a mobile operator. For a typical mobile operator, our analysis shows that swapping its bottom 5% of customers (measured by revenue) for the same number of customers exhibiting the behaviours of its top 5% then its valuation would increase by 18%[3] . If instead the measure used is customer profit, then the valuation changes by a massive 34%.

In fact, many operators have already started to shift from rapid customer acquisition at any cost to focus on HVC retention and increased ARPU. For example, Vodafone in the UK cut the subsidies for pre-paid customers[4] and publicised its effort to concentrate on high value contract users.

Mobile operators can achieve a higher share of HVCs by:

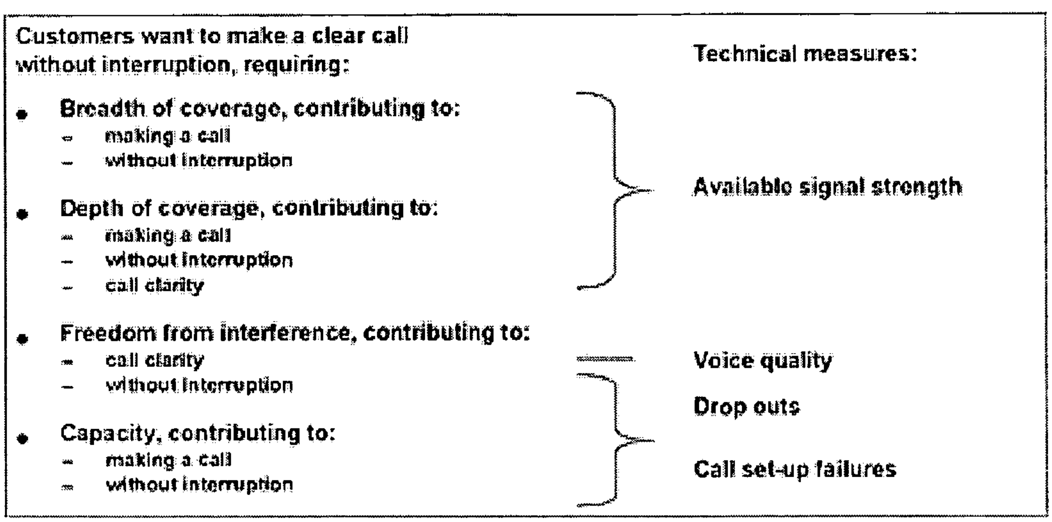
- Convincing customers of superior quality network
- Developing dedicated sales and service channels with clearly differentiated levels of service
- Building a compelling brand that appeals to HVCs
- Targeting high-potential vertical industry segments with tailored offers
- Putting in place the right supporting infrastructure.

2. Convince customers of superior quality network

Excellent network quality and coverage is essential to attract and retain high value customers. Dropped calls and poor voice clarity are likely to cause this group of customers to churn and to be resistant to churning back in future. HVC attraction and retention is very substantially enhanced if superior network quality can be proved.

The first step in improving perceptions of network quality is to develop defensible, communicable and objective proof. This involves measurements of received signal strength, drop-out rate, call set-up failure rate and voice clarity using a rigorous testing methodology. Measures of quality are shown in Figure 3.

FIGURE 3. ASSESSMENT OF NETWORK QUALITY



Tests have to be conducted at a large enough number of indoor and outdoor locations, and the measurement system has to be repeatable, accurate, fair, applicable and robust:

- **Repeatable** – results must be consistent for a given set of conditions and inputs
- **Accurate** – outputs must be correct within an acceptable tolerance
- **Fair** – the measures are fair for comparing the quality of cellular networks
- **Applicable** – the measures are ones the typical customer would say is relevant to comparing the quality of mobile networks
- **Robust** – the associated methodology and procedures have sufficient rigour to ensure fairness, accuracy and reputability.

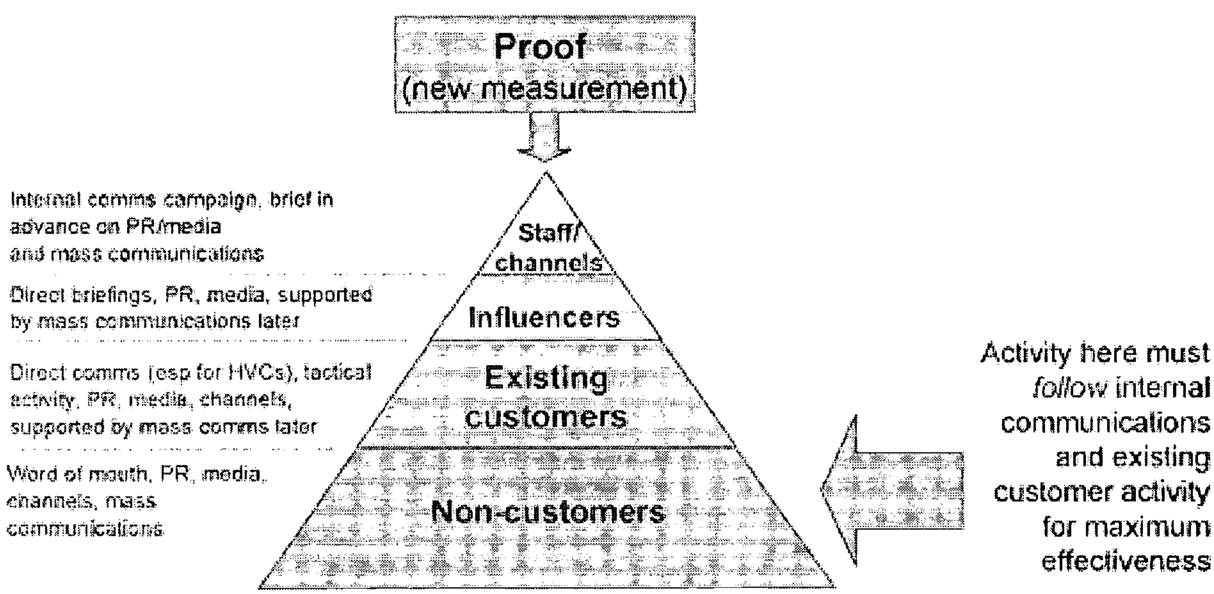
Ideally, the test approach should be audited by an independent party and/or the regulator to bring additional credibility to the results.

The defensible measurements need to be converted to marketing messages and communicated to all key audiences, which include:

- **All staff** (especially sales and service channels)
- **Key influencers** (e.g. investment community, media, opinion leaders)
- **Existing customers** (starting with HVCs and extending to the whole base)
- **Wider market and ex-customers** (via a multi-execution, long-running campaign – heavy percentage of total communications spend).

Active management of 'word of mouth' is very important and the key audiences have to be briefed in the right sequence (see Figure 4).

FIGURE 4. COMMUNICATING THE PROOF OF NETWORK QUALITY



If the operator is not the network quality leader and is playing a catch-up game, a claim of being No.1 is not possible. In such cases an operator may be able to aim for an image of network quality parity – telling customers that network quality has improved to the point where it is no longer a discriminator – or at a minimum finding a positive network quality fact to promote.

Operators successful in rapidly improving network quality perceptions also support coverage claims with tactical initiatives to promote network improvements and prevent network quality-related churn. Examples of such 'quick win' initiatives are:

- **Localised network upgrade at high-priority locations** – e.g. central business districts (including lifts in high-rise buildings), highways, airports, tunnels, high speed railroads and other known HVC concentrations
- **Dropped call callback programme for HVCs** – send a text message to the customer to reassure them that they will not be charged for the call, communicate network status, cause and likely resolution time (especially for repeat problems) – this can potentially turn a bad impression into a neutral or even positive one
- **Improved complaint handling process for HVCs** – e.g. dedicated support lines, continued personal attention to complaints, automatic follow-up, free handset upgrades, focus on corporate users rather than just the corporate facilities buyers.

3. Develop dedicated service/sales channels with clearly differentiated levels of service

HVCs typically want to be given preferential and superior treatment. Best practice mobile operators very often develop a dedicated sales/ service channel tailored to the needs of the HVCs. This channel is typically of significantly higher quality and has appropriate business experience to deal with HVCs, in the same way as some retail banks have developed separate channels for high-worth customers.

The key to successful HVC channels is clear differentiation of service levels. This usually means dedicated resources, better trained frontline staff, aggressive performance targets, good customer relationship management (CRM) system support and an HVC-focused mentality, as shown in Figure 5.

FIGURE 5. DIFFERENTIATED LEVELS OF SERVICE FOR HVCs

Channel	Service standards for mass market	Service standards for HVCs
Call centre	• Limited operating hours • >50% of calls handled by IVRS • Moderately skilled CSRs • High agent-to-customer ratio • Medium to long average queue time and hold time	• 24x7 operation • All calls handled by human operators • Highly skilled customer service relationship managers with excellent language and communication skills • Low agent-to-customer ratio • Very short waiting time
Retail outlets	• Mass market customers served in the general queuing area at shops	• A number of dedicated HVC-only service centres available at premium locations • Dedicated counters or rooms available at other outlets

Direct sales/ service workforce	• Minimal support from direct sales/service workforce – mass market customers need to go to the outlets or call the hotline	• Door-to-door delivery and pickup service (e.g. replacement handset) for top-tier HVCs • Personal visits from sales representatives (e.g. for new product demonstration)
On-line	• Medium to long response time for Web-based or < e-mail enquiries	• Same functionality as for mass market; but the quality of the interface must be high enough to satisfy HVCs • Quick response time for enquiries (i.e. priority will be given to HVCs)

The ongoing costs associated with such differentiated services are high. Like other service industries such as airlines, hotels and consumer banking, many HVC-focused operators adopt a tiered membership structure to offer different service standards to customers with different spending levels. This way the expensive services will only be offered to the highest end users.

Another important element in the design of a HVC membership programme is the set of entry, exit, upgrade and downgrade criteria. These conditions should be developed such that:

- Existing high-potential medium users will not be ignored – otherwise you may lose many hidden gems
- Entry flexibility will be offered to promising new subscribers – for instance, all customers from a competitor's HVC club should be granted the same status automatically (without, for instance, insisting on a six-month track record of high usage)
- HVCs with bursts of high usage (e.g. seasonal roamers) should be included, provided that aggregate annual expenditure exceeds the threshold.

Customers under active relationship management of a HVC membership programme tend to have much lower churn (2-4 times lower in PA's experience). It is therefore important to identify all HVCs in your customer base and manage all of them consistently under the dedicated channels. If, after all that, a HVC does churn, the systems should immediately prompt action to:

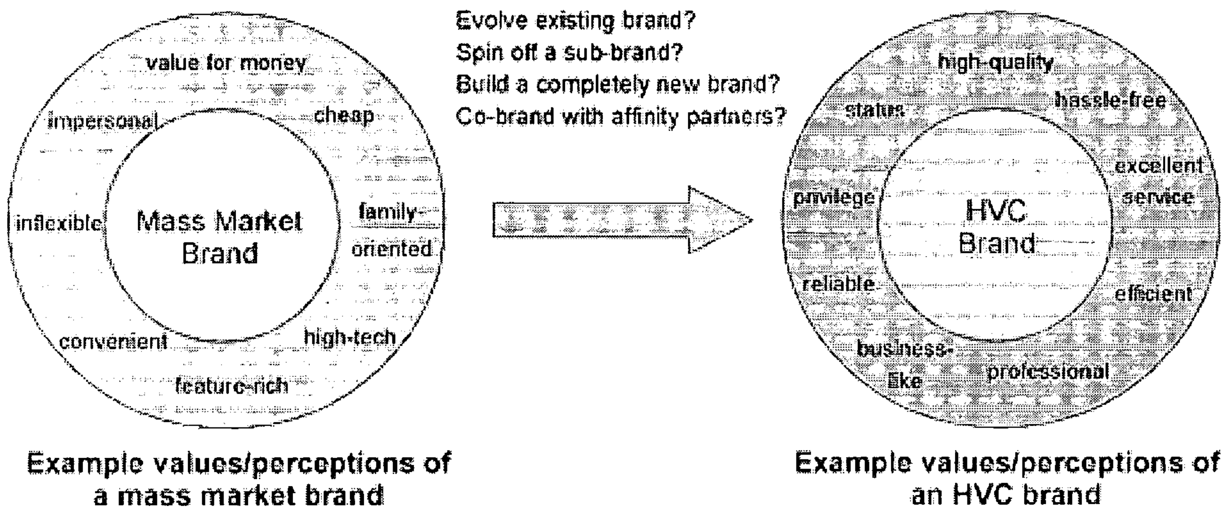
- Find out what happened, and how it can be fixed
- Win that customer back through an appropriate and personalised offer.

4. Build a compelling brand that appeals to HVCs

What does your brand stand for in the minds of HVCs? How compatible are the perceived brand values of your brand with those expected of a high-value offering (e.g. privilege, high-quality, hassle-free)? These are all questions that a best practice HVC-focused operator needs to examine. Having a compelling brand and value proposition is key to success.

As illustrated in Figure 6, a mass-market brand has very different values from a HVC brand and is very ineffective in attracting and retaining HVCs. A brand repositioning is often necessary if a mass-market based operator wants to target the high-end segment.

FIGURE 6. MASS MARKET AND HVC BRAND VALUES



From PA's experience, there are several ways to migrate from a mass-market brand to a HVC brand:

- **Evolve via a re-branding exercise –** typically through a series of aggressive, high-impact communication campaigns
- **Spin off a sub-brand with very distinct attributes –** the sub-brand can have a certain degree of endorsement from the parent brand for credibility (and other positive attributes) but at the same time possesses its own unique values that are HVC suitable. Examples in other service industries include CitiGold of Citibank and BA Executive Club of British Airways
- **Create a completely new brand –** e.g. PCCW in Hong Kong has three separate mobile brands targeting different segments: 1010 for HVCs, one2free for the young and yuppies, 1+1 for the price-conscious
- **Co-brand with key affinity partners –** for instance, arrangements can be made such that high-end customers of the affinity partners (such as banks and airlines) will automatically be pre-qualified as members of the mobile operator's HVC club.

Each method has its pros and cons and the brand architecture needs to be considered very carefully. If incorrectly designed, it may ruin your existing mass-market business without making a significant difference to HVC attraction and retention.

Brand migration needs to be supported by matching communications, public relations and service offerings.

5. Target high-potential vertical industry segments and specific job functions with tailored offers

From our experience, one good source of HVCs is carefully selected vertical industry segments (e.g. investment bankers who roam around the region and need to be in touch). Mobile operators successful in attracting HVCs typically develop specific offerings for these vertical industry users – with the customer benefits described such that they play to the particular needs of that industry.

The task of segmentation is made more difficult by not all job functions within an industry sector requiring extensive mobile usage. In addition, some job functions are mobile-intensive irrespective of industry (e.g. sales forces). For this reason, PA recommends a three-part process:

- Identify the highest potential industry verticals
- Identify the highest potential job functions
- Develop tailored offers.

5.1 Identify the highest potential industry verticals

Vertical industries are like potential gold mines that contain pockets of HVCs with high telecom usage due to business needs. It is useful to map out vertical industries for a particular geographical market. Each sub-sector can then be sized, allowing the operator to determine its priority targets.

From various vertical segmentation exercises that PA has conducted, we find that high concentrations of HVCs can usually be found in the following types of industries:

- Professional services (eg accountants, solicitors, investment bankers, consultants, project finance bankers) who often travel regionally and internationally with high roaming demand
- Industries with a large mobile salesforce (eg insurance sales agents, real estate agents, stock brokers/traders) – they are locally mobile and they need to be in touch with clients all the time
- Industries associated with regional or international trade (eg import, export)
- Cross-border transportation companies.

Figures 7 and 8 highlight target industry segments.

FIGURE 7. CONCENTRATION OF HVCs BY INDUSTRY

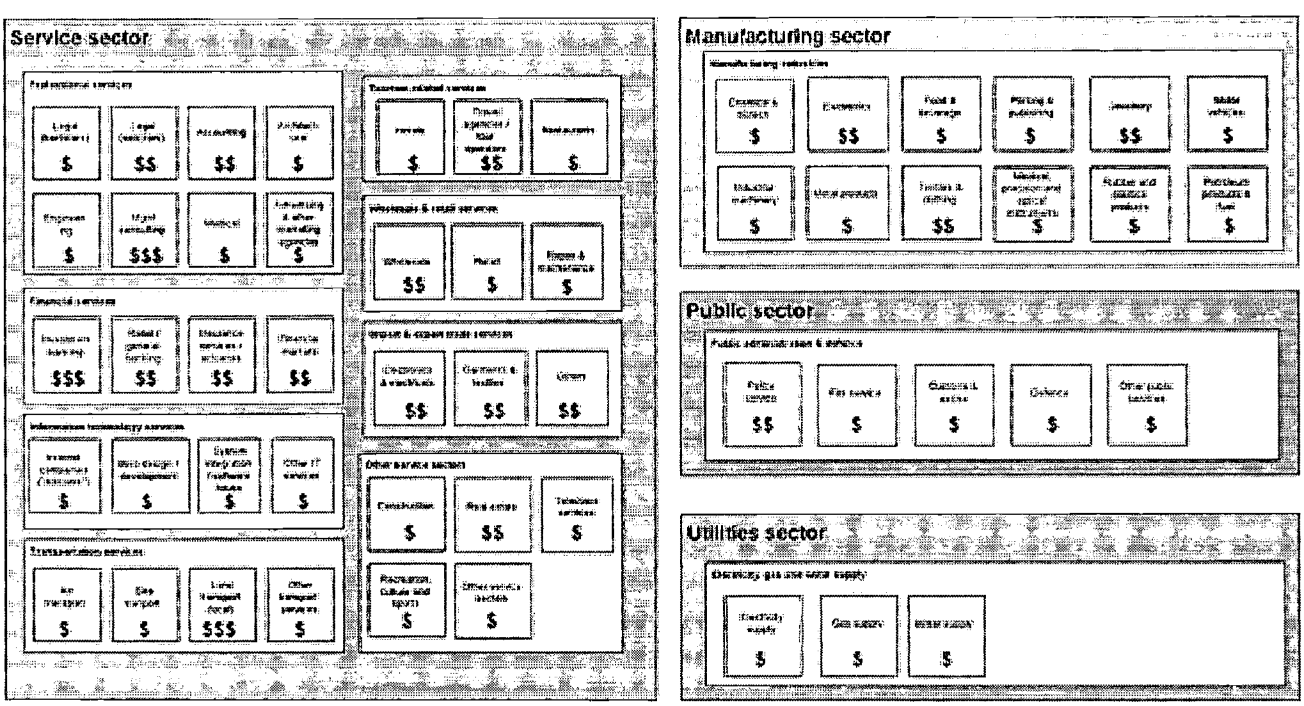
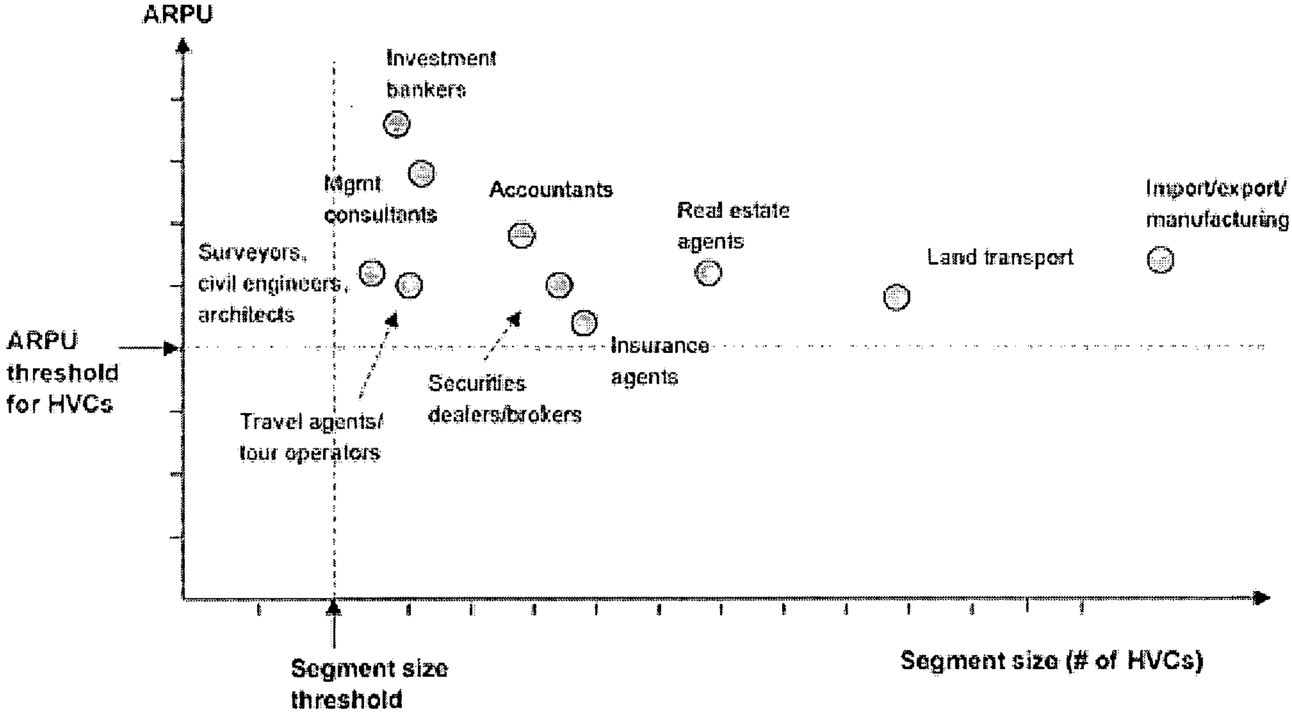


FIGURE 8. ILLUSTRATIVE HIGH-PONTENTIAL VERTICAL INDUSTRY SEGMENTS



A good way to evaluate the potential of a vertical segment is to analyse each segment by company size, rank, role and geographical spread. This will vary between countries and cities. The usage pattern of each logical group of users can then be analysed to determine the ARPU level, as illustrated in Figures 9 and 10.

FIGURE 9. FURTHER SEGMENTING WITHIN VERTICAL INDUSTRIES
DIFFERENT DIMENSIONS: GEOGRAPHICAL SPREAD, COMPANY SIZE, RANKS/ROLES, FUNCTIONS

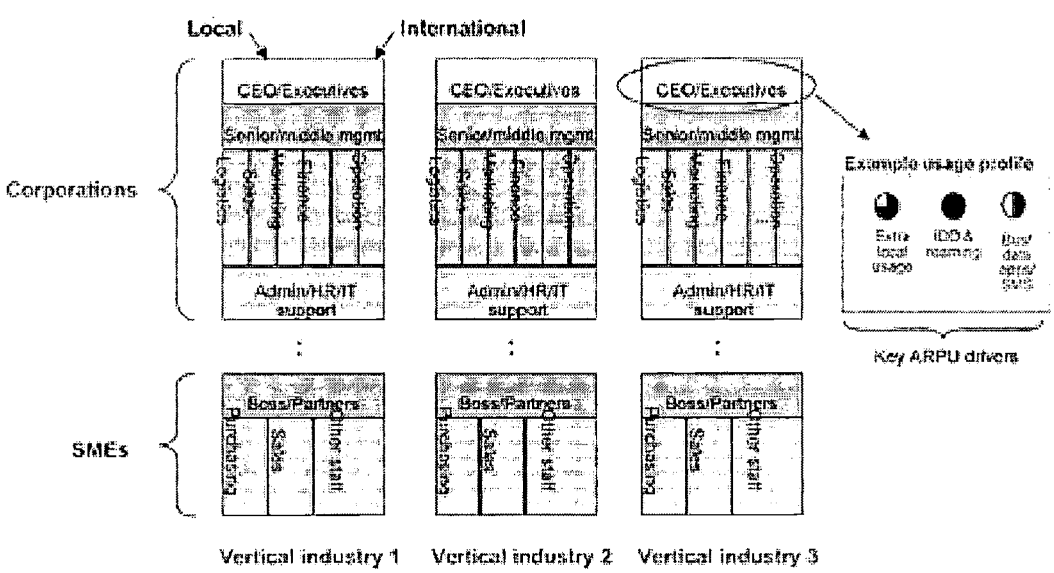
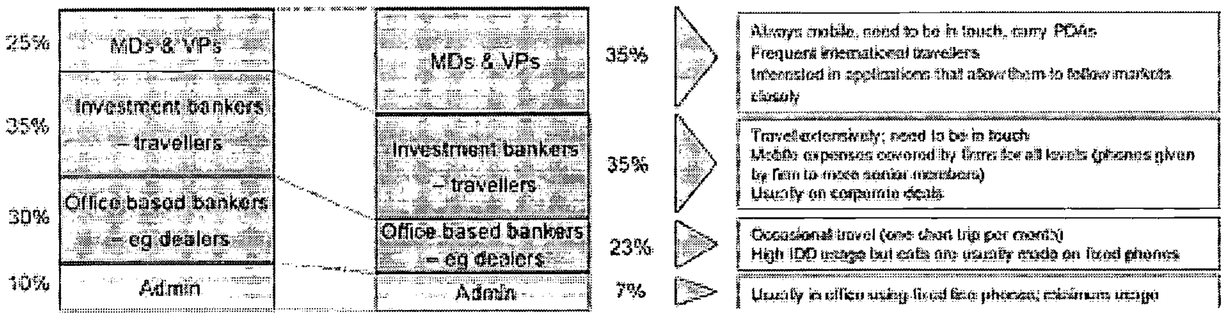


FIGURE 10. ILLUSTRATIVE EXAMPLE – PROFILE OF THE INVESTMENT BANKING SEGMENT



5.2 Develop tailored offers

To get the best results with these high-value industry segments, mobile operators must first understand the specific needs of the industry and then develop tailored value propositions and offers. The technique of product bundling is particularly effective, as proven in other industries such as utilities (multi-products of electricity and gas) and financial services (banking and insurance). Meaningful bundling can benefit telecom operators through reducing average customer acquisition cost and erecting a higher barrier to switching.

Note that the industry segmentation and offer development process is a very useful one for mobile operators to master. It not only helps to increase share of HVCs, but also prepares the organisation to deal with the demands of a successful 2.5G/3G business (many of the techniques involved are similar).

6. Put in place the right supporting infrastructure

Effective strategies to improve share of high value customers and to reduce churn are based on thorough market analysis and deep understanding of segment needs. However, many initiatives are at risk of failure because they are simply not implemented well or not implemented at all. Initiatives need to be supported by the appropriate IT infrastructure, business processes and organisational structure.

Appropriate IT (including billing system, CRM/call centre system, data mining tools etc) is essential for implementation in sales channels, customer service and marketing. In order to achieve focus on HVCs in channels and marketing teams, it is essential to set performance measures for teams and to implement ongoing monitoring of customer behaviour. Other examples of desirable IT capabilities include:

- Ability to recognise HVC calls by 'calling line identification' and route to different team of call centre agents
- Expanded database structure and front-end screens that support a rich customer profile (e.g. contact history, needs and preferences, full range of demographic data)
- A scalable CRM system to automate campaign management and dialogue management
- Advanced data mining/manipulation tools that allow criteria-based selection of customer segment and mass customisation of customer records
- Ability to customise bill presentation (including tailored marketing messages) for different categories of customers.

HVC-focused business processes are another critical enabler. For example, best practice operators:

- Modify EIS to reflect impact of HVC initiatives on business performance
- Put in place a performance measuring system (e.g. balanced scorecard based on customer lifetime

value, customer profitability or shareholder value) to monitor the success level in obtaining value from HVCs – all measurements and reporting are HVC focused
- Re-align market research, market analysis, strategic planning and other key marketing/sales processes to increase emphasis on HVCs.

Simple process changes are not enough. Top management must commit to a principle of not all customers being equal. Managers need to drive a culture and set of behaviours throughout their organisation that ensure high value customers are treated with a level of care commensurate with the value they contribute to the shareholders of the company.

Creating value in mobile communication is no longer about having the most customers. Success depends on superior service of high-end customers and ensuring that even your worst customers are worth having. Achieving such a position in highly competitive telecom markets requires changes to many aspects of business operations. Those who can swap out 5–6% of low-end customers for high-end customers can boost their valuation by around 20-30%. Those who cannot will have to be very lean, low-price operators or suffer the consequences of being caught between the only two viable strategies.

Endnotes

1. 12 months to March 14, 2001 (Morgan Stanley Capital International)
2. Assuming that the lifetime is 2x (i.e. half the churn rate), ARPU is 12x, gross margin is 1.3x (due to use of more profitable services such as roaming)
3. Assuming that the top 5% customers have eight times the ARPU of those in the bottom 5% and that the net profit margin will stay the same after the swap
4. March 2001

back to index

Abstract

Mobile operators should increase emphasis on high-value customers (HVCs) to protect value in competitive markets - they need to win a higher proportion of those customers, retain them longer, and win them back if they leave. The value of a typical mobile operator can be boosted by 18% if the bottom 5% of customers (as measured by revenue) could be swapped for a group representative of the top 5%. This paper describes how such a transformation can be achieved. If instead the measure used is customer profit, then the valuation changes by a massive 34%.

back to index

Guy Templeton

PA Consulting Group

Guy Templeton is responsible for PA Consulting Group's Global Telecoms & Interactive Media Practice. The Practice has resources through North America, Europe/UK and Asia Pacific and specialises in consulting to telecommunications, media and related companies.

Guy has been with PA for 11 years: 4 years based in PA's Sydney office and 7 years in Hong Kong. During this time he has worked in over 20 countries undertaking strategy, business planning, performance improvement, regulatory and financial due diligence/M&A work.

Prior to joining PA, Guy held a number of engineering and management roles in the telecommunications and electricity industries. He holds a degree in electrical engineering and a MBA.

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back to index

Alan M. Kolnik

Present Position:
Member of PA's Management Group

PA Experience:

Joined PA in March 2001
Leads the US Telecommunications and Interactive Media Practice
Recently led an engagement developing the marketing approach for a manufacturer of very advanced multiprocessing enhancements for 3G wireless base stations. The enhancements add about 30% to coverage or capacity of a 3G base station. PA developed value propositions for the client to use to approach 3G base station vendors and network service providers, modeled networks with and without the enhancements, and built a detailed network business plan to demonstrate the cost savings achievable. Currently working with one of the large US wireless service providers to establish their 3G network development and deployment strategies.

Pre PA Experience:

Practice Leader and Engagement Manager for numerous projects in areas of telecommunications, financial services, e-commerce, information systems, data networking, and general corporate strategy

- Engagement director of a scenario planning exercise for a large North American telecommunications conglomerate developing its strategic plan for interactive television (iTV) services. The work examined the role of all communications activities of the company, from television to mobile commerce, and led to plans for coordinating their interactive service offerings.

- Engagement director of a project to advise a leading NA gas company on its strategy to enter the US telecommunications market. The work examined the value of its rights-of-way, strategic and operational planning, and its proposed entry into the telecommunications business, with subsequent recommendations on a course of action to be pursued.

- Engagement Director of a study of a leading North American wireless carrier's marketing and sales approach. The results assisted the carrier develop approaches to reduce churn and lower customer acquisition costs

- Engagement Director leading a team developing the business plan for a global voice and data network, with anticipated revenues of $10 Billion after 10 years. The business was later sold for $5 Billion.

- Engagement director for a project to model an RBOC's complete residential sales-force costs. The model allowed the RBOC to project the benefits of consolidating, closing and opening sales offices throughout its seven-state territory.

- Engagement director managing the equipment specification, procurement, and deployment of the network used to collect voter registration information throughout Mexico

- Engagement director of an engagement for an Argentinean telecommunications company concerned that new cellular carriers threatened its long distance revenues. The team modeled the revenue flows along all major long-distanced routes and projected cellular by-pass using benchmarks from other countries. The results indicated that the threat would be minimal and the carrier avoided entering a costly litigation process.

- Engagement director for an 18-month project at one of the world's largest market data vendors, leading a turn-around effort. The work covered new product development, marketing studies to refocus the company, organizational restructuring and culture change, development of a new global data collection and dissemination network connecting over 120,000 users, and personal coaching of the executive team. The business was sold at the end of the engagement for $450 million.

- Engagement Director of a project to assist the New York Stock Exchange respond to a concept release from the SEC that would require it to move to a rate-based pricing structure for market data. The response was the central part NYSE's response, and was instrumental in delaying and possibly blocking the proposed changes.

- Engagement director leading a team that mapped out new collaborative processes for the two committees (CTA and OPRA) that are now used to develop estimates of processing capacity needed to process all US equity and option trades. The process created three planning regimes that allow the committees to plan successfully for annual capacity increases, capacity increases required for events such as, for example, the conversion to trading in decimals, and for emergencies.

- Engagement director for a turn-around effort at a small telecommunications equipment vendor. Following a thorough assessment of the company's product lines using a modified Activity-Based-Costing method, the company sold and closed three out of five product lines and moved to develop new fiber-optic components for the telco market. The company was sold two years later for a value nine times its market capitalization when the engagement began.

- Assisted one of the RBOCs develop its frame relay marketing strategy, including distribution strategies, channel strategies, pricing approach

- Developed annual strategy documents for two years for the Small Business and Commercial lines-of business at an RBOC.

- Developed valuations for satellites, transponders and earth-stations in support of litigation efforts by major satellite carriers.

- Led numerous projects to develop network strategies for corporations and banks. The work included organizational and technical recommendations, equipment selections, and budgeting.

Before entering consulting, led teams developing advanced computerized numerical control machines and fiber-optic LANs. Led the development of the first operational FDDI LAN.

Education:

B. E., Auckland University, Auckland, New Zealand
MBA, Yale School of management, New Haven, Connecticut

Languages:

English, Hebrew

http://www.paconsulting.com

back to index

An Intensive Use of Satellite Weather Information for Agriculture

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Fujitsu Limited
Kawasaki, Japan

View Abstract

1. General

There is an old Japanese proverb: "Sei kou u doku." The meaning of this proverb is an advice to people to read books at home when it rains and to plow fields when the sun shines. The proverb expresses a spirit to follow the course of nature. It also means that life is dependent on nature. In today's agriculture, even though it is impossible to control the weather, the effects of the weather on agricultural production can be minimized if detailed weather forecasts are available.

Recent demand for productivity improvements in agriculture has led to a call for use of information and communication technologies. Since the weather in recent years has changed noticeably in comparison with the more distant past, obtaining accurate weather information has become extremely important in order to prevent damage caused by weather-related catastrophes. The availability of such information enables improvements in agricultural efficiency and development of value-added production methods. Consequently, in addition to the general weather information currently available, more detailed and farmer-friendly weather information is necessary for agriculture, and such information has to be linked to systems of agricultural technology. Continuous development of agriculture in the 21st century thus requires further improvements in productivity through the use of information based on scientific data and new technologies.

For the above reasons, the Japan Agriculture Information Systems Association, a cooperative organization, has been using satellite communications to develop and set up an agricultural weather information network system that covers all of Japan. The system offers detailed information immediately, contributing toward accomplishment of the above stated goals. We have been engaged in the development of the VSAT satellite network and weather analysis software under guidance of the Japan Agriculture Information Systems Association and the Japan Weather Association (JWA), and our work has contributed to implementing the latest and largest-scale system to date.

This article describes the characteristics of the developed technology and the structure of this system, and it presents the prospective effects of the new services.

2. System Characteristics

Until now, weather forecasts have been made by analyzing conditions in areas of 20 square kilometers, and forecasts have been based on the observational data. News providers, such as broadcast services, have then provided the weather information. In agriculture, however, specialized regional forecasting of events such as forecasts of frost is desired. This kind of forecast requires more detailed information about areas within specific limits (micrometeorological forecasts) than currently available.

To satisfy this demand, our systems analyze weather conditions in areas of 1 square kilometer (1-km mesh). In addition, for community-based weather forecasts, weather-monitoring robots have been installed in different parts of the country. Those robots send weather information to a central headquarters. The headquarters corrects weather forecasts depending on the information from each region. Highly accurate weather forecasts can thus be obtained. The weather forecasting system is divided into the Weather Information Headquarters and regional centers. They coordinate their operations to provide regional weather information that integrates both national and regional weather data. This is the main feature of the new system. The system can provide weather information for every hour up to 48 hours in advance.

This system uses bi-directional satellite connections to distribute highly accurate weather information immediately all across the country and to collect observational data from various regions, including secluded locations in the mountains.

Constantly changing weather information requires continuous analysis of the latest observation data. Our new micro weather forecasting system, which has a 1 km mesh, requires a processing capability about 100 times faster than that of the current system, which has a 20 km mesh. In addition, the new system requires one-third of the analysis time required by the previous system, thereby ensuring even faster results. By employing a supercomputer, we are able to match our performance requirements.

3. System Configuration

As shown in Fig. 1, this system consists of the Weather Information Headquarters, which analyzes weather data for forecasts, the Satellite Up-Link Center, which transmits the information, the Regional Centers located across Japan, and related organizations that use the data, including agricultural organizations. Each Regional Center is equipped with a meteorological observation robot. The robot provides local weather information as data sent to the Weather Information Headquarters via a satellite return circuit.
The Regional Centers are connected to regional agricultural organizations and cable television providers of agricultural districts, and they send information to farmers via TV, personal computers, and facsimile machines.

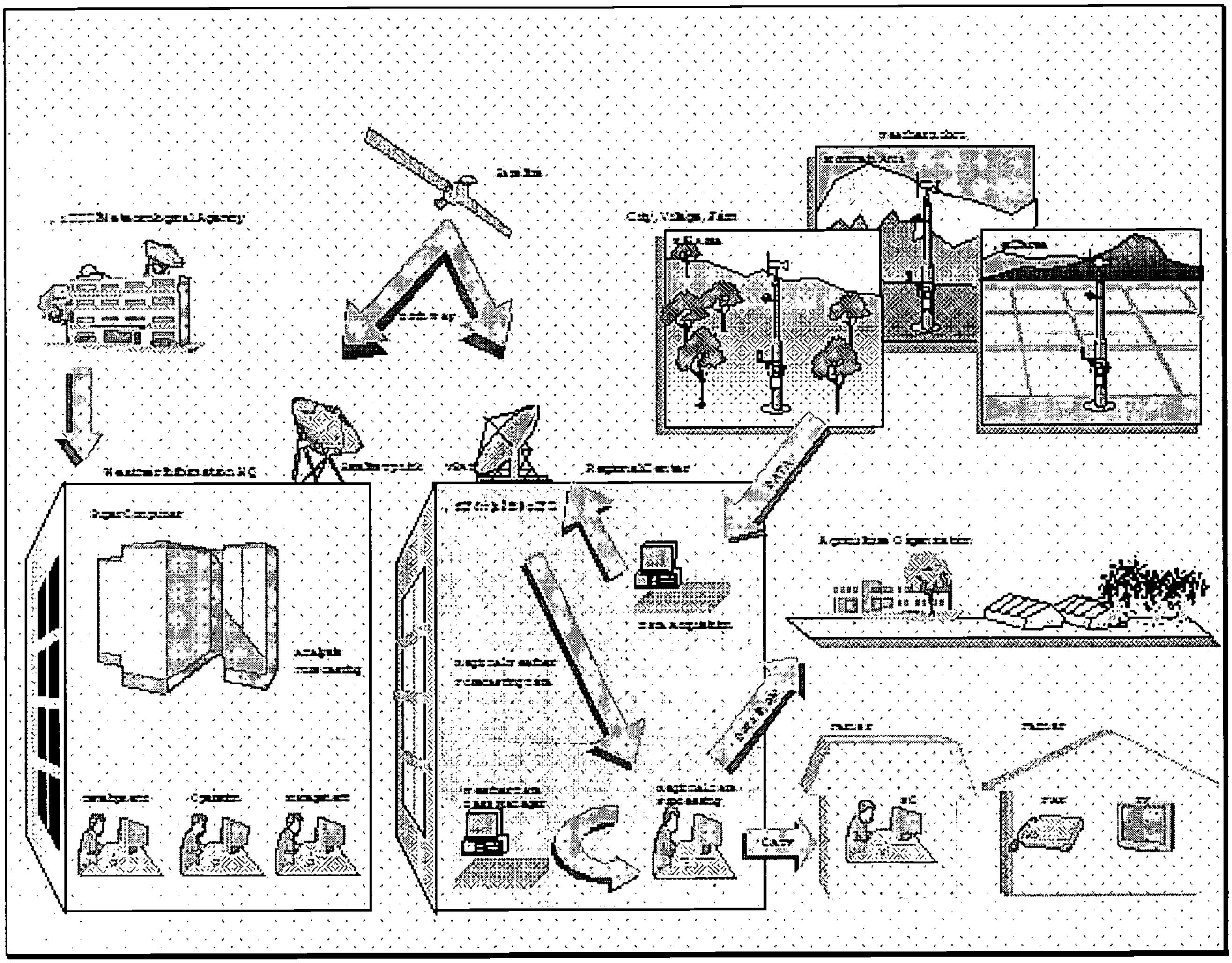

FIG.1 SATELLITE WEATHER INFORMATIONS SYSTEM FOR AGRICULTURE

3.1 Configuration of the Weather Information Headquarters

As shown in Fig. 2, the Weather Information Headquarters consists of a weather information receiver server, which receives weather data from the Japan Meteorological Business Support Center, and the Japan Meteorological Agency, which has a supercomputer that partitions the received weather forecast information into micro units and predicts weather with greater precision. The Headquarters also includes a satellite communication controller and a database server. The satellite communication controller picks out the necessary information for each Regional Center from the more precise computation of weather forecast data and sends it to a Satellite Up-Link center. The database server accumulates data from the weather information robots used for long-term accumulation of forecast data and for correction of data in actual weather forecasts to improve the precision of weather forecasts and for verification.

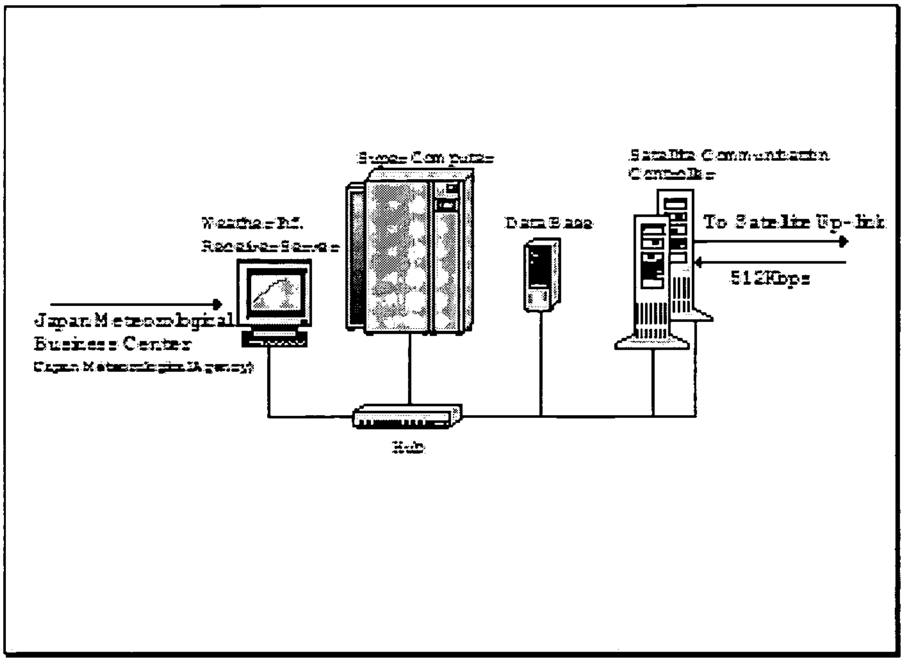

FIG.2 WEATHER INFORMATION HQ

3.2 Satellite Network

Weather data is sent to the Satellite Up-Link Center in Tatebayashi via a dedicated terrestrial circuit after it has been analyzed and processed at the Weather Information Headquarters. Tatebayashi is located about 100 km northeast of Tokyo. As shown in Fig. 3, the Satellite Up-Link Center is composed of a satellite terminal, which delivers data from the Weather Information Headquarters to the satellite network, a converter for converting data into radio frequencies, a high-power amplifier, and a network monitor and control system. The network monitor and control system monitors an antenna, RF equipment, and the whole network. To maximize the reliability of system operation, the Satellite Up-Link Center contains a backup system in duplex configuration, and all buildings are of course built in earthquake- and fire-resistant fashion. The center is also equipped with batteries and an electrical generator, as well as with an emergency system for oil supply, in order to secure uninterrupted operation. In addition, the paths of communication circuits to external connection destinations are multiplexed, and the use of a system of multiple oil providers is in place.

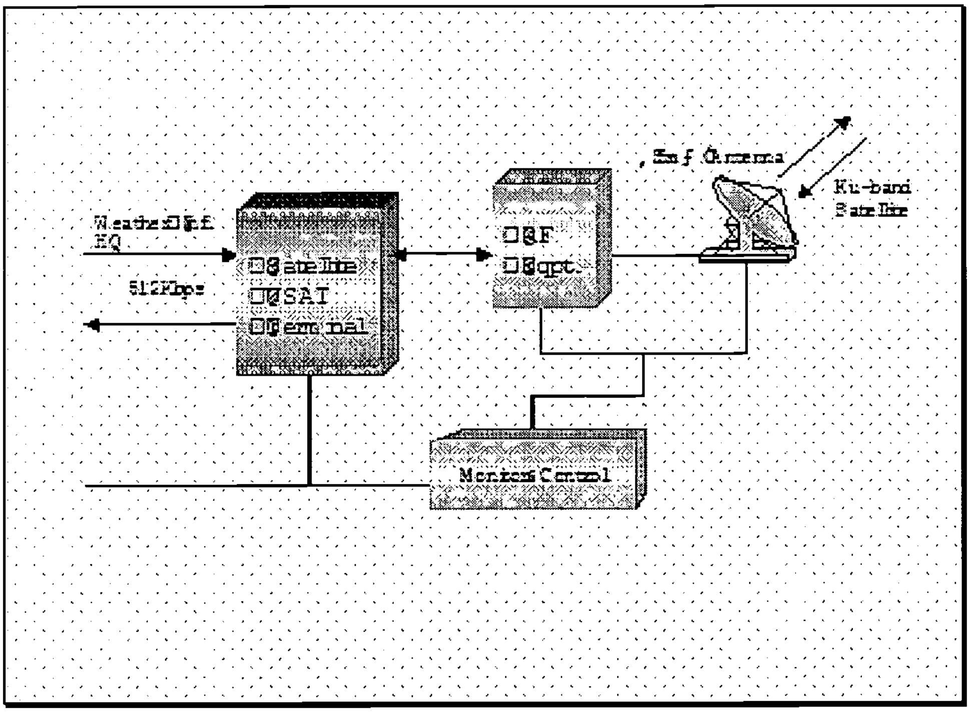

FIG.3 SATELLITE UP-LINK CENTER

3.3 Configuration of Regional Centers

Fig.4 shows the configuration of a Regional Center. Every Regional Center has two functions. The first function is to receive weather data from the Weather Information Headquarters via satellite and then provides this information to agricultural organizations and farmers. The second function is to gather information sent from robots to collect observation data peculiar to the region, and then transmit it to the Headquarters. A Regional Center consists of computers, servers, and a VSAT earth station with a 1.8-m diameter antenna.

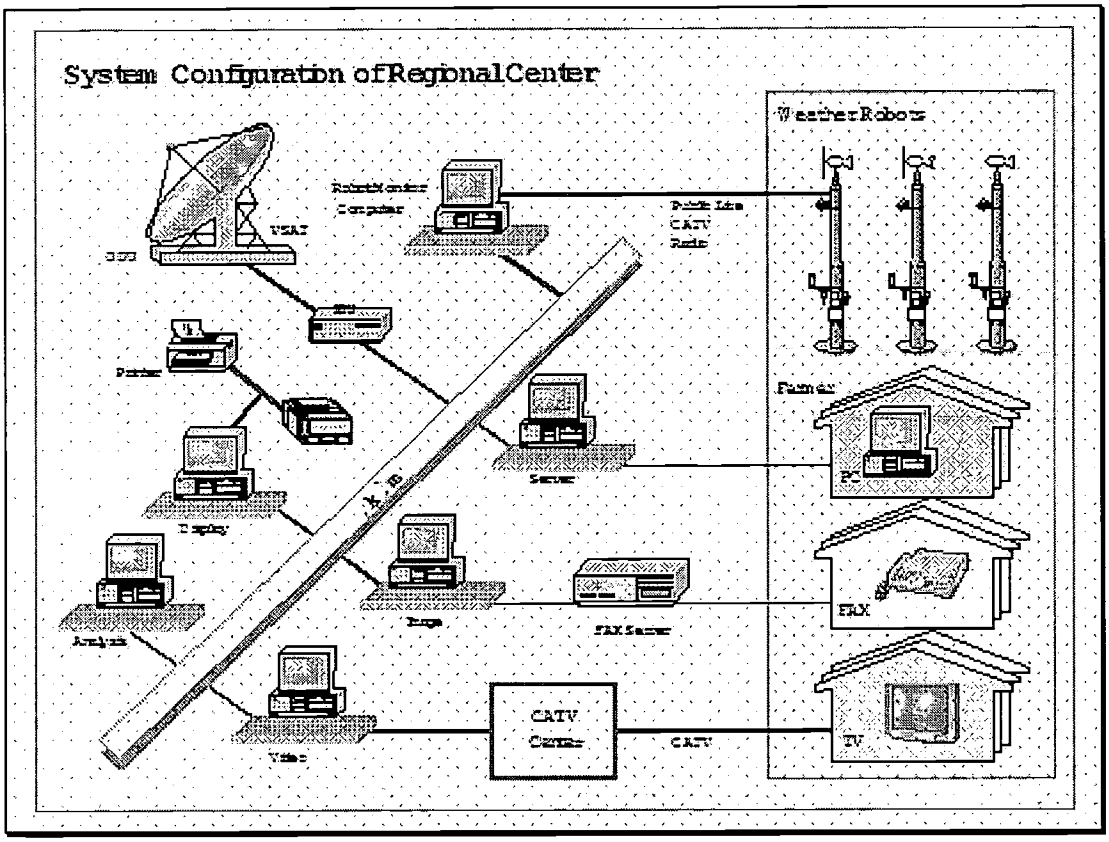

FIG.4 SYSTEM CONFIGURATION OF REGIONAL CENTER

VSAT earth stations are set up in agricultural districts and in mountain regions. The circuit is designed to be capable of adequately and properly receiving data from satellites, even on rainy days. Moreover, any loss of data can be recovered by issuing requests to resend the data.

Figure 5 shows a distribution map of 200 VSAT earth stations across Japan.

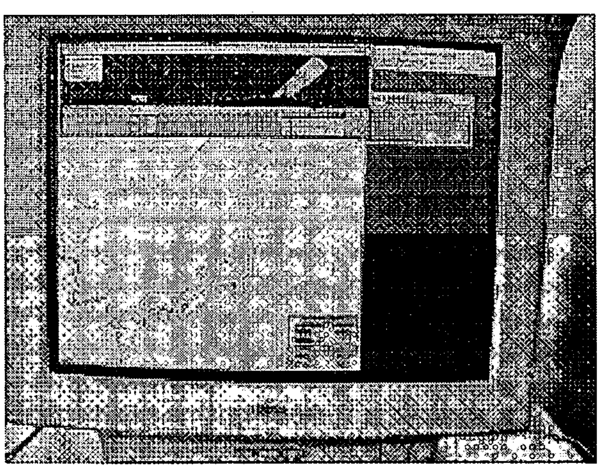

FIG.5 MAP OF VSAT EARTH STATIONS (REGIONAL CENTER)

4. Technical Key Points

4.1 Weather Data Analysis

This system processes and analyzes various kinds of weather information sent from the Japan Meteorological Agency and the Japan Meteorological Business Support Center so that farmers can use weather information in varied ways to increase farming productivity. It handles mainly such information as typhoon information, weather forecasts, and weather forecasts at specific points, synthesized radar data, short-term rainfall forecasts, warnings, and cautions. Data is received in the form of Japanese "kana" characters, as binary data, images, and in other formats sent from the Japan Meteorological Agency, and the system converts it into displays, including temperature and precipitation graphs, and radar images. Table 1 provides a summary of the primary information processed.

Item	Information processed on this system
Typhoon information	The present location of a typhoon, its predicted future course, its maximum wind velocity, and its area of effect, and converts it into images. It can compute predictions of up to 72 hours in advance.
Weather forecast	Processes weather forecast information of up to one week in advance for major locations in Japan, and converts it into images.
Weather forecast at specific points	Predicts the weather at 1,200 points in Japan every hour (temperature, wind direction, wind velocity, precipitation, weather, and humidity), and processes such information to convert it into images.
Synthesized radar	Synthesizes data from a number of weather radars set up across Japan before processing and converting it into radar diagrams covering all of Japan.
Short-term rainfall forecast	Processes 5-km-mesh GPV data and converts it into images of rainfall forecasts of up to six hours in advance by expanding bits.
Weather warnings and cautions	Processes warnings and cautions issued by the Meteorological Agency and converts them into characters and images after evaluating the present status.

TABLE 1. PROCESSING WEATHER INFORMATION

4.2 Realization of 1 km-mesh Forecasts

The system provides 1 km-mesh weather forecasts for farmers of cultivated farming land. The utilization of weather forecast information from the Meteorological Agency (GPV: Grid Point Value) and AMeDAS data facilitates detailed predictions and computations. Data from the weather information robots enables the very detailed processing of weather forecast information.

As shown in Fig. 6, the processing flow involves using a local forecasting model to compute small-scale atmospheric phenomena. The model quantitatively assesses the air conditions in compliance with the laws of physics and the GPV data sent as input by the Meteorological Agency. Then, the mesh values obtained are corrected into values for actual states based on the data from AMeDAS and the weather information robots. The computation results provide estimates on temperature, humidity, the amounts of sunshine, precipitation, and other estimates for a 1 km mesh.

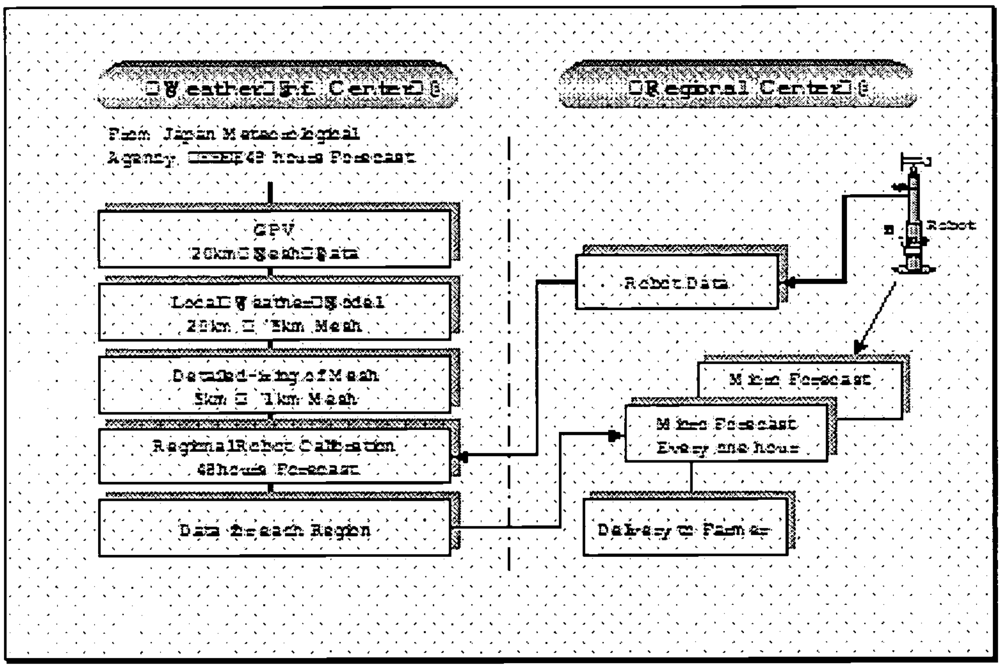

FIG.6 1KM MESH WEATHER FORECASTING FLOW

Fig. 7 shows the total information flow in this system. The left side of Fig. 7 shows basic meteorological information (e.g., cold-and-warm weather forecasts, three-month forecasts, weather information, earthquake and tsunami information) sent from the Japan Meteorological Agency. The right side shows various types of information that are analyzed at the Weather Information Headquarters (such as once per hour, or every 12 hours). The top right corner shows observation information (wind direction, sunshine, relative humidity, and other factors) from the weather information robots stationed near Regional Centers. The bottom right corner shows the output generated by an analysis of the aforementioned data, that is, regional weather information incorporating real-time 1 km-mesh data, forecasts with 1 km-mesh data, forecast data at specific points, and other micro meteorological information necessary for crop management.

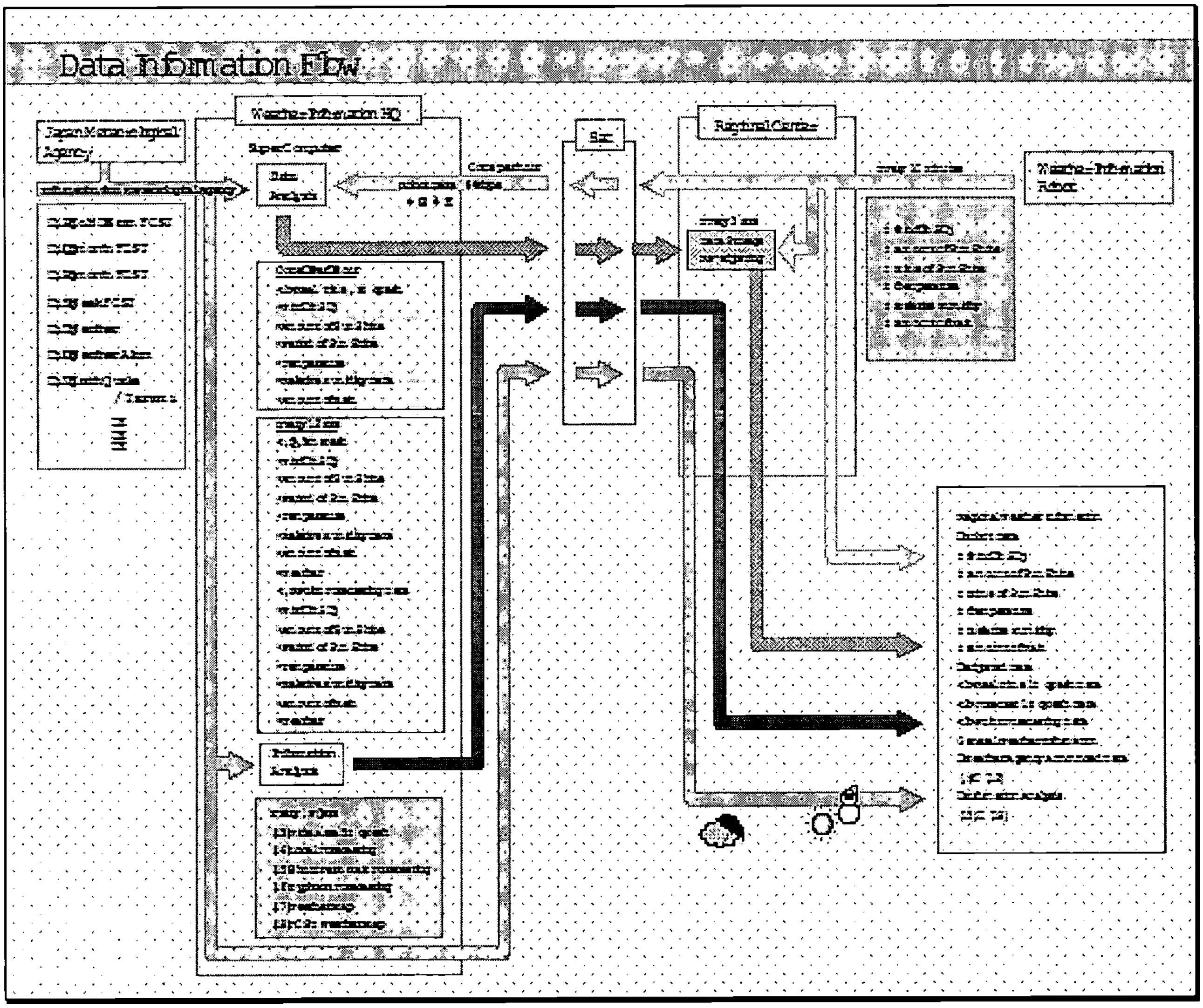

FIG.7 TOTAL INFORMATION FLOW

4.3 Sample Screenshots of Weather Information Display

This section includes sample screenshots for display on personal computers at Regional Centers and the homes of farmers. Fig. 8 shows a 1 km-mesh weather information map, and Fig. 9 shows chronological forecasting for up to 48 hours in advance (wind direction, wind, amount and intensity of sunshine, amount of rain, humidity, and other factors). The system enables the display of weather and forecast information for individual sections of a 1km mesh at any point in Japan by selecting a section on the display. Similarly, this 1 km-mesh point forecasting display also provides forecast information on frost, sleet, and other weather conditions.

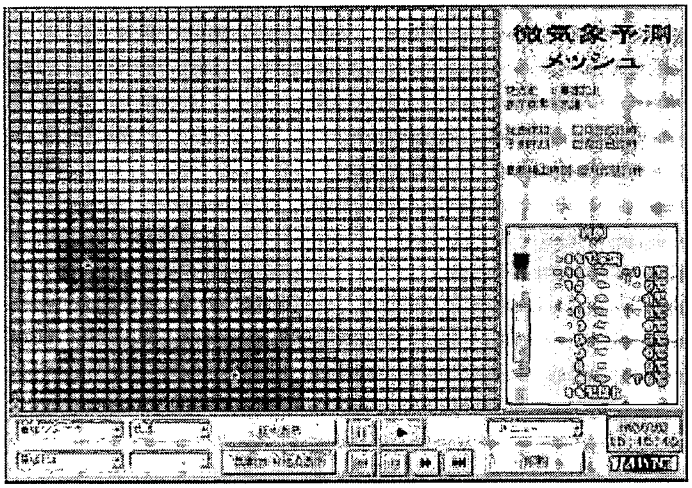

FIG. 8 1KM-MESH FORECASTING (AT MAKUHARI CHIBA)

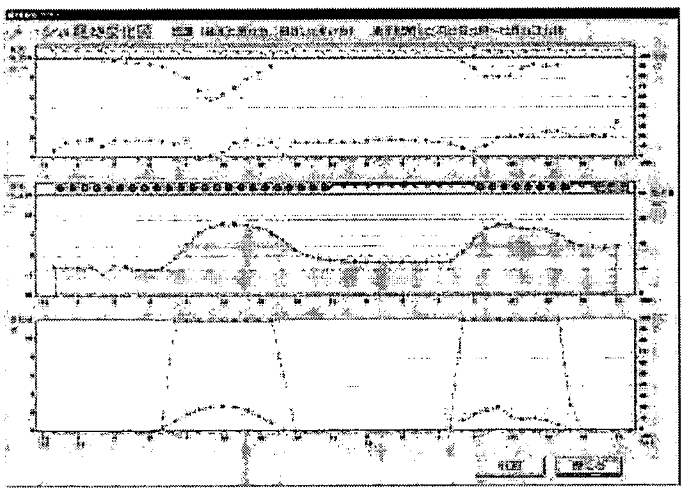

FIG.9 CHRONOLOGICAL FORECASTING (AT ONE POINT OF FIG.8)

Figure 10 shows short-term rainfall information, providing real-time forecasts and forecasts for every 48 hours.

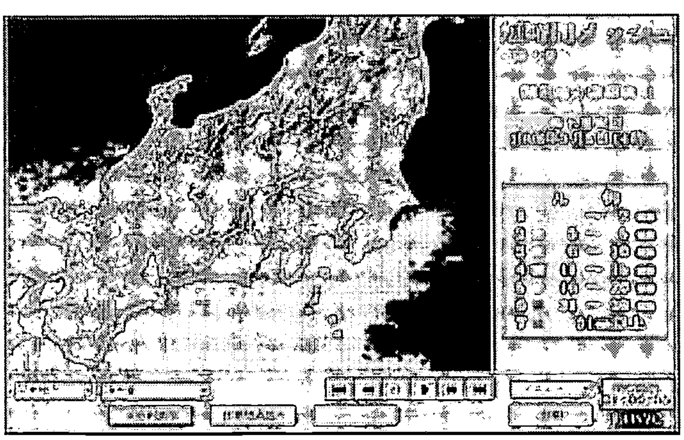

FIG. 10 SHORT-TERM RAIN INFORMATION (5KM-MESH)

5. Use of The System

5.1 Usability

The Regional Centers offers information exclusively to farmers and agricultural organizations. The Regional Centers are connected to farming families via cable televisions, personal computers, and facsimile machines. Up to 1,000 farmers are estimated to have subscribed to a cable television service in order to utilize this service. These farmers use this system as an effective means by linking to agricultural technology to plan planting, manage cultivation (estimating the times at which fruits and vegetables flower and germinate), decide the optimum time for harvesting, manage water resources, plan pesticide spraying, estimate crop damage, and arrange shipments, as well as for other uses.

Table 2 shows summery application examples of the information. Some farmers judge the plan by themselves using various weather information. For example they use chronological data of next 48 hours to decide sowing. Others get the consulting from agricultural promoters in municipal offices who evaluate and analyze these data to forecast. For example, they forecast the harvesting time of rice by using the data such as cumulating temperature and rainfall for last several months before harvest . Weather information from the Regional Centers is also provided to local agricultural organizations and municipal offices to help them to gauge the state of production at farmhouses in individual regions. The Japan Agriculture Information System Associates are striving to further improve their services and their precision, for example, by carrying out hearings with farmers who are the end users in order to ascertain the extent of the use and effectiveness of the services.

Application	
New Cultivation Planning	By use of statistical weather infomation
Work Scheduling	By use of several days micro-weather information
Cultivation Management	By use of cumulative temperature,sun-shine etc
Growth Analization and Prediction	Predict growth by chronological change of weather information
Estimate Flowering Germinating	By use of chronological change of regional Temperature etc.
Plan of mating	Adequate plan by use of 5.
Harvesting Planning	By use of cumulative temp.
Management Water Resource	By use of rainfall information
Pesticide Spraying Plan	Prediction of genarating noxious insect by weather information of dedicated and circumference area

Frost Forecasting	By the observation value of temp. ,humidity and wind etc.
Agriculture Disaster Forecasting	By the data of rainfall and snow etc.
Shipment Planning	To plan by considering 4. and 7.

TABLE 2. EXAMPLE APPLICATIONS OF WEATHER INFORMATION FOR AGRICULTURE

5.2 Verification of the Accuracy of the Frost Forecasting System

Farm products are very sensitive to climatic changes. Frost, in particular, can be deadly to fruit and vegetables. In this sense, accurate frost forecasting is extremely important for agriculture. Although the Japan Meteorological Agency does release cautions against frost, the applicable area is too large in many cases to apply to individual farms and orchards. This system predicts the possibility of frost based on 1 km-mesh weather forecast information, temperature, humidity, wind velocity, and atmospheric conditions. The time range for such forecast is from the evening until the early morning, when frost can form. The possibility of frost is ranked and displayed with six degrees ranging from "None" to "Very High." The display starts with an initial value and has a value determined every hour for 48 hours. The accuracy of this system was verified at 40 places with data from ten Regional Centers across Japan. The accuracy of the prediction was as high as 90%. However, about half of the cases of frost that occurred were not predicted, that is, there was a 50% "miss" rate in the predictions. Users generally gave high evaluations of the system, but further improvements in precision will be targeted by gathering opinions from the relevant farmers and accumulated verification data.

This system also analyzes and predicts the growth of crops by using 1 km-mesh data. Growth analysis is conducted differently depending on the crop or region targeted for forecasting. Today, it can predict of the growth of tangerines almost all over Japan. Improvement in the forecasting system is now being attempted for wider applications, that is, for other crops.

6. Acknowledgments

We would like to thank the Japan Agriculture Information Systems Association and the Japan Weather Association for giving us the opportunity to develop of this system. In addition, we could not have completed this system without the kind advice of Mr. Yoshihiko Ikeda, the General Manager of the Japan Agricultural Systems Association. We also would like to express our gratitude to the late Dr. Morimoto of JWA for his advise of weather information analysis. This paper refers to newspaper articles from "Town Village Now" issued by the Japan Agriculture Systems Association and other materials.

back to index

Abstract

This paper describes the use of very detailed weather information on agriculture to get the significant improvement of the productivity. We get 1-km mesh forecast by introducing super computer and satellite communications. Many farmers are now using this system for their efficient and value added agriculture.

back to index

Takao Hara

Mr. Takao Hara is General Manager of Regional Information Systems Division of Fujitsu Limited. He has graduated from Osaka University in 1968 and joined Fujitsu at the same year. He has been engaged in the development of satellite communications for about 20 years until 1990. He is now working for systems integration of wide area regional information and telecommunication networks including satellite and other telecommunication systems.

back to index

Country / Region

Monday, 14 January 2002
1400–1530
South Pacific I - II

M.1.3 Pacific Islands

Organizer:
Pacific Islands Telecommunications Association (PITA)

Chair:
FRED CHRISTOPHER Manager, Pacific Islands Telecommunications Association

Speakers:

Pacific Islands Telcos Report
FRED CHRISTOPHER Manager, Pacific Islands Telecommunications Association

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Pacific Islands Telecom Issue
WILLIAM WITHERS, Senior Expert, International Telecommunication Union, Regional Office for Asia and the Pacific, *Thailand*

Where are we at
PETER LOKO, General Manager, International Business, Telikom PNG, *Papua New Guinea*

back to sessions

William J. Withers

William J. Withers is a senior expert on telecommunications sector reform and finance in the ITU's Asia-Pacific Regional office located in Bangkok, Thailand.

Prior to joining the ITU in 1994, Mr. Withers was president of Telecommunications Terminal Systems, a customer equipment distributor and service provider with its head office in Toronto, Ontario, Canada.

From 1981 to 1987, he held several senior management positions with a major Canadian telecommunications carrier.

From 1974 to 1981, Mr. Withers was the executive director of the province of Ontario's Telephone Commission. In addition, during this period he was appointed by the Canadian government on two separate occasions to participate in federal government telecommunication inquiries. He was also a member of the staff subcommittee on Communications of the National Association of Regulatory Utility Commissions of Washington, D.C. from 1975 TO 1981.

He has a BA in Economics and a MBA in Finance from York University in Toronto Canada.

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back to index

Country / Region

Monday, 14 January 2002
1600–1730
Tapa III

M.2.3 China

Chair:
TAO YUN, Chairman, Beijing Star-Net Communications, *People's Republic of China*

Speakers:

Wireless Communications In China– An Update **(View Abstract)**
ZIXIANG ALEX TAN, Assistant Professor, Syracuse University, *USA*

Voice Service–A Shining Star in China Quickly Growing Telecommunications Market
ERHAI LIU, Vice President, China Railcom Netcom Co., *People's Republic of China*

Market Strategy Towards Enterprises in China Telecom/Internet Market
XIAOXIN FAN, COO, Beijing Star-Net Communications, *People's Republic of China*

Broadband Market in China
DAVID HONG, Senior Business Development Manager, China Business Development, M3COM Limited, *People's Republic of China*

back to sessions

Wireless Communications In China -- An Update

Zixiang (Alex) Tan, Ph.D.
IST, Syracuse University
USA

View Abstract

1. Introduction - Overall Growth.

As mobile phone users in China reached 120.6 million at the end of July 2001 according to China's Ministry of Information Industry (MII), China became the largest mobile communication market in the world, surpassing the 120.1 million users in the United States. The year 2000 witnessed an impressive 95% annual user growth. Further growth has been predicted as China has positioned to aggressively expand its second generation CDMA systems in the next a few years and move to third generation (3G) systems in the near future.

While the first TACS cellular phone system was installed in China in 1987, cellular phone subscribers had experienced an average 200% annual growth rate until 1993. After 1993, China's wireless phone subscribers have nearly doubled each year. By the end of 2000, there were 85 million subscribers in China, which made China the second largest national market in the world. Detailed data regarding the subscriber growth is shown in Table 1-1: Wireless Phone Subscribers in China.

TABLE 1-1: WIRELESS PHONE SUBSCRIBERS IN CHINA

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total Subscribers (in thousand)	48	177	638	1,570	3,630	6,850	13,230	24,980	43,800	85,260
Annual Growth rate (%)	–	269	260	146	131	88.8	93.1	88.8	75.3	94.6

Source: Telecommunications Statistics by Ministry of Information Industry (MII).

At the same time, China's wireless system infrastructure has also seen dramatic build-up. By the middle of year 2000, there were 63,946 base stations and 2,993,621 radio channels in China. China's mobile switching centers could handle 96 million users, as shown in Table 1-2: Terrestrial-based Wireless System Infrastructure in China.

TABLE 1-2: TERRESTRIAL-BASED WIRELESS SYSTEM INFRASTRUCTURE IN CHINA

Year	Capacity of Mobile Switching Centers (in thousand)		Number of Base Stations		Radio Channels	
	Total	Newly Added	Total	Newly Added	Total	Newly Added
1995	7,966.7	4,250	5,038	2,569	186,385	112,054
1996	15,360	7.393.3	10,826	5,788	403,547	291,493
1997	25,856	10,496	20,796	9,970	767,442	363,895
1998	47,067	21,211	34,451	13,655	1,458,178	690,736
1999	81,360	34,293	54,381	19,930	2,256,063	797,885
2000,6	96.024	14,664	63,946	10,358	2,993,621	560,386

Source: Telecommunications Statistics by Ministry of Information Industry (MII).

2. Create a competitive market -- through government interference rather than market forces

China's public wireless communication services started with a monopoly - China Telecom. In 1994, a second carrier, China Unicom was licensed to operate wireless services. However, given the limited investment, poor management, unskilled technical and management manpower, China Unicom was slow to grasp market share. China's market had been a de facto monopoly market until 1998 with China Mobile held about 95% of the total market share, as shown in Table 2-1.

TABLE 2-1: MARKET SHARE BETWEEN CHINA MOBILE (CHINA TELECOM) AND CHINA UNICOM

Year	1995	1996	1997	1998	1999	2000
China Mobile's Subscribers (in thousand)	3,629	6,889	13,232	23,858	37,959	66,515
China Mobile's Market Share	99.78%	98.97%	97.17%	94.44%	87.84%	79.50%

China Mobile's Total Revenue (million RMB)	n/a	22,820	46,180	86,150	139,840	229,100
China Unicom's Subscribers (in thousand)	8	72	386	1,427	5,254	17,150
China Unicom' Market Share	.22%	1.03%	2.83%	5.56%	12.16%	20.50%
Total Revenue (million RMB)	n/a	280	800	2,100	13,520	42,940

Source: MII's Telecommunications Information Research Institute.

To address the failure of market-driven competition, China government has implemented a series of policies and administrative measures to transfer its wireless market from monopoly to duopoly. The goal is to nurture the new, small, and poorly operated China Unicom into a decent competitor. Senior executives, middle-level managers, and technical supporting personals are transferred from China Mobile to China Unicom. Some of China Telecom's assets including its paging service operation are shifted to China Unicom's ownership. China's CDMA wireless operation, which was formerly installed and operated by telecommunications affiliates of China's People's Liberation Army, has also been brought under China Unicom's umbrella. After all of these aggressive government interventions, China Unicom has emerged as a serious competitor to China Mobile by successfully grasping 20% of Chinese wireless market in 2000. China Unicom's revenue reached to 43 billion RMB in 2000, which was close to the one fifth of China Mobile's revenue. This change has positioned China's wireless market as a competitive one. In addition, there is high possibility that additional licenses might be granted in the near future to further competition in supply.

3. A Rocky Path for Wireless Standards -- History and Future.

China's first generation (1G) wireless system started from TACS technology in 1987. TACS, one of the first generation analog technologies, was developed in Britain. TACS and ETACS (Extended TACS) technology, supplied by European and US manufacturers, then dominated China's wireless market. There were only a very small percent of market share by AMPS technology developed in the United States. These AMPS users were limited in five remote provinces and operated by military affiliates.

When China began deploying its second generation (2G) wireless systems in the middle of 1990s, GSM was chosen among three major competitive technologies - GSM, CDMAone, and US TDMA. A complex of commercial, political and even cultural factors have contributed to the selection of GSM standard. One of the major reasons was that GSM was a mature and widely deployed technology at that time in the world. GSM technology was then deployed in a large scale by both of the two competing mobile carriers - China Mobile and China Unicom. Exception happened again for China's 2G wireless systems. China's military affiliates imported and deployed CDMAone technologies from Qualcomm in the United States in five major cities. As the results of China's rule of prohibiting military from civilian business in 1999, these CDMA systems were then taken back by the Chinese government and re-assigned to China Unicom in 2000. Table 3-1 documented the user distribution of China Mobile and China Unicom among different standards in detail. The 1G analog systems owned by China Mobile will apparently be phased out of the market gradually. GSM is currently in an absolute dominating position. CDMAone only has a small market share.

TABLE 3-1: WIRELESS PHONE SUBSCRIBERS OF DIFFERENT TECHNOLOGIES IN CHINA

Year	1995	1996	1997	1998	1999	2000
TACS of China Mobile (in thousand)	3,472	5,205	6,386	6,608	4,949	3,245
GSM of China Mobile (in thousand)	157	1,684	6,846	17,250	33,010	63,270
GSM of China Unicom (in thousand)	8	72	386	1,421	5,212	16,870
CDMAone of China Unicom (in thousand)	–	–	–	6	42	280

Source: MII's Telecommunications Information Research Institute.

As China moves forward, there are several uncertainties regarding technologies in its wireless market. The first one is how China Unicom deploys its narrow-band CDMA technology (CDMAone) mostly developed by Qualcomm in the US. After being granted a "go ahead" decision from the central government, China Unicom has been delayed to launch its CDMAone system by several political events a few times. Its CDMAone system was finally inaugurated in May 2001. Initial market reaction is reportedly positive and large-scale expansion has been planned in 2002. However, its fate in terms of competing with existing GSM systems remains to be seen. The second uncertainty is when China will start to deploy third generation (3G) technologies, while the current forecast is between 2004-2006. China Mobile is most likely to adopted WCDMA developed in Europe as its 3G standard. The primary reason is for the protection of China Mobile's investment in its GSM networks. On the other hand, China Unicom is most likely to go with CDMA 2000 as its 3G technology if large-scale deployment of narrow-band CDMAone could be executed as planned. This is also a natural continuation since CDMA 2000 is an improved version of narrow-band CDMAone technology. Meanwhile, China Unicom will be challenged to whether to upgrade its GSM system to W-CDMA system. Assuming that China Unicom could successfully deploy narrow-band CDMAone in large-scale in 2002 and the 3G will be deployed in 2005, China's wireless market is forecasted in Table 3-2: Forecast of Wireless Phone Subscribers in China between 2001-2005.

TABLE 3-2: FORECAST OF WIRELESS PHONE SUBSCRIBERS IN CHINA BETWEEN 2001-2005

Year	2001	2002	2003	2004	2005	Notes
TACS of China Mobile (in thousand)	2,650	2,250	1,200	–	–	Phase out
GSM of China Mobile (in thousand)	88,190	111,400	134,600	152,600	170,800	3G in 2005
GSM of China Unicom (in thousand)	31,330	43,570	53,660	61,030	68,660	3G in 2005
CDMAone of China Unicom (in thousand)	560	2,290	6,760	8,890	12,690	Large-scale CDMA in 2002

Source: MII's Telecommunications Information Research Institute.

Another major uncertainty regarding 3G in China is the fate of the standard, TD-SCDMA. TD-SDMA is a 3G standard proposed and developed by a group of Chinese engineers led by Dr. Li Shihe, chief engineer at one of China's indigenous manufacturers, Datang. More significantly, TD-SCDMA has been accepted by the standard making body, 3GPP.

As a domestically developed technology, TD-SCDMA enjoys broad support from government agencies, including MII, and local manufacturers. It is viewed as an opportunity for China to develop and establish its own Intellectual Property Rights (IPR), which are currently costing the fortune of domestic manufacturers. However, there is a long way for TD-SCDMA to be commercialized and be deployed in the market since it is relatively new and still not tested in a large scale. Established operators might be reluctant to adopt it in fear of the potential cost in case TD-SCDMA fails in market. Two likely scenarios are possible. First scenario might see that established operators might be encouraged by government agencies to deploy small-scale TD-SCDMA systems in favorable terms, which coexists with large-scale WCDAM or CDMA2000 systems. Second scenario might see a newly licensed operator deploys TD-SCDMA systems. Doing so could enable the new operator to obtain favorable supports from regulators, TD-SCDMA suppliers and even domestic customers. This could also be a strategy to differentiate the new operator from others.

In summary, standard adoption is dynamic even in the highly regulated Chinese market. China's 1G technology was dominated by an European/British standard, TACS/ETACS, with some insignificant presence of AMPS standard from the US. 2G technology in China is dominated by a European standard, GSM, again. Only one of the two U.S. standards, CDMAone, made a minor presence in five cities while there is a chance for this U.S. standard to gain significant base right now. China's 3G technology will very likely see a competition among a European standard (WCDMA), an U.S. standard (CDMA2000), and a Chinese standard (TD-SCDMA).

4. Competition in Equipment Supply - Dominating Foreign Suppliers and Emerging Local Manufacturers

Since 1987, foreign suppliers have dominated China's wireless market. However, fundamental changes have emerged recently. Infrastructure equipment for China's 1G systems, including base stations and mobile switches, were mostly supplied by Motorola and Ericsson. Motorola had absolutely controlled the supply of handsets and car phones. Local manufacturers did not have a chance to get into it while the 1G had been gradually phased out of the market.

Since 1994, China started to install its 2G (GSM) systems by directly importing all the equipment. As far as the infrastructure equipment was concerned, supply was initially dominated by Motorola, Ericsson and Nokia, with Siemens, Alcatel and Nortel holding a minor market share (less than 15%). In 1999, all the suppliers localized their products through their Joint Ventures (JVs). Local manufacturers, including Datang, Huawei, Zhongxin and Jingpeng started to gain 3% market share in 1999. It was increased to 5% in 2000 as shown in Table 4-1.

TABLE 4-1: MARKET SHARE OF CHINA'S GSM MARKET.

Year		1994	1999	2000		
Infrastructure Equipment (Base Stations & Mobile Switches)	Direct Import	100%	0	0		
	Joint Ventures	0	97%	89%		
	Local Producers	0	3%	5%		
Terminal Equipment (mostly handsets)	Direct Import	100%	0	0		
	Joint Ventures	0	97%	86%		
	Local Producers	0	3%	10%		

Source: MII's Telecommunications Information Research Institute.

The terminal equipment went through similar path. This market sector started from an absolute domination by Motorola in 1994 (more than 80%). It was quickly turned into an almost even divide among Motorola, Nokia, and Ericsson for more than 80% of the Chinese market, with Siemens, Philips, and others share the remaining 20% share. Local manufacturers, including Kejian, Podao, and Haier started to gain 3% market share in 1999. It was increased to 10% in 2000. Strong growth momentum for local manufacturers has been predicted, given the strong government support, favorable financial terms from local banks and aggressive marketing efforts by manufacturers.

China started to install its 2G CDMA systems by directly importing all the equipment in 1997. Infrastructure equipment is mostly dominated by Samsung in Korea, with LG from Korea and Qualcomm from the US holding the remaining share. Motorola started to supply its CDMA products in Chinese market in 1999. Local manufacturers have only had their prototype CDMA products. China Unicom's move toward CDMA will both promote local manufacturers to start gaining market share and attract more foreign suppliers into Chinese CDMA market.

TABLE 4-2: MARKET SHARE OF CHINA'S CDMA MARKET.

Year		1997	1999	2000		
Infrastructure Equipment (Base Stations & Mobile Switches)	Direct Import	100%	100%	100%		
	Joint Ventures	0	0	0		
	Local Producers	0	0	0		
Terminal Equipment (mostly handsets)	Direct Import	100%	100%	100%		
	Joint Ventures	0	0	0		
	Local Producers	0	0	0		

Source: MII's Telecommunications Information Research Institute.

5. Conclusion

China surpassed the United States to become the largest wireless market in the world in July 2000. This has further demonstrated that wireless communications will be a significant market in China. However, it is also very dynamic, as we have discussed in the above sections. The future scenario will to a large extent depend on which technology will be adopted. It also depends on what applications will be developed and accepted by Chinese users, and when and how 3G will be deployed in Chinese market.

back to index

Abstract

As mobile phone users in China reached 120.6 million at the end of July 2001 according to China's Ministry of Information Industry (MII), China became the largest mobile communication market in the world, surpassing the 120.1 million users in the United States. The year 2000 witnessed an impressive 95% annual user growth. Further growth has been predicted as China has positioned to move to second generation CDMA systems in the next a few years and third generation systems in the near future. This rapid growth creates both opportunities and challenges. This paper aims to analyze the most recent developments in government policy and regulations, service provision competition, and strategic competition among domestic and foreign equipment suppliers.

Government policies and regulations have been actively pursued to nurture China's wireless communication industry. In China, wireless phone services are within the category of basic telecommunications services that are heavily regulated and not open to foreign carriers. Up till now, China has only licensed a second carrier, China Unicom, to compete with the former monopoly, China Mobile. However, Chinese regulator has recently launched series of initiatives to help China Unicom to grow as a capable competitor to compete with China Mobile. This could be explained as China's preparation to open its mobile service market to foreign operators when China is accepted to enter the WTO. While China's market of both infrastructure equipment and handsets is open to foreign suppliers, China relied almost totally on multinational corporations until about two years ago. Chinese government has been working hard to formulate policies in order to promote local manufacturers. Local manufacturers start to capture 6-10% of the infrastructure equipment and handset market.

On the service provision side, the paper first looks at the recent growth patterns in China. Strategies by China Mobile and China Unicom, including national roaming, technology upgrading, and the introduction of new applications, will be examined in detail. The paper will also address the key issue of how China Mobile and China Unicom are preparing themselves for the potential competition from foreign operators once China is accepted to enter the WTO.

Foreign equipment suppliers, including Motorola, Ericsson, and Nokia, were the only sources for infrastructure equipment and handsets until about two years ago. China's local manufacturers started to roll out their own wireless switches, base stations, and handsets into Chinese market in 1998. In 2000, domestic manufacturers captured 8% of switch and base station market and 10% of handset market. This paper examines the strategies, challenges, and opportunities among domestic manufacturers and multinational corporations.

While the paper focuses on the most recent developments in China's exciting wireless communication market, up-to-date data will be included to support author's analysis and arguments. The paper will be significant and valuable for academic researchers, industrial practitioners, and policy makers.

back to index

Dr. Zixiang (Alex) Tan

Dr. Zixiang (Alex) Tan is an assistant professor at Syracuse University (http://istweb.syr.edu/~tan). Dr. Tan has published actively on telecommunications regulations, policy, and industry in prestigious journals including Telecommunications Policy, INFO, and The Communications of the ACM. His co-authored book, China In the Information Age - Telecommunications and the Dilemmas of Reform, was jointly published by the Center for Strategic and International Studies (CSIS)/Praeger Publishers. Dr. Tan presented his papers at PTC98, PTC96, and PTC95.

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back to index

Market strategy towards enterprises in China telecom/internet market

Xiaoxin Fan
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While developed country telecom markets are suffering from over-investment in infrastructures and slowing down demand, developing countries represented by China and India are still showing fast growth in their telecom and internet industries. In developed countries, new value added services especially data services have not picked up as people expected. Meanwhile, telecom deregulation in last 20 years and technology advancement have introduced numerous new operators into the market. New operators not only compete for new services but also take market share from traditional basic services such as voice service which is already saturated with much new growth room. In contrast, in countries like China, low telecom density provides huge growth margin in both traditional telecom services and new data services. Recent telecom deregulation in China has allowed new players to compete against traditional incumbent telecom companies. China's accession to WTO by the end of this will also speed up the market development. China market becomes one of the strong hedges for world telecom market.

Listed below are products and services that China consumers generally demand.

Basic products like PC and VOIP are in highest demand, however the profit marging is the lowest due to severe competition.

For SMEs, intranet, leased line internet service, website/email servers are growing demand. This level services require higher technical sophistication from service providers.

Services for SMEs in developed markets usually can't be afforded by SMEs in developing countries. Rather they are for large corporations. This purchase power difference actually is one the most important factor, far more important than technology, differentiating the markets in developed and developing countries.

High end service such as total e-commerce solutions, DVB service and broadband services (as a matter of fact, it's still a evolving concept) might not generate enough business in China although the profit margin is much higher than lower level services due to less competition.

Along with the internationalization of China economy, multinational in China can be a unique market to serve high end services.

According to the analysis above, a service providers strategy should go along with the market situation which both involves service market and capital market. When the capital market is hot and allows business models seeking future high profit, service providers can experiment high end services even they are money loss. When capital is tight in the market, service providers should be more focused on lower level services for instant profit. In a market in China, low end services are still in high demand due to its low tele desity and low service quality. It's still an opportunity for telecom/internet providers.

An example of "low end" services to meet SMEs' demand in China.

IT Help Desk Service

Along with growing adaptation of IT applications, SMEs in China are facing challenges of IT maintenance if they don't have their IT force. As in other areas over the world, outsourcing of IT support work is becoming a trend in China as well. "IT Help Desk" service can improve the working efficiency of the companies at low cost. Items of the services, for instance, include:

1. Desktop service
    a. Hardware documentation
    b. OS and software installation
    c. Hardware and software maintenance and upgrading
    d. Detect and kill virus
2. Network service
    a. Office intranet solutions
    b. Internet access (dial up, leased line and DVB)
    c. Intranet security solutions
3. Other telecom services
    a. Low cost telephony (such as IP telephony)
    b. Long distance network connections (fiber and VSAT)
4. Other IP applications

a. Website and e-commerce

b. Email service

An example of "high end" service and its difficulties in China (Digital Video Broadcasting service)

DVB access service

In recent years, DVB technology has become one of the major applications in satellite communication territory especially when the profit margin of simple satellite connection has become less competitive to terrestrial connections. DVB can provide customers high speed and high quality Internet access and multi-point content distribution. In China, Internet access via DVB is seen as a high end service in trial mostly in Beijing, Shanghai and Guangzhou. Besides domestic players, a few overseas operators are also testing the water in the market. So far, no clear models have shown sure success. A comparison of flat monthly fee between uni-casting DVB and terrestrial internet access in China is shown below (by September 15, 2001):

Table 1. Monthly fee comparison between uni-casting DVB and terrestrial internet access in China

	Uni-casting DVB	Terrestrial internet access
64k	RMB2,500	RMB3,400
128k	RMB4,800	RMB4,500
512k	RMB12,500	RMB9,500
2M	RMB50,000	RMB19,000

We believe in this period of time, DVB applications for multi-casting (fixed content to multi-points sharing same bandwidth) has more opportunity than uni-casting (each customer occupy certain bandwidth for its desired content). The bottleneck for promoting is content and its organization.

After the steep drop of infrastructure service margin after the end of 2000, a new round of market adjustment is happening in China. The companies that are focused on the high-end future business have been hit hard by the market and are facing the danger of being eliminated. However, companies that are providing products/services to meet present growing market demand may stand a chance to prevail.

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back to index

Broadband Market in China

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View Abstract

I. Summary of Telecom Market in China

Against the specter of global recession of telecommunications sector, China's telecom market has kept its quick development pace. The booming and rapidly transforming Chinese telecommunications market will open considerable alternative business opportunities to telecommunication companies worldwide, local and global telecommunication players.

Statistics show that the number of telephone users increased by 57.96 millions in China in the first seven months of year 2001, of which 22.628 millions are fixed phone users and 35.339 million are mobile phones. The fixed phone users had totaled 167 millions, ranking second in the world, while the number of mobile phone users stood at 121 millions, ranking the first in the world. The growth of China telecom market is estimated at an annual rate of 30 to 35 percent over the next couple of years.

With the imminent entry into WTO, China must open up its domestic market to telecom competition both in basis telecom and value-added telecom services, a more open and orderly telecommunication market means more cooperation and business opportunities for all telecommunication companies worldwide.

II. Commercial Telecom Operators & International Bandwidth Distributions

Broadband Network	Operators	Direct Int'l Access	1998.7	1999.7	2000.12	2001.12
ChinaNET	China Telecom	yes	78 M	195 M	1953 M	--
CNCNET	China Netcom	yes	N/A	N/A	377 M	--
CMNET	China Mobil	yes	N/A	N/A	90 M	--
UniNET	China Unicom	yes	N/A	12 M	55 M	--
GBNET	China Jitong	no	2.2 M	8 M	148 M	--
CRCnet	China Railcom	no	N/A	N/A	N/A	--

Total (Mbps)	**80.2**	**225**	**2,630**

For years, the monolithic China Telecom is the only services provider in the country. The dominant position turns China Telecom badly managed company with little regard to consumer. To break up the monopoly and better serve telecom consumers, the government split up China Telecom to create three independent companies, China Telecom, China Mobile, and China Satellite, as well as supported the formation of Jitong, China Unicom, China Netcom, and China Railcom to compete with broken up China Telecom. No matter what happens, China Telecom still controls nearly all ground communications network resources, the company has a monopoly in the fixed-line telecom sector.

To create a true competition market, Chinese government in planning to further separate the company.

III. What will happen in China Telecom Market after WTO?

China's "Regulations on Foreign Investment in Telecommunication Industry" have been submitted to the country's State Council for approval and will be released prior to China's entry into the WTO.

Value-added and Paging Services

Upon accession	Up to 30% foreign ownership in Beijing, Shanghai & Guangzhou
2002	Up to 49% foreign ownership in Beijing, Shanghai, Guangzhou, Chengdu, Chongqing, Dalian, Fuzhou, Hangzhou, Nanjing, Ningbo, Qingdao, Shenyang, Shenzhen, Xiamen, Xian, Taiyuan and Wuhan.
2003	Up to 50% foreign ownership with no geographic restriction.

Mobile Services

Upon accession	Up to 25% foreign ownership in Beijing, Shanghai & Guangzhou
2002	Up to 35% foreign ownership in Beijing, Shanghai, Guangzhou, Chengdu, Chongqing, Dalian, Fuzhou, Hangzhou, Nanjing, Ningbo, Qingdao, Shenyang, Shenzhen, Xiamen, Xian, Taiyuan and Wuhan.
2004	Up to 49% foreign ownership with no geographic restriction.

Domestic and International Fixed line Services

2004	Up to 25% foreign ownership in Beijing, Shanghai & Guangzhou

2006	Up to 35% foreign ownership in Beijing, Shanghai, Guangzhou, Chengdu, Chongqing, Dalian, Fuzhou, Hangzhou, Nanjing, Ningbo, Qingdao, Shenyang, Shenzhen, Xiamen, Xian, Taiyuan and Wuhan.
2007	Up to 49% foreign ownership with no geographic restriction.

IV. Strategies of Foreign Telecom Company Enter China Market

- Invest in publicly traded telecom companies; such as purchasing stocks issued by China Mobile and China Unicom listed in both Nasdaq & HK stock exchange.
- Directly acquire minority holding of a new telecom operators; such as News Corp invested into China Netcom Corp.
- Enter JV with Chinese telecom license holder; such as the joint venture between AT&T and Shanghai Telecom.
- Create Strategic or corporate partnerships with one or more prospective telecom license holders, synergy the strength of partners to delivery international telecom/broadband services to customers. Such as M3COM's bilateral relationship with Chinese Broadband Carrier – China Netcom Corp.

back to index

David L. Hong

Senior Business Development Manager for China

David Hong has over ten years of experience in international marketing, negotiating, and business development with sound knowledge of telecommunications market & regulations in China. He jointed Millennium 3 Communications (Reston, Virginia, USA) in mid of 2000.

Mr. Hong becomes the Senior Business Development Manager for China, and is working in China since November 2000. He is responsible for telecom regulations and market research, analysis, and identifying potential market opportunities in China, as well as serving as a liaison officer between M3COM and telecom operators/local authorities in China.

Prior to joint M3COM, Mr. Hong served as Assistant to the General Manager of Able Computer Inc. in Portland, Oregon. He is responsible for the company's market expansion, cost control & general management.

Mr. Hong also served as Marketing Manager of Thai Maparn Trading Company, a privately held company in Bangkok, Thailand, and responsible for the company's international market. During his tenure, Mr. Hong increased the company's international sales by $20 million by building partnership with distributors in China and the U.S. markets.

Mr. Hong received his M.B.A. from the Marymount University in Arlington Virginia in 1996, and B.S. from Guangzhou Jinan University in 1989. He currently resides in Beijing, China with his wife Sarah, and daughter Sidney.

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back to index

Technology

Monday, 14 January 2002
1400–1530
Coral I

M.1.4 Network Convergence

Chair:
ELLEN HOFF, President, W.L. Pritchard & Co., L.C., *USA*

M.1.4.1 Integrating Ethernet & Optical Networking in High Bandwidth Public Networks (View Abstract)

NAN CHEN, President, Metro Ethernet Forum & Director, Product Marketing, Atrica, Inc., *USA*

Presenter:
DAVID YATES, Vice President, Marketing, Atrica, Inc., USA

M.1.4.2 Satellite and Terrestrial Networks for Content Delivery - Competition or Complement? (PowerPoint Presentation)

JEREMY ROSE, Communication Systems Unlimited, *United Kingdom*

back to sessions

Integrating Ethernet & Optical Networking in High Bandwidth Public Networks

Nan Chen
President, Metro Ethernet Forum & Director Product Marketing, Atrica, Inc.
United States of America

The requirements for networked communications within today's business and residential marketplace have changed dramatically over the past two decades. In fact, user requirements have been undergoing a steady pace of evolution since the first forms of electronic communications became commonplace at the turn of the last century. Most importantly, the rate of change in user requirements has accelerated dramatically over the past few years. This is a key point in that most of the technology being deployed today in the Metro network has its roots in wide-area technology developed in the early and mid-1990's and is thus targeted at a market that has evolved past the then-targeted requirement.

Several notable trends in the market include the following:

- The overwhelming domination of Ethernet as the core networking media around the world. Once thought of as just a temporary technology that would be replaced by more "predictable" technologies such as Token-Ring and FDDI, Ethernet has unpredictably outlasted them all to become one of the ultimate commodity forms of communication transport mechanisms.

- The steady shift towards data-oriented communications and applications. The old axiom of "let the data ride for free over the voice network" has been almost completely overturned in a market where data communications now dominate the high-growth markets.

- The rapid growth of mixed-media applications. Not only have new multi-media applications stormed the user market (including everything from integrated voice/data/video communications to the now commonplace exchanges of MP3 music files), but existing voice communications has also begun to migrate towards IP/packet-oriented transport. In fact, while the number of people communicating verbally across the "phone" network has increased dramatically as both business usage and population growth rates have soared, the amount of pure circuit-oriented voice traffic has remained fairly constant.

Perhaps one of the most significant trends, however, is not technology-based at all. Rather, it involves the societal changes in the way that we communicate and expect communications services to be available. As technology has developed and offered the opportunity for users to communicate "on demand" (just look at the power and popularity of the various forms of instant messaging on the Internet), users have come to expect extremely rapid and low-cost provision of communications services. In short, users expect rapid high-speed communications at a very low commodity-driven price, something that yesterday's high-priced SONET technologies simply cannot provide.

1. The Lasting Power of Ethernet

As mentioned earlier, Ethernet has become the de facto standard for data-oriented networking within the user community. This is true not only within the corporate market, but many other market segments as well.

- Corporate Market: Ethernet, especially with the advent of high-performance Ethernet switching, has totally dominated this segment. This includes the workgroup, departmental, server and backbone/campus networks.

- Internet Service Providers: While many of the ISP's in the market today are still basing their WAN-side communications on legacy circuit oriented connections (supporting Frame Relay, xDSL, ATM, SONET), their back-office communications is almost exclusively Ethernet. This is also true for their massive server farms used to host client web sites and applications within the Application Service Provider (ASP) market.

- Residential Market: While the residential community still has a wide range of relatively low-speed, circuit-oriented network access technologies, most individual users are deploying 10 Mbps Ethernet within their homes to connect PC's to printers and other PC's (in fact, most PC's today ship with internal Ethernet cards). Even many of the so-called "integrated" voice/data solutions for the home market (that ultimately use xDSL for their local loop access) utilize some form of Ethernet within the home itself.

The success of Ethernet in these seeming diverse markets has come from two main themes, namely the scalability of this technology and the commodity-oriented nature of its design.

- **Scalability:** Ethernet has consistently demonstrated its ability to scale from extremely low-speeds (1 Mb/s - still equal to or above the data rates that most individual users achieve into the Internet) to the ultra high-speed (10 Gb/s). Further, new development efforts underway today suggest that that Ethernet could easily scale to 40, 80 or even 100 Gb/s. Much of this is due to the growth of high-performance switching systems that have enabled today's engineers to utilize Ethernet to its optimal performance levels. Originally developed as a mere shared broadcast media, Ethernet, through the coupling of LAN technology with switching technology (whether it is today's packet switching or the emerging optical and photonic switching systems) has been able to match the performance - and undercut the cost - of any other system on the market today.

- **Commoditization:** All things being equal, the lower priced technology will almost certainly prevail in a competitive market situation - a significant advantage Ethernet has always held over its competition. And while it is true that newer versions of Ethernet, such as 1 Gb/s Ethernet, have evolved and changed significantly compared to 10 Mbps Ethernet which is still in massive deployment, advances in coupling these technologies (such as the dual 10/100 Mbps Ethernet products) leveraging common core designs have helped to keep these technologies similar enough to benefit from common commoditization.

Now, a new technology called Optical Ethernet combines the scalability and performance of Ethernet with optical networking, and is beginning to revolutionize metropolitan-area networks (MANs) by delivering very high bandwidths - 100M bit/sec, 1G bit/sec or even higher - across cities and regions, at prices similar to today's 1.5M bit/sec T-1s.

Current MANs are built using SONET technology. Designed originally for low-speed, circuit-switched traffic, SONET running at 10G bit/sec is proving too costly and inflexible to carry the vast amount of IP traffic required by the Internet economy. Enter Optical Ethernet - a technology based on the proven Ethernet standard, but which adds the traffic engineering and management capabilities carriers need, and integrates these with optical networking to deliver the distances and speeds required to traverse metropolitan areas.

Optical Ethernet - the combination of high-speed Ethernet with packet/optical switching - can meet the growing bandwidth demands in the Metro market in a way that is much more user-driven than the alternative SONET vendor-deployment strategy in effect today. The existing technology being deployed - SONET - may not suitable for this task in the Metro network:

- **Circuited-oriented support:** SONET was designed to meet the then-popular demand for circuit-switched traffic and has lost much of its appeal in today's market where the trend is clearly towards more of the more flexible statistical multiplexing (packet-oriented switching) requirement.

- **WAN focus:** SONET, even as envisioned in its early days, was never intended as a LAN replacement. Its focus was - and still is - the WAN. However, as the LAN has grown and moved inward from the edge of the network (desktops) to the core (Metro network), SONET has no longer become the most viable option.

- **Costly operations:** Targeted as a mixed voice/data circuit-oriented WAN technology, SONET was designed with many complex features (such as costly redundant ring structures) that, while they helped improve resiliency and carrier management, have been designed as overly complex for the LAN environment that is moving into the Metro network environment.

The same problems that are plaguing SONET today also hurt the long-term prospects of other technologies such as ATM, FDDI and SMDS. In fact, every step of the way, the LAN has always outperformed the technologies that were designed to transport the LAN across the Metro area. This has resulted in a very uneven step-evolution of service offerings. For example, as 10 Mb/s Ethernet dominated the LAN, Frame Relay was touted as the solution for Metro and WAN networking. But while Frame Relay struggled to climb up to a cost-effective 45 Mb/s (DS-3) level, Ethernet jumped again to 100 Mb/s.

This entire process was repeated again as ATM, originally less than half the performance of 100 Mb/s Ethernet, was touted as the technology that would ultimately outperform Ethernet and solve the Metro bandwidth crisis. What we witnessed was the continued rapid evolution to 1 Gb/s Ethernet while ATM has become a "legacy" interface on many vendor's data sheets. The same is now holding true for SONET as 10 Gb/s Ethernet has grasped the market and continues to climb upward towards the 100 Gb/s mark through the melding of Optical Ethernet coupled with new technologies such as hybrid packet/optical switching, photonic switching and Wave Division Multiplexing (WDM and Dense WDM - DWDM).

This step-function swap-out of technology every few years has kept prices of new services high, and is something that cannot continue in today's cost-sensitive market. Further, this high-cost approach to core implementations has impacted edge technology costs, such as DSL and ISDN, at the edge/core demarcation point.

To highlight the cost issues that SONET faces in the Metro network today, one need look no further than the interfaces required to support each of these technologies, given a similar internal switching infrastructure. Average street prices for low-speed SONET (OC-3 to OC-12) range from a low of $5,000 to over $15,000 per interface. In stark contrast, low-speed Ethernet (using Fast Ethernet at 100 Mb/s) costs under $200 per interface.

The most likely growth scenario for the LAN and Metro markets is one that continues the trends that have become core to the development of the Internetworking industry. Rather than witnessing an approach where costly technologies at the core (that are fundamentally non-supportable at the periphery of the network) are constantly upgraded to new incompatible technologies, we are in the midst of a revolution where the dominant LAN-based technologies are being upgraded and adapted for use in the Metro network. This only makes sense as the purpose of the Metro network is to support the LAN network, and not the other way around.

2. Optical Ethernet: Scaling the MAN

Most of the necessary components to build an Optical Ethernet Metro network exist today - a point that should help speed both rapid product development and rapid service provider deployment over the next 12-24 months.

- Gigabit Ethernet is standardized and widely deployed in the enterprise and service provider markets.
- 10/100 Mb/s Ethernet is widely deployed throughout the enterprise and service provider markets and has a large untapped base within the residential community.
- Infrastructure providers are already pulling fiber to the curb of residential units in anticipation of increased bandwidth demand.
- Metro-range Ethernet (multi-kilometer range) exists today.
- Packet/Optical switching in the Terabit range exists today in emerging platforms.

- High-speed photonic switching is rapidly developing and should be deployable within the next few years.

- 10 Gigabit Ethernet is in the final stages of standardization and development work on increasing performance 2-4 fold has already begun.

Based fundamentally on Ethernet, Optical Ethernet MANs let carriers deliver standard, well-known 10/100M bit/sec or 1G bit/sec Ethernet interfaces - the same as those used to easily connect office networks today. And instead of a SONET ring, the metropolitan backbone for Optical Ethernet networks will be based on the 10G bit/sec Ethernet standard now being completed in the IEEE working group 802.3ae.

The advantages:

- Ethernet is 10 times less expensive than the SONET technology being used today.
- Ethernet is a simple and widely understood technology.
- Ethernet is the best technology for carrying IP traffic - Ethernet and IP have grown up together.

Optical technologies enable Ethernet networks to extend over much greater distances than campus Ethernet nets. Running over single-mode fiber, Optical Ethernet lets links in the network range from 3 to more than 6 miles in the case of 1310-nm wavelength technology, and up to 43.4 miles for 1550-nm wavelength technology.

Key components of Optical Ethernet are the abilities to segregate traffic of different users and to deliver the particular service level each user purchases. Traffic segregation is accomplished by using the IEEE 802.1pQ virtual LAN (VLAN) standard. This standard lets Optical Ethernet networks mark each user's traffic with a VLAN tag as it enters the network and then use this tag to keep each user's traffic separate as it crosses the network. Of course, 802.1pQ was designed for enterprise networks and the number of possible VLAN tags is too low. Work is under way in IEEE to extend this number from 4,096 to approximately 16 million.

Optical Ethernet can also deliver guaranteed levels of latency, jitter and bandwidth. Optical Ethernet networks deliver user-specified levels of delay and jitter by using the techniques developed in the Internet Engineering Task Force Differentiated Services (Diff-Serv) project. As each packet enters the network, information from the packet is used to assign it to a particular class of service. User contracts also specify bandwidths, which network operators guarantee by limiting the aggregate of guarantees to network capacity. Then the rate of incoming traffic is compared with the contract. Traffic above contract is carried - but only as long as it does not congest resources required to carry guaranteed traffic.

Using these techniques, Optical Ethernet networks can easily handle the needs of both data and circuit-switched or voice applications. Circuit traffic requires only modest bandwidth, but quite demanding levels of latency and jitter. Optical Ethernet easily achieves voice-quality levels of delay and jitter by combining the sheer speed of the 10G bit/sec backbone network with Diff-Serv's quality of service.

Carriers deploying Ethernet into metropolitan networks have been pushing the edges of the available Ethernet technology. Enterprise technology does not easily scale to carrier applications. Ethernet's move from workgroup to enterprise backbone was not made by deploying more workgroup switches, but by purchasing enterprise-class switches. Similarly, to scale Ethernet across MANs, carriers will need solutions that can satisfy the unique requirements of the carrier environment.

Integration of WDM and Ethernet enables additional advantages for Optical Ethernet. First, this integration delivers an ideal platform for scaling bandwidth in the metro core from 1 Gbps to 100 Gbps and beyond per fiber link. It also delivers greater flexibility for network design, allowing for the separation of logical and physical topologies. Finally, it is extremely cost effective, representing more than 50 percent Capital Expenditure savings over traditional WAN technology such as SONET. Perhaps more importantly though, Optical Ethernet using WDWM integration can represent a significant Operational Expenditure savings, including efficient provisioning of new services, less truck rolls and reduced maintenance costs.

3. Increasing Service Provider Profitability

In the end, Optical Ethernet will only be successful if service providers are successful in selling and supporting their own customer base. Through the deployment of Optical Ethernet, services providers will be able to strengthen their service offerings and increase their revenue income:

- **Reduced equipment costs:** Initial estimates project that large-end Metro networking systems using high-end Optical Ethernet equipment should be able to reduce their equipment acquisition costs by over 50% as compared to similarly capable SONET-based equipment. This estimate includes existing SONET vendor projections for cost reduction in their own products. This will help not only the larger service providers, but will also greatly help the smaller, more cost sensitive smaller and emerging providers who will have to invest less in equipment in order to realize a reasonable return on their investment.

- **Reduced deployment costs.** Anytime a technology is deployed in a limited fashion as compared to a widely deployed technology, deployment costs are higher. When comparing SONET to Optical Ethernet, one need only look at the number of qualified SONET professions as compared to the significantly larger number of experienced Ethernet engineers throughout the industry. Further, since Optical Ethernet is a fundamentally simpler technology than SONET, additional training requirements should be considerably less.

- **Reduced management costs.** Optical Ethernet benefits from two strong positions here. First, as a simpler technology it is easier to troubleshoot and manage. Second, there is a much greater pool of Ethernet-savvy engineering/support talent than there is SONET technologists. Lastly, as a second-generation Metro implementation (the first being SONET), Optical Ethernet developers will have the ability to design their management and hardware/software platforms together from the beginning to meet the demands of service provider managers. This is in contrast to the first generation of products that often have to be tuned and redesigned in order to meet these same high level of management standards.

- **More user-friendly services.** When it comes to networking, users understand Ethernet much better than they understand SONET. This is a very important point as an increasing number of users find themselves working closer and closer with their service providers to provision, manage and monitor their network services.

Optical Ethernet solutions create the opportunity for carriers to roll out new, more profitable services that can be rapidly provisioned. Following are examples of these services:

Ethernet Internet Access Service

Ethernet Internet Access Service is a turnkey offering that includes the connection and full Internet service. It is provided through a native Ethernet interface (100 Mbps or 1 Gbps) and offers throughput from 1 Mbps to 1 Gbps on demand in 1 Mbps increments. Flexible usage is enhanced through customer self-provisioning via Web CNM. Further pricing flexibility is gained through the ability to provision CIR (Committed Information Rate) and EIR (Excess Information Rate.) For example, CIR bandwidth would be priced at a premium while very low pricing would be assigned to EIR burstable bandwidth. In this way pricing combinations can be tailored to meet the performance requirements and budget constraints of every customer. Additional features include QoS alternatives and guaranteed SLAs (Service Level Agreements) with automatic credits.

Ethernet Transparent LAN Service

Ethernet Transparent LAN Service provides a private LAN-like service across an enterprise's metro sites. It provides true LAN-to-LAN connectivity to other enterprise locations (establishments) or partner sites. It is provided through a native Ethernet interface (100 Mbps or 1 Gbps) and offers throughput from 1 Mbps to 1 Gbps on demand in 1 Mbps increments. There is no requirement that each location operate at the same data rate. This allows matching up performance requirements on a per site basis yielding effective budget/performance tradeoffs. Flexible usage is enhanced through customer self-provisioning via Web CNM. Further pricing flexibility is gained through the ability to provision CIR (Committed Information Rate) and EIR (Excess Information Rate.) Additional features include QoS alternatives and guaranteed SLAs (Service Level Agreements) with automatic credits.

T1 Private Line Service

T1 Private Line Service is offered to make transition to Ethernet easier by providing support for legacy services. The service is delivered using Ethernet Circuit Emulation Service through a direct connection on the Atrica Customer Located Equipment (CLE.) Despite being carried over the metro Ethernet network this service meets ANSI T1 specifications because it is provided a guaranteed prioritized transmission path through the metro network.

Ethernet Private Line Service

- Ethernet Private Line Service provides a private secure connection between any two sites within the metro network. It is offered at speeds of 5 Mbps, 10 Mbps, 50 Mbps, 100 Mbps, 150 Mbps, 600 Mbps, and n X 1 Gbps up to 10 Gbps. These speeds have been chosen to reflect available TDM and SONET data rates as well as the popular Ethernet data rates. Ethernet Private Line Service extends the capabilities of TDM private line through its use of arbitrary CIR and EIR limits. CIR service is the same as TDM service in that the allocated bandwidth is dedicated to the circuit–it need not be locked in according to the digital hierarchy rates, however. EIR, burstable service, uses shared but secure bandwidth and offers cost/megabit flexibility not possible with legacy services. Service providers, therefore, have the tools to create pricing packages tailored to the specific needs of each customer that can double revenue and more than double profitability through differentiated pricing strategies.

Custom Dedicated Ethernet Private Network Service

Custom Dedicated Ethernet Private Network Service is a custom network build similar to ILEC special construction of dedicated SONET networks. It is a managed service offer and is premium priced. Unlike SONET, however, it is possible to combine dedicated Gigabit subtending rings with transparent LAN service (TLS) at the network core to produce a very wide range of performance/budget tradeoffs. This will result in more sales and improved profitability. For example, a 1 Gbps dedicated ring serving three customer sites combined with 500 Mbps TLS on the metro core could be profitably priced at $53,900/month while a comparable 10 Gbps ring combined with 5 Gbps TLS could be priced at $200,000/month.

In the end, this all translates into increased opportunity for service providers to leverage the 10x performance increase every three years of Ethernet into a new, wider variety of high-performance user services. In a time when service provider profitability and overall competitiveness are paramount, deploying solutions like Optical Ethernet for the MAN could turn out to be a crucial paradigm shift for the industry.

back to index

Abstract

The requirements for networked communications within today's business and residential marketplace have changed dramatically over the past two decades. In fact, user requirements have been undergoing a steady pace of evolution since the first forms of electronic communications became commonplace at the turn of the last century. Most importantly, the rate of change in user requirements has accelerated dramatically over the past few years. This is a key point in that most of the technology being deployed today in the Metro network has its roots in wide-area technology developed in the early and mid-1990's and is thus targeted at a market that has evolved past the then-targeted requirement.

back to index

Nan Chen

Mr. Nan Chen is the Director of Product Marketing at Atrica, a leading provider of Optical Ethernet solutions for Metropolitan Area Networks. Mr. Chen is the President, founder, board member of Metro Ethernet Forum, a worldwide industry consortium to accelerate optical Ethernet in metro networks. Prior to joining Atrica, Mr. Chen served as the Director of Product Management and Product Marketing at Force10 Networks. Mr. Chen was a founder of 10 Gigabit Ethernet Alliance (10 GEA) and served on the board of directors of 10 GEA. Mr. Chen spent 4 years at Nortel Networks. While serving as a Director of Technology at Nortel Technology Center, Mr. Chen drove Nortel's 10 Gigabit Ethernet strategy, and founding of IEEE 802.3ae & formation of its standards — 10 Gigabit Ethernet. Mr. Chen is a frequent invited speaker, panelist and chairperson at various conferences. In past life, Mr. Chen is a record holder of pole vault at Beijing University.

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back to index

David Yates

Prior to joining Atrica, David Yates served in senior positions at 3Com. His most recent position was at 3Com's WAN Access division, where , as Vice President and General Manager, he managed the company's initiatives in the VPN, DSL and Voice over IP CPE. The division became the leading supplier of CPE to prominent CLECs, was selected as VPN supplier to one of the largest US telecommunications companies. Yates joined 3Com when the company acquired OnStream Networks, where Yates was VP Marketing. Under his leadership, OnStream Networks became one of the two leading suppliers of ATM Access equipment. Prior to OnStream, Yates spent 5 years at Wellfleet Communications/Bay Networks, joining as product manager when the company was pre-IPO and leaving as Director of Product Management. Before that, Yates spent 5 years at AT&T, working in the Service Planning group for AT&T Communications and as Product Manager in AT&T Network Systems (now Lucent), where he was responsible for the BNS-2000, one of the first commercial cell switches. Yates holds an MBA (with Distinction) from Harvard Business School and MA Degrees from Harvard and Oxford Universities. Yates received a BA, with First Class Honors, from Oxford University.

back to index

Technology

Monday, 14 January 2002
1600–1730
Coral I

M.2.4 Future Wireless Systems

Chair:
ANTHONY BRISCOE, General Manager International, Telecom New Zealand, *New Zealand*

M.2.4.1 Evolution of Wireless Devices (PowerPoint Presentation)

UMESH AMIN, Director of New Technologies, AT&T Wireless, *USA*

M.2.4.2 A Perspective of Mobile Communication Service Beyond IMT-2000 (View Abstract)

DONG-HAHK LEE and SEONG SOO PARK, Research Engineers and JONG TAE IHM, Principle Researcher, Network R&D Center, SK Telecom, *Republic of Korea*

M.2.4.3 Development of a New E-Commerce System Using Contactless IC Card and Personal Data Assistant (PDA) Terminal (View Abstract)

TATSUO ITABASHI and SHUSAKU MARUKO, Mobile EC Project Department, I-Card System Solutions Division, Broadband Network Center, Sony Corporation, *Japan*

M.2.4.4 The Analysis on the Effect of Repeater System in 3G Wireless Network (View Abstract)

HYUN-CHEOL JEON; YOON-SEOK JUNG; BUM KWON and JONG-TAE IHM, Associate Researchers, Network R&D Center, SK Telecom and BEOM-DAE BAK, National Computerization Agency, *Republic of Korea*

Presenter:
YOON-SEOK JUNG, Associate Researcher, Network R&D Center, SK telecom, *Republic of Korea*

back to sessions

Umesh Amin

Chairman Emeritus, UWCC

Director of New Technologies and Planning Team, AT&T Wireless Services, Inc.

Umesh Amin is Director of New Technologies and Planning Team at AT&T Wireless Services (AWS). His team is responsible for new services planning; managing the wireless research program; product development/technology development alignment; evaluating new technologies; supporting intellectual property management; and coordinating the Technology Development Group budget activities.

As Chairman Emeritus for the UWCC, Mr. Amin represents the organization's membership in support of the digital wireless technologies TDMA (Time Division Multiple Access ANSI-136), WIN (Wireless Intelligent Network ANSI-41), and EDGE (Enhanced Data Rates For Global Evolution). He has been involved in the UWCC since its inception in 1996, participating on all UWCC subcommittees. Mr. Amin has made over 40 presentations at telecommunications conferences throughout the world; including ITU (International Telecommunications Union) events in Brazil, Singapore, and South Africa as well as CTIA (Cellular Telecommunications Industry Association) and PCIA (Personal Communications Industry Association) annual events.

Prior to joining McCaw Cellular (now AT&T Wireless) in 1994, Mr. Amin was at AT&T Bell Laboratories where he worked on all aspects of wireless and wireline services planning.

Umesh Amin is a member of The School of Business & Economics Advisory Board at the Central Washington University. Mr. Amin has been an active member of the Institute of Electrical and Electronics Engineers (IEEE) for the last fifteen years. He was a Vice-Chairman and Chairman of the IEEE New Jersey Coast Section. He is currently on the editorial board of the IEEE Personal Communications Services Magazine and is the wireless industry representative to the Globecom 2000 Executive Committee. In addition, Mr. Amin has seven wireless patents issued to his name.

Umesh holds an undergraduate and graduate degree in Electrical Engineering from the City College of New York. He has also completed short business and management courses including a mini MBA from Wharton School of Business.

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back to index

A Perspective of Mobile Communication Service Beyond IMT-2000

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Network R&D Center
SK Telecom

(View Abstract)

1. Introduction

Mobile communication systems have been successfully deployed since about 1980 in different regions of the world to extend telephone services to mobile users. Also, it has been an evolutionary change in mobile communication systems every decade [1]. In first-generation, analog systems were developed to support manly voice service. Second-generation cellular systems in 1990s have been used for voice applications and low rate data services. The main representatives of second-generation systems are Global System for mobile Communications (GSM), which has been deployed since 1991 [2]. The radio interface is based on TDMA, digital modulation, forward error correction and digital signal processing. In addition to GSM, other digital systems were developed, such as CDMA-based IS-95 system [3]. Due to the introduction of these second-generation systems, the penetration of analog systems is decreasing. In recent years, third-generation mobile systems, IMT-2000 [4] are currently being standardized and developed worldwide. The IMT-2000 service will be deployed at the beginning of 21st century. Third-generation systems are addressing a mass market for mobile multimedia communications and enhanced multimedia services such as video on demand, image communications, and multimedia short message, etc.

Based on the successful development of mobile communication system, discussions have already started on the development beyond third-generation mobile systems in Europe, North America, Japan, Korea, and many other countries. In recent years, ITU-R WP8F [5] is studying the vision of the ongoing enhancement of IMT-2000 and systems beyond IMT-2000. In WP8F, there are six working groups, Vision, Circulation, Developing IMT, Radio technology, Spectrum, and Satellite coordination. The relationships among the working groups are overlapped according to the interest areas significantly. The goal of WP8F is to establish the global focal point for the continuing vision of next generation wireless services and systems. Also, WP8F acts as a forum for user requirements and as a catalyst for translating those requirements into technical reality. It has a plan to complete the preliminary draft new recommendation (PDNR) in June, 2002 [6]. The PDNR includes vision, objectives, market trends, technology trends, spectrum implications, service applications, and other recommendations of the ongoing enhancement of IMT-2000 and of systems beyond IMT-2000.

In the generation transition of mobile communication, we have experienced various kinds of services such as voice, multimedia service, etc. The evolution of service represents an increase in requirements for accessing information which requires higher bit rate significantly. Above all, in the era of next generation, it is dynamic and adaptable in all aspects with minimal user involvement and intelligence to learn and adapt with use. Also, the user will experience a wider range of services and applications such as integrated service with mobile communications and broadcasting according to user environments.

Since many advanced wireless communication technologies have been being developed, the implementation issues of system to launch the new services might be easier. Thus, it is needed to discuss the system features as well as the future services and service-related technologies. In this paper, we presents a concept of mobile communication beyond IMT-2000 and various services which are appeared near future. Also, we consider technologies to provide advanced services to users.

The rest of the paper is organized as follows: Section 2 describes service requirements of next generation mobile communication. In Section 3, we describe core technologies of service aspects. Finally, Section 4 concludes the paper.

2. Service requirements of systems beyond IMT-2000

The number of subscribers for mobile communications increased much faster than expected. In 2010, the number of user will become more than 1.7 billion worldwide [7]. From increase of users, study of high capacity of new generation system with improved spectrum efficiency or a new frequency band is necessary to accommodate growing data traffic. The system will also support high speed and capacity with low cost to provide new services.

In next generation, the major aspect of the system will be defined according to service capabilities rather than the specified service. Also, next generation system is needed to consider the following characteristics:

- Seamless services across heterogeneous wireless systems and networks operating across different frequency bands
- Service adaptation between multiple standards, across multiple operators and service providers, with the service quality level of user
- Reconfigurable radio concept according to the characteristics of service providers and application developers while keeping data privacy and information integrity

If the services are given with the system considering the above characteristics, we will experience interworking service between intergeneration. Also, multimedia services and applications with various information speeds will be widely used in the future as shown in Fig. 1.

Considering the accessibility to services on the internet in the future, support of IPv6, Voice or IP (VoIP), Quality of Service (QoS), multicast, and real time applications end to end will be required. This should take into account the QoS requirements of both real time and non-real time applications. A system capability that enables users to access either the 3G, systems beyond IMT-2000 and wireless private networks such as wireless LANs and also enable seamless roaming between heterogeneous networks without interruption will be requested as well. In addition, geo-location services using air interface signals and its applications will play an important role in future mobile services as shown in Fig. 2. The future mobile applications may be expected as follows [8]:

- The enhanced services
  - Location information service offering multimedia geographical information in detail
  - Wireless Internet education
  - Mobile computing
  - Emergency service : vehicles repair and life rescue
  - Life convenient applications (video phone, VOD, home shopping, banking, internet news and broadcasting, etc.)
- The new services
  - High quality image service : HDTV broadcasting service
  - Wireless services according to various QoS
  - Multimedia services transmitted over communication satellites
  - Wireless interface selection service according to the user terminal capability.

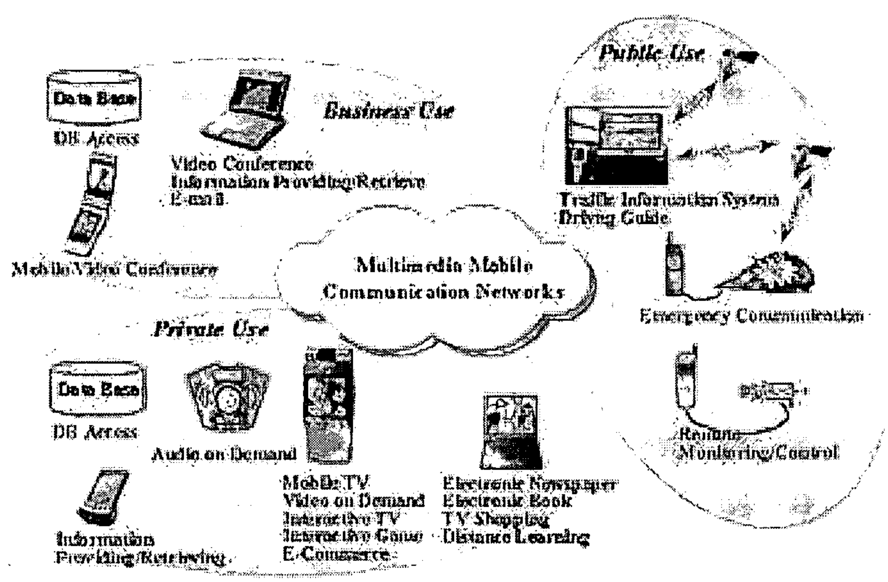

FIG. 1 MOBILE MULTIMEDIA SERVICE

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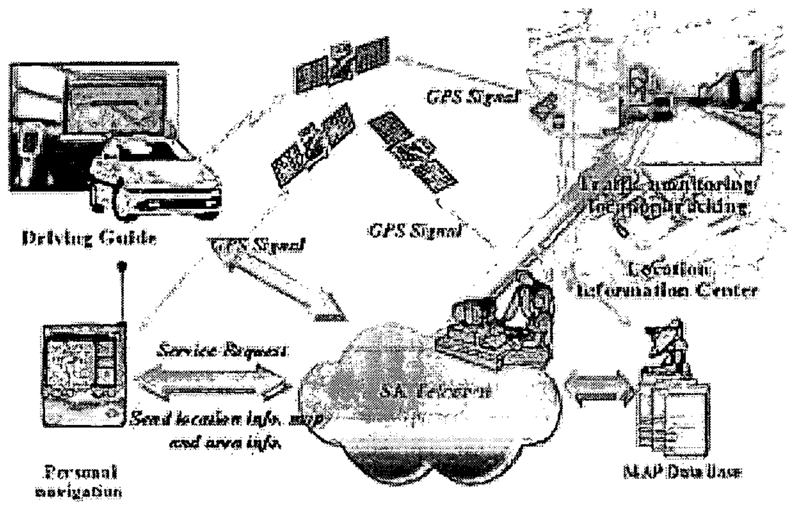

FIG. 2 DRIVING/PERSONAL NAVIGATION SERVICE

To realize the future service, ITU-R WP8F prepares the system requirements to define the systems beyond IMT-2000. The system requirements to perform the services with systems beyond IMT-2000 are as follows [6]:

- Support terminal and personal mobility
- Flexible allocation of required system capacity
- Usability on variable environments (high/low tier movement, indoor, satellite, etc.)
- Seamless service via different technologies .global roaming and hand-over support to other different systems
- Provision of QoS for real time services and efficient transport of packet oriented services. Guarantee comparable quality with wire-line network
- Global seamless support of a wide range of services including symmetrical and asymmetrical services
- Support of a wide range of data rates according to economic and service demands in new mobile systems
- Requirements for future mobile communications from the end-user perspective
- Efficient support of broadcast and distribution services
- Economic deployment of systems in the entire coverage area with optimized radio interfaces for macro cells, micro cells, indoor, hot spots and broadcast
- Allocation of significant parts of the system complexity to the base station to simplify terminal implementation
- Reconfigurability of network entities and terminals

According to the system characteristics, application services, and system requirements, we can expect that the service features of systems beyond IMT-2000 will be integrated with broadband wireless access service to support high speed data transmission, various cellular services, and broadcasting services transmitted over communication satellites as shown in Fig. 3.

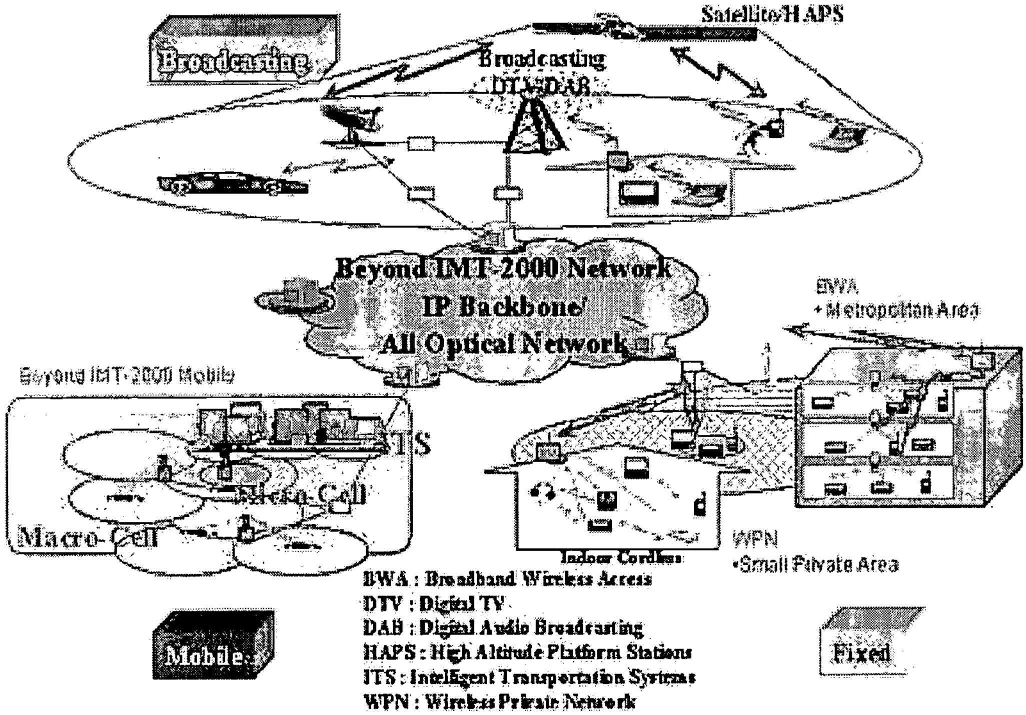

FIG. 3 SYSTEM SCENARIO OF BEYOND IMT-2000

3. Service-related Technologies

To identify the core technologies from the viewpoint of developing the system concept and objectives, ITU-R WP8F considers enabling technologies of next generation mobile communication. There are many kinds of technologies such as radio access technology, advanced terminal technology, network and system technology, and service-related technologies, etc.

Among them, we present the service-related technologies to provide the advanced services, since the service requirements are changed according to various demands of user and next generation mobile communication will be driven by services. It can be divided into four representative categories, service operation technology, mobility supporting technology, interface technology, and information security technology. The characteristics of each technology are discussed below.

3.1 Service operation technology

When launching the new services with next generation systems, it is needed to consider the technologies to employ the service very well. In the future, since carriers will provide the various multimedia service, billing technology is important to charge the fee to user according to time, user location and environment, service type, and QoS requirement, etc. Especially, as installing billing software in server and terminal at the same time, the right of service selection should be provided to user with billing rate and radio access selection which is considered capability of user terminal. In the future, to employ seamless service in anywhere and anytime, we have to set the global networking arrangements through the worldwide discussion of a network harmonization and a seamless network provisioning.

A mobile ad hoc network can be formed by a group of wireless hosts without any pre-existing infrastructure and central administration. Since the nodes in the mobile ad hoc network can be served as routers and hosts, they can forward packets on behalf of other nodes and run user applications. From ease of deployment, reconfiguration, and adaptation, if mobile ad hoc network technology is developed in next generation, we may expect the service to share the information and build the private network easily.

3.2 Mobility supporting technology

In beyond IMT-2000 service, since user will require high-speed mobility services, it is essential to combine the mobility supporting technologies and other applications to employ new services. In mobility supporting technologies, there are location detection and application, seamless handover, interworking technology between wireless and wireline communication, and service providing technology to adapt system environments, etc.

The technology of location detection and application is employed to provide the service such as user/driving navigation, travel and traffic information after processing to combine location information and other contents. Also, even if users do not know what kind of technologies are used to obtain the service, new services will be offered according to user requirements. Therefore, considering QoS of users, we need to develop seamless handover technology. To give the mobile service comparable to wireline service, interworking technology considering protocol and interface between networks will be employed to provide new services.

3.3 Interface technology

Since we will experience interworking environment between wireless and wireline communication network in next generation, intersystem/interservice interface standardization is required to provide mobile multimedia service. Also, to guarantee QoS in interworking environment, it requires to monitor and control traffic in real time. In addition to the above interface technology, there are contents reconfiguration according to QoS requirements and network capability and mark-up language conversion technology to represent various contents.

3.4 Information security technology

Currently, we already used various ciphering algorithms to protect information which is communicated through the network. However, in next generation mobile communication, since new services will be provide according to various QoS and CoS, high-performance ciphering algorithm associated with service QoS and ciphering key management technology are developed to give the multimedia service efficiently. In addition, more sophisticated algorithms related to IC card, finger print and voice recognition, and other identifications are developed to protect information intelligently. Also, content preservation technology is required to secure from cyber attacks or accesses without permission.

4. Conclusion

This paper has presented the concept of mobile communication beyond IMT-2000, the service aspects, and the system requirements. Also, we have considered the technologies to give user-friendly services to users. In next generation, we will employ IP centric concept that is represented by IP-friendly network including backbone network, wireless access, and application service. In service aspects, we will experience convergence concept that will be integrated with mobile communication, fixed wireless, and broadcasting. Also, to achieve seamless service in anywhere and anytime, we have to set the global networking arrangements through the worldwide discussion of a network harmonization and a seamless network provisioning. Since next generation mobile communication will be driven by services, we also consider service-related technologies as well as other technologies to realize the new services near future.

In recent years, to define the global focal point for the continuing vision of next generation wireless services and systems, ITU-R WP8F will prepare the PDNR, which includes vision, objectives, market trends, technology trends, spectrum implication, service applications, and other recommendation, in June, 2002. Even though it is difficult to move next generation mobile communication, we will experience interesting technical challenges and services.

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back to index

Abstract

Third-generation mobile communication systems are currently being standardized and developed worldwide to be initially deployed at the beginning of the 21st century in different regions of the world. Even though services are not launched using third-generation system, the research of systems beyond IMT-2000 is already started to realize next generation mobile communication. Additionally, since there is a growth in the overall number of subscribers as well as a massive demand for capacity stemming from high-speed multimedia services, studies on next generation wireless communication, which have to provide high-bandwidth low-cost reliable mobile service comparable to wireline communication, are conducted worldwide to prepare the standardization activity. Before specifying a standard of systems beyond IMT-2000, this paper presents a concept of mobile communication beyond IMT-2000 and various services which are appeared near future. Also, we consider technologies to provide the user-friendly services to users.

back to index

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Development of a New E-Commerce System using Contactless IC Card and Personal Data Assist (PDA) Terminal

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View Abstract

1. Introduction

The contact-less IC smart card, which has become popular since its original introduction as a common pass [1] [2] [3] for the mass transportation system, including railways, has further increased its applicability to such terminals as POS terminals and ATM machines [4]. It also has been adapted as an electronic ticket [5], and is showing signs of large-scale expansion. Meanwhile, people have begun to frequently access the internet through the use of mobile terminals, along with the popularization of mobile phones and PDA's (personal data assistance). [6] [7] Due to these circumstances, high expectation has been placed on a combined function that allows the replenishment over virtual society (Network-type) of the electronic value on the IC card used in real society (Real-type).

There is naturally, however, a difference in the security requirements between the real-type and network-type E-commerce systems. For example, the highest priority of the real-type system, in which system operators can be relatively certain of security protection, is placed on performance. On the other hand, the highest priority of the network-based system is security, because, due to its non-human assisted computerized processing, damage, once the system is broken into, would be enormous. Due to these conflicting challenges, there is currently no such hybrid with the combined functions of both systems that is equally equipped with satisfactory practical performance.

This report proposes system architecture designed for a mobile E-commerce system containing the function to inject electronic value into the contact-less IC smart card used in the real world through the use of a packet radio network. First, in chapter two, we will summarize the current E-commerce system, which can be broadly divided into two types: a network-based system, in which settlements are made without any direct human assistance; and a real-type system, whose real-life infrastructure, such as the transportation system and POS systems, becomes computerized. In the third chapter we will first discuss the challenges of both the network and real-type systems in terms of their respective approaches to convenience, security, cost, and performance. These points will then be summarized with an eye on the realization of a hybrid with the functions of both types of system. The fourth chapter describes our proposal for a newly developed system architecture that transfers value from mobile terminals, which are widely used in real life, to the contact-less IC card system via network.

The benefit that this system supplies is that existing service providers can change smoothly without the need for a major investment to modify their system. This is because a security server (SS**) will bridge the infrastructures of the existing real-type and network systems. And, finally, in the fifth chapter, we review this new system after comparing its features with those of several other system architectures.

2. Overview of the Popular E-commerce Systems at Present

Before discussing our proposal, we would like to summarize the current E-commerce system.

FIGURE 1. TRAIN SYSTEM

2.1 Network-Type System

The service that enables users to make electronic transactions by using their own Internet terminals and mobile phones has been a focus of attention. For the purpose of this report, this type of system will be labeled as network-type E-commerce.

A network-type E-commerce system is characterized as follows:
It allows 24 hour a day transactions without the need of human assistance/ attendance, and Because of this, priority is placed on the system's security.

In terms of settlement, this type system deals mainly with post-payment transactions, such as credit card enactment or the charging of the user's account in the telecommunication providers, which are collected simultaneously with the telephone bill. And the format of the network-type E-commerce system is defined according to the various systems such as i-mode, WAP (Wireless Application Protocols), PKICC (Public Key Infrastructure Card Consotium), and SET (Secure Electronic Transactions) systems.

2.2 Real-Type System

We have seen, on the other hand, many occasions in daily society where the existing cash-based settlement system has been replaced by electronic transaction.

Such examples as the electronic pass for public transportation (Figure 1.) and the pre-paid public telephone card, which were at the forefront of electronic transactions, have become widely accepted because they provide the user-friendly benefit of convenience.

Credit cards, which started expanding in the 1960's, have, in recent years, almost perfected their online transaction function. There are, moreover, many examples of this type of application, including debit cards, which allow you to make an immediate bank-account transaction from store front terminals, and independent cards issued by retail stores in order to provide various services through a POS terminal. For the purpose of this report, we call this type of system, "real type-based E-commerce."

2.3 Hybrid-type System

We call, for the purpose of this report, an E-commerce system with the benefits of both the network and real type systems a "hybrid-type."

The Sonera Corporation of Finland attracted attention in 1999 when they announced a new service making vending machine payment and general services available to GSM (Global System for Mobile Communication) mobile phone subscribers. Sonera also announced a plan to provide the service in Europe, their home market, for replenishment of electronic money values. [8] These services are seeking greater convenience by combining widely popular systems, and are also highly demanded in the market. However, each of these hybrid systems mentioned above are still in the experimental stage or at a similar level, and it would be inaccurate to call them practical.

3. Challenges in the Realization of a Hybrid-type E-commerce System

We examine, in this section, the respective challenges of the network and real type systems in preparation of the proposal and examination of our new system architecture.

3.1 Convenience

As explained above, with "convenience" as a keyword, real-type E-commerce has been widely accepted in the market. Their wide-spread success can be clearly seen in the case of pre-paid cards for public telephone and railroad tickets, where contact-less IC cards prevail, enabling users to instantly receive services whenever they want them. For example authentication, the confirmation of value, and the subtraction of value from the pre-paid account are all implemented within 0.2 seconds while the user passes through a railway gate. In order to maximize the priority of convenience at the time of usage, the system's security is not designed on the assumption of unattended service, but designed, instead, with operability as its main consideration. We can say that this approach is made possible because the infrastructure is built around a comparatively reliable security system furnished by the service provider. There is also, due to this structure, the limitation that users must go to certain areas where card-refill vending machines are located during available service hours. Conversely, the convenience of the network-based E-commerce system is that users are relieved from the restrictions of time and place. However, the ability to reduce the processing time of settlement transactions is limited due to the security requirement described in the next section; and the use of protective measures, such as passwords and a Personal Identification number (PIN), is unavoidable.

3.2 Security

Settlements are conventionally made as the result of authentication that is dependent on a person's judgement, including person-to-person sales, signatures, and seals. In order to computerize these settlements, authentication must be made an automatic process containing security measures alternative to human judgement, or it becomes necessary to provide some other measures to complement the automated authentication.

In the case of the real type system, with its emphasis on convenience as described in the previous section, it is possible to conduct generally safe business by applying such measures as unique infrastructure (protocols hardware), limiting available areas of use, limiting users, and the recording of transactions by security cameras, etc.

However, these effective measures are not necessarily applicable to a network-based system targeting a broad range of users. As part of its structure, the network system needs to depend upon the commonly used protocols or electronic devices available to everybody, and there are many cases where time or place of usage cannot be limited. Moreover, there is an increasingly strong possibility that damage incurred by any one person's vicious misuse, such as repeatedly attacking the system or making illegal transactions, will be incomparably greater than can be inflicted on the real-type system. It will thus be required that the network-based system strengthen its ability to prevent impersonation, denial, and tampering through electronic authentication. Under the current technology, it is essential that the network-based system have an electronic authentication system supported by PKI-based digital signatures, even if it means sacrificing certain performances on the electronic devices available to consumers.

3.3 Cost

The demand to prioritize the cost factor is high in both real-type and network-based systems. However, the actual cost-reducing methods are different in each system. The real-type system tends to concentrate the responsibility for security and performance on the side of the infrastructure. Taking the public transportation system as an example, end users hold only IC cards, while the railway operator invests in and manages the IC card readers at tollgates and the host computers required to keep the system going.

In contrast, network-based systems tend to diversify cost and function. Internet service providers, for instance, can start and operate their businesses with less investment cost than is required for the real-type system. On the other hand, since the risk of wire tapping, impersonation, and tampering is greater with the network system's infrastructure and transmission equipment, all users are required to complete a certificate and prepare PKI functions.

When considering a hybrid-type system that fulfills the requirements of both the real-type and network-based systems, it is not desirable in terms of cost to have it equipped with all of the factors of both system's architectures. And if the architecture is one-sidedly based on either system, it will lose compatibility with the other system, and a considerable additional investment will be required.

3.4 Performance

We previously stated that with the network-type system security requirements are given priority over performance.Generally, as can be seen in the case of cryptographic key length, whenever new devices for security requirements appear, they engender still further requirements. Because of this reason, mobile information devices, whose processing ability is inferior to those of PCs and workstations, are, at least for the time being, required to perform beyond their capacities. That means that there is always the risk that the right time to introduce a new system into the market will be missed if we must always be waiting for the emergence of new devices with satisfactory performance.

Meanwhile, as was stated earlier, the market demand for a hybrid-type system is becoming obvious, and it is clear that some kind of solution is required.

3.5 Summary of Challenges

In summary of the above examination, we can say that the advantages of the real-type are in aspects of convenience and performance, and the advantages of the network-type lie on the side of security and the cost of system architecture. (see Table 1)

Also, regarding the possibility of realizing the Hybrid-type E-commerce system, it is necessary to place primary importance on introducing it into the market as early as possible, since it is unrealistic to think that all the requirements, which run contrary to one another, can be fulfilled. In the next section the issues heretofore described will be ranked by priority; and, based on this ranking, we shall propose our detailed solution.

TABLE 1. REQUIREMENTS OF THE HYBRID SYSTEMS BASE COMPARISON BETWEEN NETWORK-TYPE AND REAL-TYPE

	Network	Real	Hybrid
Convenience	Anytime Anywhere	Ease of use Fixed location	both
Security	Most important (PKI is mandate)	Complemented by operations	network
Performance	Depends on the devices	Most important (<100ms)	real
Cost	Distributed (PKI required in each terminal)	Centralized (System centric investments)	Gateway type (BlackBox)

4. System Details

4.1 Principles of the System

- The system architecture we propose should circumvent, in a well-balanced way, the four challenges presented by the contradictory natures of the real-type and network-type E-commerce systems. In addition, we must also ensure that the original compatibility of the existing systems be maintained in a way that impels no major changes. This will enable the quick commercialization of the system under proposal, and facilitate the popularization of its new service features. Thus, the new system under proposal should be made to fulfill the following five conditions:

- Performance that the real-type system provides
- Security that the network-type system provides
- Adopt the widely accepted system architecture
- Easy introduction
- User friendly applications

Here is the principle behind our approach: we will select the most fully accepted system architecture of the real-type and network systems which are already commercialized; and will design a hybrid architecture, dependent, to a certain degree, on the features, functions, and limitations of the two systems. This approach is necessary because if any new devices are needed for the new system architecture, it will take over a year just to develop the designs for them, and a quick examination as to the system's practical use will be impossible. Though this will be a newly developed system, it is also essential that it be compatible to the existing system in the applicable market. In order to achieve this goal, we will take the effective measure of utilizing, as our hybrid model, the most widely employed existing system and infrastructure.

Our proposal for the first application of this new system is to give electronic value via the mobile network to the contact-less IC card available for transportation-related terminals in the real-type system. With this application, we can change the previous pattern that required users to get their additional value at card-refill vending machines located in certain areas into a convenient one where users can use the cards at anytime and anyplace. We will also examine if, by extending this function, this system under proposal will be applicable to the commonly used electronic tickets.

As for this system under proposal's architecture, we will aim to prioritize making it compatible with existing systems and to make it versatile. We will also attach importance on getting results that lead to high expandability (scalability). However, in order to view its practical application, it is necessary, when conducting a demonstration, to have selected the correct system at the actual time of installation. First, in selecting the contact-less IC card system we placed emphasis on actual market performance and adopted the Japanese proposal for ISO14443 standardization. 6) And in selecting the radio packet network, we chose a system that is widely accepted domestically in Japan and compatible to the Internet.7)

4.2 Concept of the System Model

On the assumption, as described in the previous section, that the new system will be applied in the existing public transportation system, its first goal was to complete the process allowing electronic value to be charged via network by using the contact-less IC card at the terminal. In this section, we will explain the framework of the system architecture under proposal through a summary of the functions and methods required in its realization.

4.3 PKI-Common Key Bridge Model

Figure 2 is the conceptual diagram of the system under proposal in this report. As is illustrated, the process of issuing value is separated into two phases. The first phase of processing consists of a series of scenarios starting from the user's request to have issued and ending with electronic value with PKI-based signature transferred to the card access server (SS). This is the bridge section of this system under proposal.

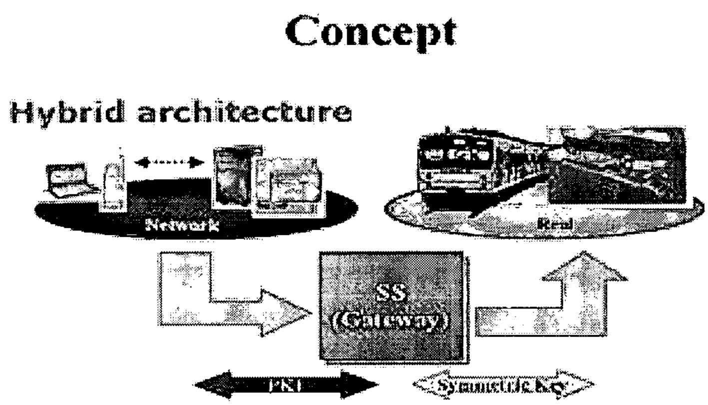
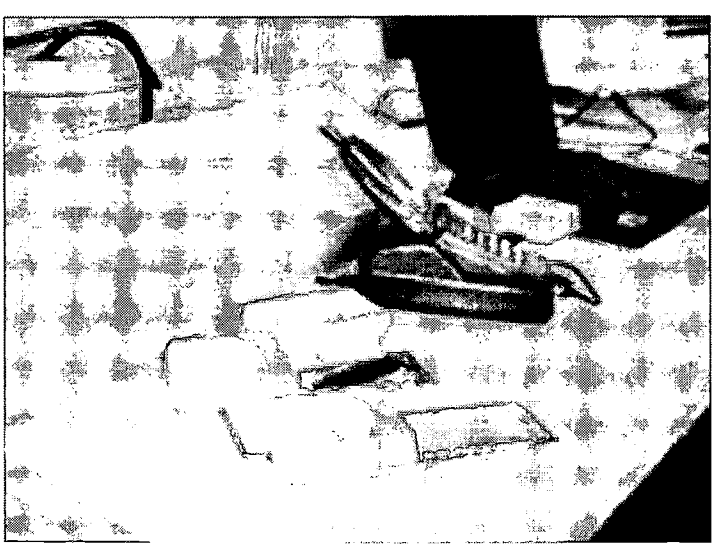


FIGURE 2. CONCEPT OF THE ARCHITECTURE

In this system architecture, a Mobile Client Certificate (user's certificate by Certification Authority [CA]) is installed in the user's terminal. User authentication, charges credited to the user's account, and value issuance will proceed based on the confirmation of this Mobile Client Certificate. In the second phase, the value with PKI-based signature transferred to the card access server (SS) is converted into the common key protocol used by the card and sent back to the card via network. Following is an explanation of the basic functions of this system architecture in order of the steps taken in the issuing process.

4.4 Terminal

It is assumed that the function to download either electronic money or electronic tickets employed by the system we propose will be operated on the mobile information terminal owned by users.



- **FIGURE 3. PDA TYPE TERMINAL**

FIGURE 4. PCMCIA CARD TYREADER WRITERS

Figure 3. illustrates the type of mobile terminal that will be used in the demonstration test to examine function. This terminal is made with the functions of radio packet communication, browser for the Internet information access, PKI processing as an end terminal to receive network user acknowledgement, and the role of reader/writer of IC cards.

Our prototype was built with the commercially available Personal Digital Assistance (PDA) with built-in radio communication function as its base device. We added an improved version of the commercially available PKI-compatible browser software, and newly created reader/writer function and driver software. A second prototype with improved versions of these functions is scheduled for production; and a field test will be conducted to determine its future practicality. As depicted in Figure 4, we also prepared PCMCIA type reader writers for PC type devices.

4.5 Mobile Client Certificate

In this experiment, we are going to use the mobile terminal's PKI function for user authentication via network. This means that the value issuance server will authenticate the user at the point when it acknowledges the access of the mobile terminal. For this purpose, the Mobile Client Certificate is loaded on the side of the mobile terminal. (Figure 5)

FIGURE 5. MOBILE CLIENT CERTIFICATE

Furthermore, the Mobile Client Certificate and PKI-based secret key is encrypted in the PKCS#12 format and loaded in the mobile terminal, which, for the purpose of validation, asks the user to input a PIN number of eight digits or more when the browser starts up.

4.6 Value-Issuance Server

The server responsible for issuing the value requested by the user terminal will process the user's authentication interactively via Secure Socket Layer Class 3 [SSL-3] through use of the client certificate described above. With the proper completion of this authentication process, a value-issuance negotiation will be under way. This process is accompanied by certain E-commerce-type tasks such as a browser search for the proper conditions and user-side data input. When the condition of issuance has been defined, the value-issuance server first implements the process to confirm the settlement. After confirming that the value can be legitimately charged to the user's account, it issues the electronic value. The value will be approved with the entry of the server's secret key, and generated with the attachment of the server's certificate and the CA's signature as well. Since all the processes described here can be implemented by generally available Internet-compatible E-commerce devices, the existing service providers will be able to make their systems compatible with the real-type system without any major equipment changes.

4.7 Conversion of Value

Since the value issued by the process described in the previous section is in the format of a PKI-based electronic signature, it is difficult to load it with the limited memory capacity of the currently available contact-less IC card. And even if there is a solution to the memory capacity problem, an answer to the challenge of performance (as described in 3.4) is not expected at the point.

Accordingly, the card access server (SS), which is the core of the system under proposal, will conduct the protocol conversion of PKI and contact-less IC card and the value format conversion that accompanies them. The SS will receive the PKI-based value via network, and confirm its validity by verifying the signature of the issuer, the value server. It will then convert the value format to compatibility with the end-terminal contact-less IC card, and download it according to the protocol for card access.

Above is a summary of the process by which the SS converts value. Moreover, the SS consists of two servers: a transaction server controlling the session between SS and card; and a key management server maintaining the common secret that is paired with the card.

4.8 Transaction Server

As one of the functions (as described above) provided by the card access center (SS), the transaction server is responsible for receiving PKI-based value, converting the format of this value, and proceeding with communication by a unit called "session" based on the reliable relationship between SS and the card. At present, due to performance requirements (as described in 3.4), the majority of widely used contact-less IC cards have adopted symmetric cryptography. Also, in order to prevent the key's dispersal over the network, the cards generally adopt a system that generates a new common key, different from the one maintained on each side of the terminal, every time a session requiring two-way authentication occurs. Inside SS, the transaction server will implement communication with card using the key to that session.

4.9 Symmetric (Session) Key Management Server

Meanwhile, in order to administer the same secret key as the IC card, the SS must have stricter security than that required for the transaction server in the previous section. Responding to meet this requirement, the card access center (SS) in the system under proposal conceals the functions of secret key management and session-key generation (the session key is generated by use of the secret key) and made them independent as a separate server.

This design gives our system the flexibility to respond to the various requirements of an extension model for multi-applications. For example, when, by mutual agreement, multiple service providers share the same key to provide service to a user, a new business model that is an independent third party can be created to administer the key.

4.10 Application Fields

The eventual aim of this system under proposal is commercialization in the actual market. The candidate market location is undecided, but end terminal are available almost anywhere in Japan. So, we have selected electronic money (including the pre-paid tickets for public transportation) and electronic tickets to events as the contact-less IC card's field of application. And, through an experiment with the participation of several hundred monitors, we plan to see if the system is commercially feasible.

4.11 Summary of the System

The features of this system under proposal are summarized as follows: First, in order to assure compatibility with network and real-type systems, we proposed features of a hybrid-type E-commerce system, and explained each function in the system. In order to match the level of performance required by a real-type system, we selected the device to deal with the most challenging aspects of service in connection with the railway system.

By using the Internet-compatible, packet radio communication network, we have assured that our system will meet the requirement for PKI-based security that is essential to the function of network-type systems. In this way, with the selection of the two prevailing, already commercialized systems, we can expect our proposed system to rapidly spread following its launch. Also, since our system maintains compatibility with existing systems through its gateway architecture, we have confirmed that it will allow businesses to get under way while minimizing the impact on existing systems. In terms of target application, this system is designed to have as its essential function the infusion of electronic value into contact-less IC cards available for the transportation system via network; and we have examined it toward extending its function to apply to a variety of electronic tickets.

5. Study of the System

The system proposed in this report was introduced with a description of its architecture and features in the previous section. There are, however, other methods that can be considered to implement the system along with the principles set forth in 4.1. In this section, we will outline the following four measures that are opposed to what we set-forth in this report, and compare their respective features: (1) a system that doesn't use PKI; (2) a system that doesn't use a symmetric key; (3) a system to exchange value on the side of the network; and (4) a system where the PKI-based symmetric key is bridged on the side of the terminal.

First, under (1), a system that doesn't use PKI, a problem of compatibility remains since, as was described in 3.2, many existing system providers have already introduced PKI in order to prevent security threats.

FIGURE 6. ALTERNATIVE ARCHITECTURES

Second, a system (2) that doesn't use the symmetric key must fulfill the conditions of making the contact-less card PKI-compatible and commercially feasible. It has been said in recent years that under this system it would be impossible to expect the level of performance of the IC card with symmetric key, making this system unrealistic for our goal.

Contrary to the above two alternative measures, it is expected that this third system (3) which exchanges value on the side of the network, can provide better efficiency than the system proposed in this report, where PKI-based value is once transmitted to the end terminal. However, we decided to wait and see about its adoption, because it is possible that it may cause the need for many changes on the side of existing service operators.

The fourth system, that has a PKI-based symmetric key bridged on the side of end terminals, is not appropriate to our principle of restraining the development of new devices. If, however, market introduction were to be postponed for about a year, and a suitable device can be developed, then there is the chance that this system along with (3) above, can be a realistic solution along with the system proposed in this report. Moreover, there is the appealing possibility that this fourth system will be able to process the majority of the value replenishment procedure into the end terminal--the IC card. However, under this system architecture, it is essential that a PKI-based symmetric key bridge device embedded in the end terminal be supplied with complete anti-tampering capabilities to prevent the threat of illegal usage. Another liability of this system is that the security-related technology, which is always changing with technological advancement, would be forced to freeze while new devices are under development.

As can be seen when comparing the four alternative system architectures with the one we propose, ours is the most adequate implementation method for the purposes set forth in this report. However when, following the testbedding demonstration, we further review the requirements necessary for commercialization, it is considered that a re-evaluation of the features of the alternative systems described in this section is required, depending on business conditions.

6. Conclusion

This report presents a summary of the current status of the research and development of the "Mobile E-commerce System," an undertaking of "the project to develop Internet technology for home information equipment" sponsored by the Telecommunications Advancement Organization of Japan (TAO). In this report, we reviewed the benefits of both the network and real-type E-commerce systems, and the technological challenges in developing a hybrid-type system containing the benefits of both systems. We then presented our plan for a new architecture that will surmount these challenges.

This new system architecture proposes a model that provides a bridge between the PKI and symmetric cryptography on the network side. We showed that, by meeting security requirements, there is a strong possibility that this model can be tested at the earliest possible time. We also, at the same time, verified that this system architecture, since it is compatible with both the network (providing value transfer and charging services) and real-type (gate system for public transportation services) systems, offers a lesser burden to existing service providers.

FIGURE 7. FIELD TRIAL

Based on this architecture, we have evaluated the system's performance by furnishing the mobile information terminal, PK-based value issuance server, and card access server which provides a bridge between PKI and symmetric keys. Using this equipment.

Currently we have been conducting a field trial in the city of Sapporo since August 1st, 2001., and it will be continued until the end of January 2002. During this six month trial, we demonstrate the operability of this architecture through the demonstration test in the real application field.

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* * For the purpose of this report, "SS" will herein be used to describe the card access server. Though the actual abbreviation is CAS, we use SS in order to avoid confusion with the broadcasting-related "conditional access server."

back to index

Abstract

The existing Electronic Commerce (E-Commerce) System can be divided broadly into two categories: a network-based system, which enacts settlements online between service providers and users; and a real-type system, whose infrastructures in the real society, such as the transportation system and point-of-sales (POS) transaction terminals, will be computerized to enable various electronic transactions. Although a hybrid type with the functions of both systems is in great demand in the market, only a few models have so far been commercialized. In this report, we propose a system architecture for a mobile E-commerce system, which provides the function of infusing electronic values (representing money) via the network system into the contact-less IC smart card used in the real world. We also examine the validity of transferring, over the network, electronic money and electronic ticket value from mobile terminals to the contact-less IC card system. Since this architecture is compatible with either the existing Web network-based value transferring system and the existing real type-based public transportation system, service providers will be able to add the new function with minimum change to their own systems.

back to index

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back to index

Analysis on the Effects of Repeater System in 3G Wireless Network

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View Abstract

1. Introduction

CDMA2000 is the 3rd generation system based on the 2nd generation standard, IS-95. It can offer backward compatibility with IS-95 system and smooth migration from 2G to 3G. Therefore, CDMA2000 is one of the strongly recommended proposals for 3G global wireless communication system.

Packet based data service is a new traffic type in 3G and it is expected to be a major part of CDMA2000 services. Many kinds of data service are also introduced. Most data services have higher data rate than voice service data rate(9.6 kbps).

CDMA2000 can provide the high mobility user with a wide variety of services such as internet service over the wireless packet data connections. These kinds of high data rate result in lower processing gain and smaller coverage than voice service. Different processing gain values also mean that coverage can vary in relation with data rates. Therefore, these coverages for various rate traffic services are different in CDMA2000.

As the wireless network environment becomes more dense and complicate, repeater systems are widely adopted in 3G network to cover traffic hole. However, repeater system could result in serious side effects to the neighboring cell site.

As described above, in comparison with 2G system, deployment of 3G system is more complicate and difficult. Therefore, more elaborate analysis methods on coverage and capacity with repeater systems are needed.

2. CDMA2000 features

There are two main schemes in classification of 3G communication with signaling methods among base stations : synchronous and asynchronous system. CDMA2000 protocol is a one of dominant protocols that satisfies synchronous scheme. CDMA2000 supports backward compatibility with IS-95A/B because it is a protocol that is evolved from IS-95. CDMA2000 is able to be operated on different radio bandwidths : 1.2288 or 3.6864(=1.2288*3) Mcps. When operating bandwidth of CDMA2000 is 1.2288 Mcps, we call that CDMA2000 service is 1X system and its spreading rate is 1. Unlike IS-95, CDMA2000 has characteristics suitable for packet data services with high rate even in case of 1.2288 MHz.

Special characteristics of CDMA2000 system are as follows.

- Fast forward power control
- Improved convolutional codes and turbo codes
- Forward link transmit diversity
- Auxiliary pilots
- Flexible frame lengths
- Coherent pilot based reverse link
- Efficient packet data transmission
- Battery saving features
- Advanced medium access control

There are many channels in forward/reverse direction. These channels can be categorized to 'common channels' and 'dedicated channels.' Common channels have a point-to-point manner between base station and mobiles. And dedicated channels carry information between the base station and a specific mobile. Fundamental channel(FCH) has a role of covering voice call and low rate data. And supplemental channel(SCH) can provide time shared high data rate packet services with channel scheduling algorithm.

3. Repeater system

Repeater can be named as a 'remote cell' and it is connected to a site(or a sector) named as a 'donor cell.' Donor cell shares its traffic channel elements with the remote cell. This means that connected repeater uses the same PN offset(pilot sequence number) of the donor cell.

Repeater system amplifies weak signal received from donor cell. It is connected to a donor base station and established between base station and shadow region. Repeater system is able to improve the quality of call by removing the shadow area. To enter into details, repeater is used to improve call quality of urban area, in-building and underground as well as to enlarge coverage of suburban, rural and mountainous area. Also, it reduces the probability of call drop in area where signals are hard to be detected. Therefore, repeater system is very useful in poor signal strength area where establishment of base station is difficult.

And the repeater is cost effective when service providers want to overcome coverage hole and enlarge coverage with small cost. But because repeater system can act as a new interference source to the neighbor cells, elaborate cell planning scheme is needed. With these reasons, the effects of repeater systems are simulated in ideal flat area and real networks in this paper.

4. Simulation methodology

In 2G system, coverage and capacity analysis are conducted with link budget table. This method is simple and easy to apply for existing voice only service, but it could be hard to predict overall physical radio link conditions in mixed traffic situation of 3G. And it is difficult to find optimal cell site location with only link budget table. For a better radio link prediction and estimation of CDMA2000 service, Radio Network Simulation(RNS) system is adopted in this paper.

4.1 Simulation System

RNS system is composed of followings.

- Digital GIS(Geographical Information System) data and morphology data
- Radio wave propagation prediction model : Hata-Okumura, COST231-Walfish Ikegami model
- Cell site configuration parameters : height, location, transmit power, etc.
- Antenna configuration information : direction, tilting degree, gain, 3-D beam pattern, etc.
- Mobile characteristics : speed, receiver sensitivity, antenna gain, etc.
- Repeater system analysis

4.2 Propagation Model

There are various propagation models to predict radio wave path loss. The path loss model should be chosen with consideration of environmental characteristics, frequency, radius and so on. In this simulation, we select COST231-Walfish Ikegami model. Because COST231-WI propagation prediction model effectively reflects building information in urban area. Refer to Appendix for more details.

4.3 Link Level Simulation Formula

To obtain simulation results for CDMA2000 channel signal to interference ratio, specific formulas are used for calculation. Refer to Appendix for more details.

4.4 Cell Configuration and Traffic Model

In this paper, analysis for voice and packet data traffic are conducted and presented in two system configurations, with and without repeater using RNS system. We select two area types for simulation; ideal flat area and real district.

In order to observe the variation of pilot Ec/Io at each condition, we set the cell configuration to honey cell type in flat area(A number of base stations are 19 with 3 tier formation and cell radius is 5km). And we use the real base station parameters to get the effects of repeater system in specific area where is the most complex district in Korea. Uniformly distributed voice and data traffic is applied to flat area and sector based non-uniform traffic is applied to specific area. The latter is from BHCA(Busy Hour Call Attempt) erlang data.

Various data traffic rate are 153.6, 76.8, 38.4 and 19.2 kbps. All data traffic services are provided by SCH except low data rate service.

4.5 Simulation Parameters

Specific link level and system level simulation parameters in flat area are listed in Table 1.

TABLE 1. SIMULATION PARAMETERS IN FLAT AREA

Parameters	**Value**	**Unit(comments)**
Chip rate	1.2288	Mcps
Carrier Frequency	880	MHz
Power control error factor	0.8	
Log-normal Shadow fading	10	dB
Max. active set size	6	
T_DROP	-14	dB
Antenna gain	12 12	dBd(Omni) dBd(Sectorized)
Antenna tilting	0	o
Traffic ch. target Eb/Nt	4 5	dB(Voice) dB(Data)
Traffic ch. target FER	1 1 or 5	%(Voice) %(Data)
BS Max. Tx power	40	Watt
SCH Max. power ratio	50	%
Overhead chs. power ratio	28	%
Turbo coding gain	2	dB
Voice activity ratio	0.42	
Data activity ratio	0.8	
Processing gain	21 9	dB(voice) (153.6 kbps data)

In this simulation, RRM(Radio Resource Management) algorithm that SCH is able to use up to 50% of available LPA(Linear Power Amplifier) power of base station is adopted.

5. Results

In order to obtain basic data throughput value regarding with signal to interference ratio, CDMA2000 1X test system of service provider is used.

The relations among pilot channel Ec/Io, handoff state and data throughput are shown in Figure 1. As we can see with results, there is high correlation between pilot channel Ec/Io and data throughput. But there is low correlation between data throughput and handoff state.

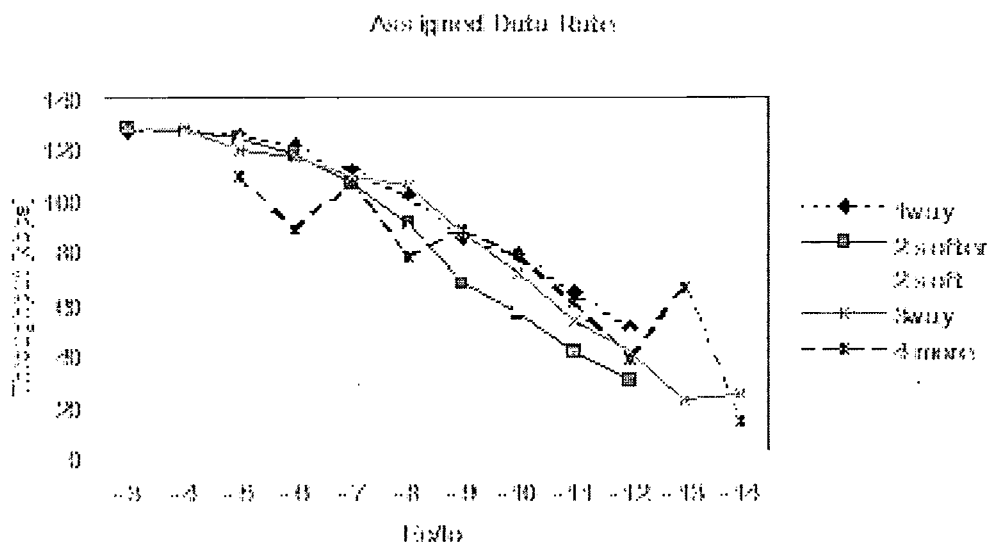


FIGURE 1. THE RELATION AMONG PILOT CHANNEL EC/IO, DATA THROUGHPUT AND HANDOFF STATE

In Figure 2, we simulate to know the variation of pilot Ec/Io according to the power limit of SCH in the respect of RRM. We can see that the stronger SCH power, the more interference. Therefore, we must tradeoff between increment of SCH power and pilot Ec/Io. With the same amount of voice and data traffic, more data throughput could be produced in 3 sectorized cell configuration.

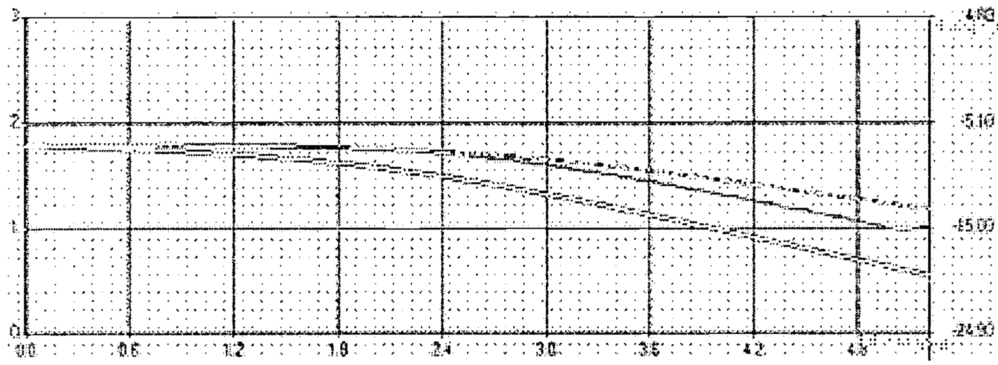
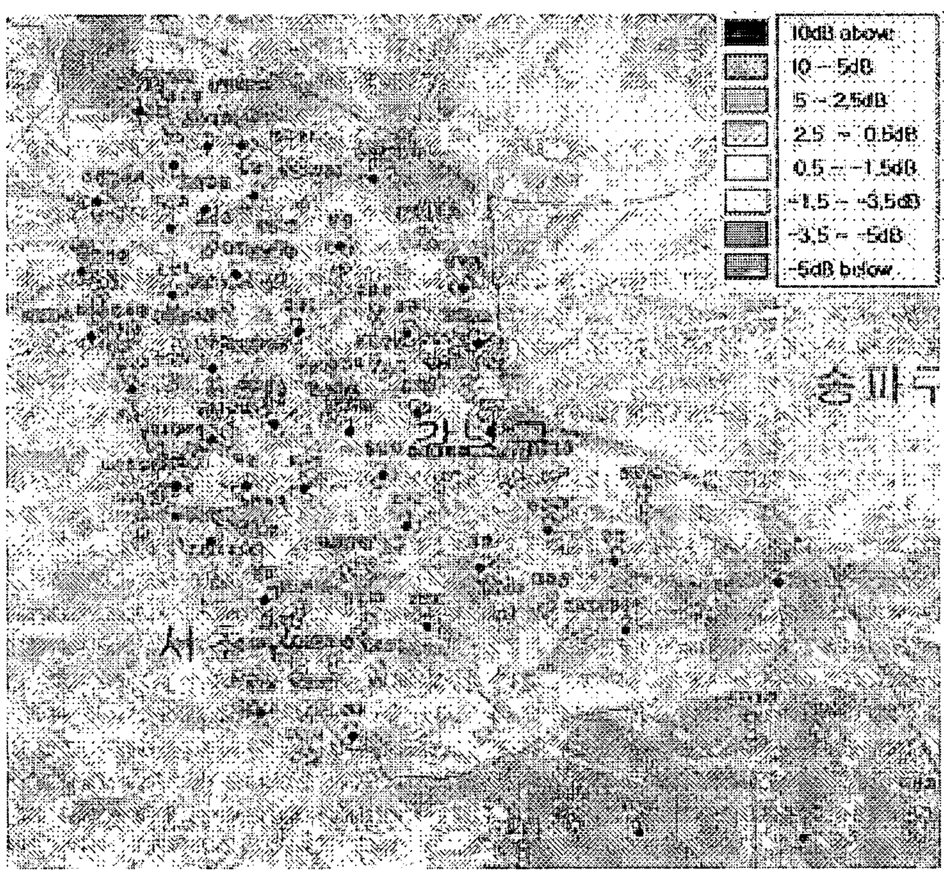
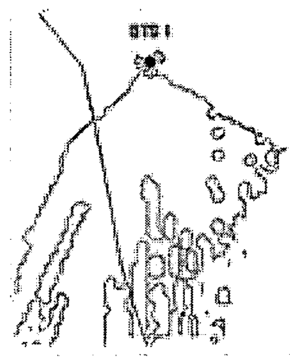


FIGURE 2. PILOT CH. EC/IO WITH VARIATION OF POWER LIMIT PER 1 DATA USER SUPPLEMENTAL CHANNEL(NO REPEATER, BOLD SOLID : 10 W, SOLID : 5 W, DOTTED : 2 W)

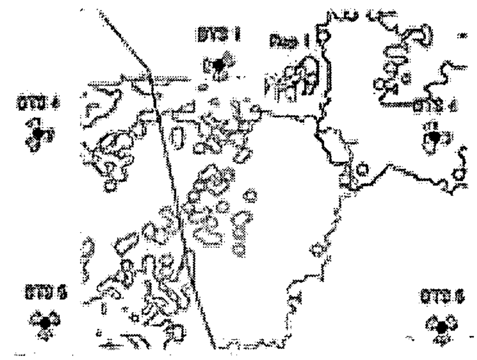
Figure 3 (a) shows the simulation contour in selected area and the result of pilot Ec/Io. Figure 3 (b) describes the extension of reverse coverage of beta sector of BTS 1. Coverage enlargement of the remote cell causes new interference to the neighbor cells. The remote cell has its unique coverage so the donor cell coverage can be enlarged, but it may lead to shrinkage of coverage of neighbor cells.



(a)



(b)-1



(b)-2

FIGURE 3. SIMULATION CONTOUR OF SPECIFIC AREA(TOTAL 46 BASE STATIONS, 65 REPEATERS)
(A) PILOT CH. EC/IO (B) EXTENDED REVERSE COVERAGE OF BETA SECTOR OF BTS 1

Generally, repeater system can enlarge donor cell's coverage. But there is a possibility to be reduced the total average data throughput by interference occurred by repeater systems. Moreover, if hard handoff technique is deployed for SCHs in CDMA2000 system, this phenomenon is quite wihtin the realms of possibility. These facts are shown in Table 2. There are three scenarios to get the Table 2. The first is 46 BTSs, 65 repeaters, the second is 46 BTSs, 57 repeaters and the third is 46 BTSs, no repeater. We refer to the physical C/I verse data throughput mapping table not listed in this paper to calculate data throughput.

TABLE 2. DATA THROUGHPUT VARIATION IN A SPECIFIC AREA

46 BTS		**46 BTS**		**46 BTS**	
65 Repeaters		57 Repeaters		No Repeater	
C/I	Throughput	C/I	Throughput	C/I	Throughput
11.88	291.96	15.55	382.16	17.50	430.08
14.84	182.35	15.76	193.66	18.01	221.31
12.16	74.71	13.32	81.84	14.19	87.18
13.82	42.46	14.74	45.28	14.42	44.30
17.67	27.14	16.65	25.57	15.41	23.67
16.05	12.33	13.81	10.61	12.70	9.75
7.96	3.06	6.42	2.47	5.21	2.00

5.62		3.94	0.00	2.57	
Average 634.007		Average 741.58		Average 818.29	

6. Conclusion

In this paper, we observe the effects of repeater systems in CDMA2000 with RNS system. We could learn the relations among the number of voice fundamental channel user, pilot channel Ec/Io, handoff states and available power through simulation. Although high data rate services are encoded with better FEC technique than 2G, it could not avoid small cell coverage as data rate increase due to low processing gain in comparison with voice service.

And as voice users are gradually increase, the interference increases and pilot channel Ec/Io becomes worse. This is because more power is assigned for voice fundamental channels, there may be shortage of available power for supplementary channel. This implies deterioration of pilot Ec/Io and it can occur shrinkage of total throughput.

In order to minimize side effects by repeater systems, we should tradeoff between coverage extension and interference. If we consider path loss-limited environment, repeater system can provide good solution. But if we want to improve interference-limited environment, there are many things to consider to optimize wireless mobile communication systems. We can see the improvement of data throughput up to 28% in the interference-limited environment, if a number of repeaters are decreased or there is no repeater through simulation.

In IS-95A/B, repeater systems are important in forward and reveres link. But we recognize that the effects of repeater are more sensitive in forward link than reverse link in IS-95C through this paper. Therefore, mobile engineer should consider these facts in designing 3G system.

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Appendix

A. COST231-WI formula

$$L_b = L_0 + L_{rts} + L_{msd}$$
$$= L_0 \qquad for \quad L_{rts} + L_{msd} \leq 0$$

[1]

Where

$$L_0 = 32.4 + 20\log r + 20\log f_c$$
$$L_{rts} = -16.9 - 10\log W + 10\log f_c + 20\log \Delta h_m + L_{ori}$$
$$L_{msd} = L_{bsh} + k_a + k_d \log r + k_f \log f_c - 9\log b$$

f_c = frequency(MHz)
h_b = base station antenna height(m)
r = distance from base station(m)

B. Link Level Simulation Formula

To obtain simulation results for CDMA2000 channel signal to interference ratio, following formulas are used for calculation.
(1) Pilot channel Ec/Io

$$\frac{E_c}{I_0} = \frac{\alpha_0 P_0^o(\theta_0) L(\theta_0, d_0) G}{I_b + I_{sc} + I_{oc} + I_{rm} + I_r + N}$$

[2]

Where

$P_0^o(\theta_0)$: Serving BS overhead ERP in the direction 0

α_0 : Fraction of serving BS overhead ERP allocated to pilot power

$L_0(\theta_0, d_0)$: Path loss from serving BS in the direction 0 to the probe mobile a distance d0 away

G : Receive antenna gain of probe mobile

$I_b = P_0(\theta_0)L_0(\theta_0, d_0)G$: Interference power received at the probe mobile from the overhead power emitted by the serving BS

I_n : Non-CDMA signals

$I_o = G\sum_{k=1}^{K} P_k(\theta_k)L_k(\theta_k, d_k)$: Sum of overhead powers from other BSs

K : Total number of BSs(or sectors) in the system

$I_s = GL_0(\theta_0, d_0)\sum_{j=1}^{J} T_j(\theta_0)$: Total traffic channels(FCHs+SCHs) power from the serving BS

received at the probe mobile

J : Total number of mobiles in the system

$T_j(\theta_0)$: Traffic channel ERP intended for mobile j but intercepted by mobile 0

$I_T = G\sum_{k=1}^{K} X_k(\theta_k)L_k(\theta_k, d_k)$: Total traffic channel power from all other BSs

N: Thermal noise power

(2) Traffic channel Eb/Nt

$$\frac{E_b}{N_t} = \frac{T_0(\theta_0)L_0(\theta_0, d_0)G}{I_{b'} + I_n + I_s + I_{so'} + I_T + N}\left(\frac{W}{R}\right)$$

[3]

Where

$I_{b'} = (1-\alpha)P_0(\theta_0)L_0(\theta_0, d_0)G$: Interference power received at the probe mobile from the overhead power emitted by the serving base station

E : orthogonality factor

$I_{m} = (1-\varepsilon) \times \gamma_{11}(\theta_{11}, d_{11}) \sum_{j=1}^{J} I_j(\theta_{11})$: Effective total traffic channel interference intercepted by the probe mobile

W/R : Processing gain

back to index

Abstract

The 3rd generation(3G) wireless communication system has more complex features than the 2nd generation(2G) system. Therefore, more extensive analysis on coverage and capacity are needed. Especially, the issue of whether to use base station or repeater system to cover shadow region effectively is important in wireless network with Quality of Service(QoS) and economic points are considered. In this paper, QoS related system capacity and coverage analysis results are provided by simulation. And we describe the various effects of repeater systems as a new remote cell with real CDMA2000 environment.

Index Terms-- 3G, CDMA2000, repeater, coverage, capacity

back to index

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back to index

Policy / Regulatory

Monday, 14 January 2002
1400–1530
Coral II

M.1.5 Fostering Competition

Chair:
GLENN S. GERSTELL, Partner, Milbank, Tweed, Hadley & McCloy LLP, *USA*

M.1.5.1 Protocol Interfaces are the New Bottlenecks: What the Internet Means for Telecom Regulation (View Abstract)

TIMOTHY DENTON, Principal, T.M. Denton Consultants, *Canada*

M.1.5.2 Unbundled or Undone: Frameworks and Incentives for LLU

ANTHONY SYLVESTER, Senior Lawyer, Arculli and Associates, *Hong Kong SAR, China*

M.1.5.3 Who Controls the Internet? (View Abstract)

ROBERT FRIEDEN, Professor of Telecommunications, Pennsylvania State University, *USA*

back to sessions

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back to index

Protocol Interfaces are the new bottlenecks: What the Internet means for telecom regulation

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View Abstract

1. Overview

This article makes two proposals: first, that in an Internet-era, regulators have fresh and compelling duties to constrain monopoly power, which will be exercised through protocol interfaces. The second is that, owing to the separation of the applications from the transport, which is a fundamental feature of the Internet, the bit transport business will be starved for capital, and that new forms of public and private ownership of bit transport are required to solve the problem that the Internet creates. The alternative is re-monopolization, which will abort the massive creation of new wealth and the destruction of old wealth, which the Internet has made possible.

This article proposes that the traditional duties of the regulator and of policy-makers, which are to limit the power of monopolies, continue in a new form, which is the supervision of the anti-competitive propensities in software architectures employed by incumbent cable and telephone local monopolies. In a software-driven system, the conceptual architecture is in embedded in code. Code determines everything important about modern communications systems, including whether they will platforms for spontaneous innovation or for the extension of monopoly power.

The second outcome which we see as inevitable is for communities to develop broadband infrastructures organized on the principles of the Internet. Just as highways are owned and managed differently from private vehicles, so will ownership and management of the transport layer be different from the ownership and management of the applications layer. These broadband infrastructures may be publicly or privately owned. They may be maintained by any form of organization suitable to the task. What will make them truly distinct from previous cable and telephone networks, however, will be the separation of the transport functions from the applications provider functions. The owner or owners of the bandwidth will not tell the users of the bandwidth what they can do with it. People will light their fiber and connect how and with whom they want, on protocols of their choosing. No one will tell the user of the network what uses the network may be put to, beyond generally applicable laws such as govern publishing.

2. Facilities-Based Competition

The policy which has been followed since the mid-1980s, and which is spreading over the world, is to encourage long distance competition in wireline telephony, cellular competition, and local competition. The latter was to be realized by the resale of network elements of the incumbent former monopoly, or facilities-based local competition, whether based in microwave or wire.

Facilities-based competition lies at the very heart of CRTC Telecom Decision 97-8, which introduced local competition in telephony in Canada.

The following quote is from this very decision, at paragraph 73:

The Commission is of the view that efficient and effective competition will be best achieved through facilities-based competitive service providers; otherwise, competition will only develop at the retail level, with the ILECs retaining monopoly control of wholesale level distribution.[1]

By the end of 2001 it has become apparent, by the number of competitive local carriers going bankrupt, that facilities-based local competition is a failed policy. It has failed for many reasons. At the time it was conceived, competition was thought of in terms of offering telephone services, rather than a completely new platform for Internet-based architectures. It has also failed because of the enormous investments that must be made. Above all, it has failed because, in an Internet era, it is an irrelevant policy to the direction technology has taken. It is this last reason, in my submission, which is supreme.

In an Internet-based architecture, applications, for which people are prepared to pay, are separated from bit transport, for which, on the whole, they are not prepared to pay enough to attract investment. The separation of applications from transport is at the root of the problem of investment in local facilities. It is the hidden factor that friends of the Internet need to account for. The enemies of the Internet already understand this instinctively.

3. The end-to-end principle

The Internet grew out of a computer-communications world of academic researchers, whose assumptions about what a communications could do were shaped by the possibilities of computers[2], which are marked by exponentially declining costs of computation, storage, and - where not under monopoly control - transmission.

The Internet was built on entirely different technical assumptions than either of the other two legacy systems, circuit-switched telephony or cable television. These technical differences form the basis of the incompatibility between the wealth-creation opportunities afforded by each system. These technical differences have permitted the Internet to run on what is called "the end-to-end principle", which results in stripping out of the lower, transport-related functions of the Internet bottlenecks or control points that would determine what services or applications could be provided and sold.

The features whereby the Internet differs from telephony include:

1. The system assumes that computation, storage and transport are subject to exponentially decreasing costs, and wastes them according to their declining costs;
2. The location of intelligence is pushed as far as possible towards the edge of the network, and is owned and controlled by users to the greatest extent possible;[3]
3. The system, which is a set of instructions for machines, is layered into what I term transport, code, and content layers[4]. The lower layers, which concern themselves with the transport of signals, make the fewest possible assumptions[5] about the nature of the task to be accomplished by the system. Hence it is optimized for no particular use, and open to the maximum feasible number of uses;
4. The relatively open content layer is a platform for innovation[6]: the World Wide Web, email, and a host of computer applications we all use testify to the transformative power of innovation without permission;
5. Because lower layers were designed to be as ignorant of the system as was consistent with the movement of traffic, the system contains very little knowledge of itself, and in particular, was not designed for record keeping necessary for billing.[7]

This is precisely the opposite doctrine to how telephone and cable systems are run, where the owners of networks determine what services are offered. In the Internet, no one has control over what services are or can be offered, at least at the technical level. of whether packets can be read, controlled, and categorized for content by the routers that guide packets to their destinations.

Numerous attacks have been made on this principle. They consist primarily of the claims of intellectual property lawyers to protect and enhance the value of copyright against the tremendous innovative force of new computer architectures, as evidenced by the attacks on file sharing programs such as Napster and Gnutella. There are also attacks on the end-to-end principle that come from network designers who seek to optimize the network for today's applications, at the expense of its general usefulness for al future applications. As David Reed writes

"In addition to economic friction against innovation, we are creating points of control, where a new class of "trolls" are being permitted to set up shop under our network bridges. These trolls (the companies who develop, and their customers who deploy and operate these special mechanisms) must be consulted and are required to bless any new protocols or applications. Just ask a company like RealNetworks, which must negotiate with firewall vendors, ISPs and other troll-like intermediaries to clear paths for its innovative streaming media protocols. In the Internet's end-to-end design, the default situation is that a new service among willing endpoints does not require permission for deployment. But in many areas of the Internet, new chokepoints are being deployed so that anything new not explicitly permitted in advance is systematically blocked."[8]

The restrictions on the end-to-end principle constitute one form in which the innovative possibilities of the

Internet may be lessened and controlled. There exist a far more obvious source of control, however, in the service models of the telephone and cable television industries. While they were each designed for different purposes, cable and telephony share a common assumption, that the network creates the value. Services are designed and created by the network, not by the end-users. The network defines the services that may be extracted from it. Hence telephony has not acted as a platform for innovation.[9]

The following sets forth the principal differences in the two systems:

Internet	**Legacy networks**
• Underspecified	• Completely specified
• Peer-to-peer	• Master-slave
• End-to-end	• Service control points
• Open	• Proprietary
• Services are defined by anyone with an idea.	• Services are defined by owners of the system.
• Applications split from transport - hence the protocol stack	• Services are vertically integrated with transport

The telephone companies, together with their cousins in the cable television business, are masters of regulatory gaming[10]. The enormous technical and business challenge of the Internet is held at bay by the inadequacy of the means whereby we reach it, which are the two legacy networks, where abundant opportunities exist to exercise new forms of market power.

Facilities-based competition was intended to be the solution to market power exercised by the two incumbent signal delivery mechanisms. It was the means intended to provide competition locally. It is my submission that this policy has been largely a failure, and in any case, needs to be radically reconceived in the light of stupid network, end-to-end arguments. Facilities-based competition is the idea that two, three and more service providers will reach a sufficient number of homes and businesses that the monopoly power of telephone and cable companies will be curtailed. The assumption in may cases was that the competitor was going to be a micro-telephone company, run on the same engineering principles as its larger rival. Enough of them have gone bankrupt that it is time to reconsider what competition would consist of in an Internet world, and where facilities-based competition would fit into this picture.

In a system such as the Internet, protocol interfaces are the new bottlenecks. Hence, when the Internet "interfaces" with a legacy network, the design philosophy of one network runs into the other, and the regulatory issue is: which one will prevail?

Unfortunately, regulators and policy makers are not sufficiently conscious of the opportunities afforded to legacy networks to frustrate the wealth-creation model afforded by the end-to-end principle.

It is my purpose briefly to outline principles that would enable relevant action to be taken to protect and enhance the Internet from incumbent carriers' strategies. To this end I propose a revised understanding of "facilities-based competition" that would adapt it to the circumstances created by the Internet's protocol-based architecture. It will examine what is entailed by the concept of equal treatment of packets, and what relevance a slogan like "mind the protocol stack" would have for regulators acting on their traditional concerns for market power.

4. The Briefest Possible Comparison of the Internet to Telephony

When the telephone network computerized, analog equipment was replaced by computers without changing any of the fundamental design ideas and assumptions of the circuit switched network[11]. They are:

• the system holds open a circuit from end to end continuously throughout the call;
• the characteristics of the network are built around the usage patterns of humans and their hearing abilities;
• intelligence is scarce and is conserved by placing it inside the system, hence the "intelligent network";
• terminals accordingly are stupid, and are slaved to the nearest central office;
• the purpose of the system is to collect revenue; hence usage is tracked where revenue can be collected.

The point to be made about these design concepts is that no fundamental change accompanied digitization. The move from analog to digital changed the machinery but not the design of the public switched telephone system. Equally important, the assumptions of the telephone network remained firmly embedded in a pre-computer era.

The telephone network is comprised of telephone switches linked together via telephone lines. The data, which travels on each of these digital telephone lines, represents the digital encoding of human voice at a rate of 64000 bits per second. At that speed the channel is called a DS0[12]. The function of a telephone switch is to set up and tear down DS0 channels and then to time the duration that the channel was kept open. From this information a phone bill is laboriously computed, which is ultimately passed on to the consumer.

Contrary to the PSTN, the Internet is not a "switched" network, but rather a packet-routed network. The Internet uses routers instead of switches to send packets to a particular destination. The difference between a switch and a router lies in the duration of the switching process. A router ultimately ends up making switching decisions for every packet, whereas a telephone switch makes a switching decision once for every call. The switch makes its switching decision based on an instruction coming from a control network (the Signalling System 7 or SS7 network) and the router makes its decision by looking at the headers inside the packet. A switch has to be warned that it is about to receive data from another switch whereas a router is constantly in a position where it is expecting data from other routers.

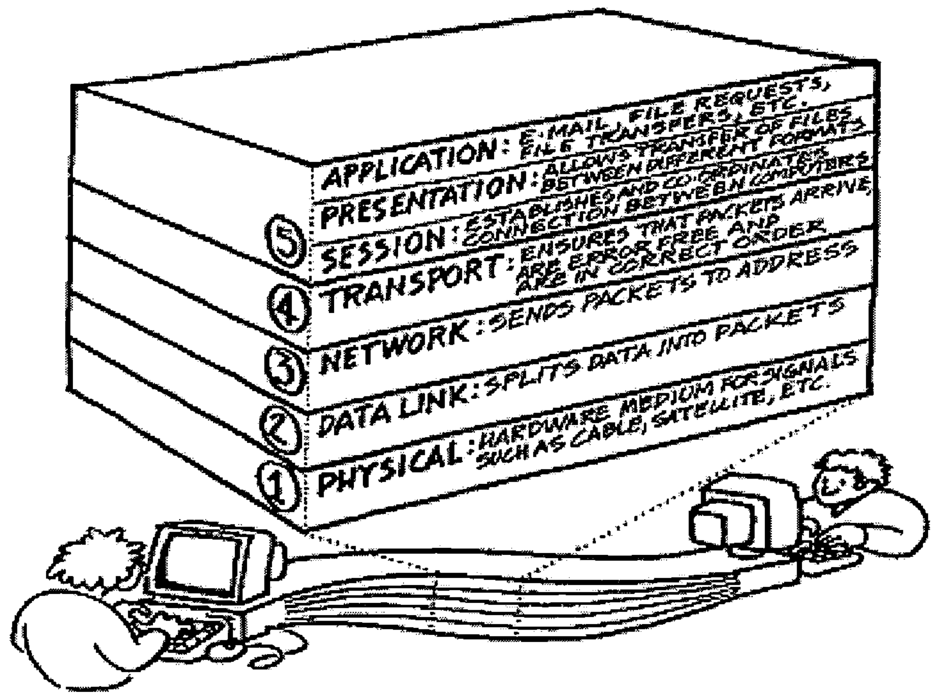
Feature	Circuit-Switched	Packet-Routed

Number of applications possible on the network	Only one: opening and closing the circuit	Potentially unlimited. The value is ultimately unknown unless each application is specified in the headers of the packet, which is never the case.
What can be measured (and thus billed for)	The duration that the circuit is kept open	Every piece of information identified in the header of the packet, the size of every packet and the percentage of link utilization
How it is controlled	By an external control network which instructs switches to set up or tears down the circuits	By link-by-link per packet forwarding control devices, i.e. routers
Knowledge by the system of itself (state)	High degree of self-knowledge	Low degree of self-knowledge

Traditionally, telecommunications was a single application, to apply a computer-era term anachronistically. Telecommunications policy makers are thus experts at regulating single application networks. Since the advent of packet-networks, the job of the regulator has become much more complicated as networks are no longer limited to one application.

The Internet's layered software architecture can be illustrated in the following way:

FIGURE 1: THE PROTOCOL STACK



The Internet is characterized by:

1. A layered architecture that separates transport from applications by the TCP/IP layers;
2. An end-to-end architecture that puts the minimum of functions into the network and the maximum of functions into the terminal (computer host) - hence the title " Stupid Network";
3. A chaotic and adaptive routing pattern that sacrifices central control and predictability for maximum network efficiency, which results in ....
4. An absence of central ownership or common planning, as each network is privately owned, and may communicate or pass traffic at the owner's discretion; which results in the fact that...
5. the Internet only knows "autonomous system numbers", that is to say, networks. States and territories have no significance for how it works.

The telephone system is characterized by:

1. A vertical integration of transport functions with service, since the telephony concept predates the possibility of separating "applications" from transport, via computers;
2. The "service" is the product of the intelligence of the network, rather than the user's terminal, hence the "Intelligent Network";
3. The routing system is designed around the characteristics of the human voice to produce highly predictable results, based on the calling patterns of humans[13];
4. Central ownership of the network, common planning, and carefully controlled interconnection with other carriers, according to international standards, which leads to...
5. a system based on territories and governments, which work through state-based international agencies, such as the ITU to coordinate standards.

5. The Regulatory Tasks

For regulators, the chief issue lies in the interconnection of Internet-based architectures with telephony and the cable system. At those points of interconnection, one design must necessarily prevail over the other. Either we are to get the platform for innovation, the end-to-end principle, or we go backwards to the principle that "you get what we deliver".

Remarkably similar concepts underlie the legislation of other countries that regulate telecommunications carriers, since the problem to be addressed derives from the common characteristics of telephone technology.

In essence, the Internet has made the new situation much more complex, as protocols are stacked on top of one another. Opportunities for self-preference by the owner of the physical facilities have been multiplied.

We consider that three principles should guide the regulator in its discharge of its duties to introduce new and relevant forms of competition in previously monopolistic markets. They are:

1. facilities-less competition,
2. equal access for packets, and
3. minding the protocol stack.

Facilities-less competition

As a general rule, facilities-less competition means that whenever there is a choice to use less or fewer facilities to enable equally effective competition, the bias shall be towards any outcome which results in less or fewer facilities.

Equal Access for Packets

Equal access for packets is a governing engineering principle by which no one is allowed to exercise self-preference by any means. This might include any of the following: to configure, locate, load-balance, render redundant, cache, prioritize or manipulate by any apparatus or method, directly or indirectly, packets originating from a customer and intended for a competitor.

Minding the protocol stack

Minding the protocol stack is a governing regulatory principle that recognizes that opportunities for self-preference and undue or unfair discrimination can arise at higher levels in the protocol stack. Accordingly, regulators must take account of the arrangements of incumbents with their competitors at layers above that of the physical connection of devices, and explore the nature of the software by which the machines operate.

6. The Regulator's Problem

In North America, we have yet to see competition develop in residential telephony despite several decisions requiring its implementation, made more than four years ago. The current absence of residential competition is amplified by the fact that the focus of carriers, as regards residential service, has now completely shifted away from traditional circuit-switched telephony services towards high-speed Internet access.

Given this new focus, no new competitor will ever seek to build new facilities until such time as all opportunities to benefit from the existing infrastructure are no longer available. The outcome of existing telecommunications policy - which does not explicitly address the issue of high-speed Internet access in a uniform manner - prevents viable competition from emerging, because the relevant form of competition no longer consists of delivering circuit-switched telephony, but rather in allowing for all the possibilities of the Internet to reach customers.

At the moment the telcos seek to extend the utility of their copper pairs by means of DSL technology, but in the United States its roll-out is painfully slow and it is still inadequate to the task. On the issue of slow roll-out, an example will suffice. The Big Hook Conference was a selected gathering of Internet financiers, entrepreneurs, policy wonks, and geeks, held at Wood's Hole, Massachusetts, in September, 2001. When the fifty participants were asked: "How many of you do not have access to DSL in your neighbourhood?", three-quarters answered 'no'[14]. These are among some of the most tech-savvy people in the United States, living in places where DSL would be expected first. DSL is wholly inadequate for an always-on world of computers. DSL is a relatively narrow bandwidth and labour-intensive stopgap system which attempts to delay the need for deploying optical fiber to the neighbourhood and then to the home.[15]

Despite the inadequacies of DSL, we are not likely to get broadband networks any closer to the home until we overcome fundamental problems arising from the architecture of the Internet.

7. Investing in Infrastructure

New Internet applications can replicate the services provided with circuit-switched telephony and conventional television equipment at a fraction of their cost. For example, the Session Initiation Protocol (SIP) Internet protocol is presently being used to unify Internet Telephony, Internet Television and Electronic Commerce applications across a common set of TCP/IP interfaces which are far more powerful than what the Signaling System 7 will ever perform.

For as long as it may be possible to interconnect with incumbent carriers to provide high-speed Internet access services, the incentives to build new infrastructure will be ineffective. The costs of building a local access network are far too high in relation to any perceivable financeable return on investment, and this is a sufficient explanation. But the Internet exacerbates the investment problem by its separation of applications from transport.

Recall that in a telephone or cable system, the money is made on owning the services which are to be provided. Alternatives are not possible. Content and transport are integrated, and by making and then squeezing the choke-points, services can be sold at high prices indefinitely. The advantage to society of this arrangement was that networks were built. The disadvantages flowed from the monopolistic business arrangements that ensued. The Internet offers the chance to fix the problem of monopolies forever.

The Internet dissociates the applications from the transport by means of a code layer. The application layer, which is everything we ever obtain from computers, is intensely competitive. There is no surplus that an owner of businesses in the applications space can transfer to the bit-transport business. It is probably this realization that began the flight of capital from infrastructure investment in October of 2000. This is the Great Big Problem of the Internet, which capitalists and society must find a way to solve.

The solution that is beginning to emerge is to have local jurisdictions, such as municipalities, employ private companies to create optical fiber infrastructure. Alternatively, consortia of private users can build their own networks. This infrastructure would be available to all on an equal basis. Users would light their fiber according to the protocols that suited their needs. Common meet-me points would allow for interconnection with other users, with radio-based access technologies, and other carriers. The capital costs would be borne by local jurisdictions or by consortia of users. Existing large carriers could rent space and offer services, and save themselves the costs of establishing networks themselves. Capitalists would make money lending local jurisdictions the money to build the systems.

These municipally-owned systems take us back to the era in the 1920's when half of the United States was served by non-Bell telephone systems. They would differ fundamentally from the older architecture of circuit-switched telephony, however. They would be all-optical systems run on principles of open access to the infrastructure for all comers: carriers, private users, governments, anyone. There would be non-discrimination among users and uses. Regulators would oversee the terms of interconnection to these as well as to legacy systems.

Utopian? Such a system already exists and has been operating for several years in Stockholm, Sweden. Other experiments, such as Chicago's CivicNet, follow the same principles. In Canada and in several of the States, community-owned or privately-owned open-access networks have been created[16].

8. Conclusion

The principle social and political task for communications policy is to realize the benefits of the Internet by allowing it to prevail over legacy networks. The task involves regulation of the protocol interfaces between legacy and Internet-related systems, which alone should give regulators years of new tasks in exchange for the need to learn new things. The second and larger task is to gradually rebuild our networks in a manner consistent with the advantages offered by the end-to end principle, which is that users should drive the network, not network owners. It took a long time for North America to move from a railway economy to a highway economy, and to build the highways that were consistent with the possibilities of automobiles. It will take almost as long for us to move to networks consistent with the possibilities of the Internet. It may take a decision similar to that taken by President Eisenhower to build the interstate highway system, which was justified as a defense measure. However it happens, it is clear to me that we will not get there until we have a coherent picture of why the two legacy systems cannot deliver the social benefits of innovation made possible by the internet architecture. It will not happen as long as we pursue a complacent policy of "letting the market work" and other bromides with which we avoid the difficult work of actually thinking about the political economy of networks.

Endnotes

[1] http://www.crtc.gc.ca/archive/Decisions/1997/DT97-8.htm

[2] *A Brief History of the Future, The Origins of the Internet*, by John Naughton ISBN0 297 64330 4, particularly Part II

[3] "End-To-End Arguments In System Design", J.H. Saltzer, D.P. Reed and D.D. Clark , M.I.T, Laboratory for Computer Science, Published in ACM Transactions in Computer Systems 2, 4, November, 1984, pages 277-288, and found at http://www.reed.com/Papers/endtoend.html

[4] The 7-layered OSI model was not really followed by the designers of the Internet. The session, presentation and application layers of the OSI model are compacted into one, leaving applications running over TCP (transport control protocol), the transport layer, which in turn runs over the network layer (Internet protocol), which runs over the data link layer, which runs through a physical transmission medium.

[5] J.H.Saltzer of MIT explained that this was a standard way to design computer functions at a conference at Stanford University on the end-to-end principle hosted by Professor Lawrence Lessig in October 2000. The point is explained in David Reed's "The End of the end-to-end argument" April 2000 at http://www.reed.com/dprframeweb/dprframe.asp?section=paper&fn=endofendtoend.html
"We agreed to architect the primary protocols of the Internet with only datagrams at the center. Vint Cerf and Jon Postel were persuaded to take a risk on a new style of network architecture, based on a radical decentralization of function."

[6] Lawrence Lessig of Stanford University documents the many attacks on the Internet as a platform for innovation in his *Code and other laws of Cyberspace*, ISBN 0-465-03913-8

[7] As David Reed said at the Big Hook conference, Wood's Hole, September 6, 2001 "We didn't design it in". See also *ISP Survival Guide*, by Geoff Huston, ISBN 0-471-31499-4, chapter 3, the Internet Protocol at page 41 and following, especially page 57

[8] "The End of the end-to-end argument", by David Reed, April 2000 at http://www.reed.com/dprframeweb/dprframe.asp?section=paper&fn=endofendtoend.html

[9] See David Isenberg's "Rise of the Stupid Network" for an explanation of the difficulties in trying to innovate through the circuit-switched system <http://www.rageboy.com/stupidnet.html>

[10] As my colleague Rob Frieden describes in a paper for the 2002 PTC "Revenge of the Bellheads: How the Netheads Lost Control of the Internet".

[11] "Rise of the Stupid Network", <http://www.rageboy.com/stupidnet.html>

[12] The reason why 64000 values of either ones or zeros per second are necessary to transmit one second of human voice have their roots in the same science which could be used to explain you how music is stored on a digital Compact Disc. A digitization at a rate of 8000 representations per second is necessary to capture the highest pitch of the voice, which is 4000 Hz. The dynamics of human voice needed to be encoded using 8 bits of information in order to yield the same "toll" quality that people were accustomed to in the non-digital version of the PSTN. By multiplying those 8 bits by the rate of 8000 samples per second, we obtain the value of 64000 bits per second, which is the value of the DS0 unit used as the basis of capacity measurement on the PSTN. A link, which is capable of transferring 24 DS0 in parallel, is called a DS-1. The DS-1 is still used today as the principal unit to measure the interconnection capacity between two telephone switches.

[13] For example, if everybody simultaneously picked up their telephone, not everybody would get dial-tone.

[14] From personal observation at the time.

[15] Peter Cochrane, former CTO of British Telecom, and now head of Concept Labs, describes ADSL as "a product of the diseased minds of a telco. They have no understanding of how cross-talk affects it. Many people need to be employed to make it work. ADSL is a job creation program. Optical fiber eliminated 90% of the people in long lines, and fiber would do the same in local. Telephone companies should have given away cell phones, sold off the copper and rented out duct space." Notes from the Big Hook Conference, Wood's Hole, Massachusetts, September 5-7,2001.

[16] See, for instance, "The Coming Revolution in Dark Fiber Networks", by Andrew K. Bjerring and Bill St.Arnaud, Canarie Networks Inc. at http://www.canarie.ca/advnet/canet3/fibre.html

back to index

Abstract

The paper takes issue with the relevance of facilities-based competition in the era of the Internet. It proposes that new modes of ownership of transport facilities are required, when applications are split from transport. It proposes that the legacy models will not deliver the benefits of innovation which the Internet has made possible. Regulators have new things to learn in their traditional task of constraining monopoly power.

back to index

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Timothy Denton is an Internet and telecommunications policy and business expert, and is head of tmdenton.com, (www.tmdenton.com) a global telecommunications/internet consulting firm. Mr. Denton has served governmental and private sector clients worldwide. Most recently, throughout 2000-2001 he was the senior external advisor on policy and regulation to Tucows International (www.tucows.com) , one of the world's largest suppliers of domain names, dealing with issues of regulation in both the ICANN forums and in Canada with the Canadian Internet Registration Authority (CIRA). He is the secretary of the Registrars' Constituency in the ICANN forum and sits on the Board of CIRA

Mr. Denton also served, with James Savage and Robert Frieden, as lead consultants to the Asia-Pacific Economic Cooperation Council Telecommunications Working Group (APECTEL) on International Charging Arrangements for Internet Services (www2.apii.or.kr/telwg/icais) or (www.tmdenton.com).

He has been an invited speaker in Japan and Brazil on community broadband initiatives. Currently he is advising the Canadian federal government on the adaptations it needs to make to its corporations law deriving from the advent of the domain name system. He has acted as the counsel to the Canadian Association of Internet Providers (www.caip.ca) on a broad variety of issues, including gaining access to underlying telecom facilities. Earlier he acted for the Consumers' Association of Canada when long distance competition was introduced into Canada.

He is the author of "Bellheads versus Netheads", and "The Internet Illustrated", found at his website. He acted as a consultant to the CRTC when it decided against regulating the Internet as "broadcasting". He was instrumental in introducing long-distance resale into the Canadian market when he served the Minister of Communications in 1985-1987. He assisted at the creation of both the new Telecommunications Act and the Broadcasting Act in Canada, where convergence, competition in telecommunications, and regulatory policies were dealt with.

His speeches, writings, and regulatory submissions are found, together, with a profile of his firm, at the website www.tmdenton.com.

Tim Denton has extensive contacts with people who have designed the protocols which drive Internet, and who are building out community-owned fiber networks.

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Mr. Denton is 51 years old, has three children, and lives in Ottawa, Ontario, Canada. He travels extensively.

back to index

Unbundled or Undone: Technical and Operational Issues Associated with Local Loop Unbundling

Anthony Sylvester
Arculli and Associates

Peter Waters and Annemaree McDonough [1]

1. Introduction

High, and possibly unreasonably high, expectations have been held for LLU. As the incumbent's local network work was ubiquitous, LLU seemed to provide a ready-made solution to the costs and difficulties which have been encountered by new entrants rolling out their local networks. The information society could be at every front door if only the incumbents could be forced to unbundle their copper and allow new, smarter providers to connect advanced equipment.

However, 2001 has been characterised as the year in which "industry expectations collided head-on with market realities.[2]

The expectations surrounding LLU in the high speed market were shaken considerably in early 2001 as a number of Digital Subscriber Line (**DSL**) service providers in the United States made sizeable staff cutbacks or exited the market. DSL penetration has failed to achieve the heights expected. In November 2000 there were 1.4 million residential DSL subscribers in the United States compared to 4.2 million cable modem customers.[3]

In June 2001, the EU Commissioner for the Information Society Directorate General of the European Commission, Erkki Liikanen, reported that only about 500,000 unbundled lines had been made available across the EU's 15 member countries. This makes a 1998 prediction that by 2002, 5.5 million households across Europe would be served by xDSL lines seem exceedingly optimistic.[4] The European Competitive Telecommunications Association (**ECTA**) has recently released figures showing that of the 914,300 DSL lines across 14 European countries only one in 20 is operated by a new entrant.[5] Only 146 lines had been unbundled in the UK by the end of July 2001.

Much of the blame for the failed expectations is being pinned to the difficulties in resolving technical and operational issues. New entrants accuse incumbents of making these issues much harder than they need to be, with anti-competitive purposes in mind. Incumbents accuse new entrants of being naïve, inexperienced and desperate because they have overhyped their business plans to naive bankers.

This paper looks at the experience with technical and operational issues across Hong Kong, the US, Australia and a number of European countries. Australia fares well by comparison, introducing LLU more quickly and with less acrimony than most of the other countries. This relative success seems attributable to the following factors:

- the incumbent's willingness to take a more pragmatic approach, including not to fight "tooth and nail" on colocation issues;
- the willingness of the main new entrant, Cable & Wireless Optus/XYZed, to assume business risks which new entrants and regulators elsewhere have fought to require the incumbent to assume;
- a less sophisticated implementation, particularly in relation to electronic interfaces (though other countries which also have not required electronic interfaces have faced a slower and more contentious process than in Australia);
- a developed industry self regulatory framework; and
- an incentive-based approach to regulation by the ACCC (though little late in the day for some).

2. General Comments

Our comparative study highlighted some general observations which may help frame discussion of the specific technical and operational issues.

Common Misconceptions

Many of the problems with LLU implementation seem to be attributable to misconceptions and false exceptions initially held by regulations and industry participants:

- *under-estimation of the complexity of the technical and operational difficulties of LLU*: As LLU involves the leasing of an inert copper wire, it may seem to be simpler than other forms of interconnection between fully activated networks. However, LLU can be more complex, and riskier from the point of view of continued customer service, than switched interconnection because it usually involves physical disconnection of the customer's line, manual intervention by and co-ordination between the incumbent's and new entrant's technical personnel, and more extensive collocation;
- *under-estimation of the competitive implications of the technical and operational issues of LLU*: Regulators generally tend to regard technical issues as competitively neutral. This may well be the case in the absence of market power. However, it is well recognised in anti-trust theory that control over technical standards can be exploited by the dominant operator to deter market entry, as was recently recognised in the initial Microsoft litigation in the United States.[6] The details of the processes for ordering, provisioning and maintaining LLU will directly impact the comparability of the downstream services which the new entrant offers wholesale and retail customers in competition with the incumbent; and
- *over-estimation of the capacity of industry self-regulatory processes to address technical and operational issues*: Regulators tend to favour decision-making by the industry as being more efficient and appropriate because regulators do not have the required technical skills or resources. As a general

proposition, this can be true. However, as the comparative study of the approaches to LLU processes set out below shows, substantial dis-engagement by the regulator from the industry process, and the absence of regulatory incentives to facilitate agreement, seem likely to result in the failure of those processes.

Highly Contested Process

Even given its complexities, the level of controversy, if not acrimony, between incumbents and new entrants over LLU is at a strikingly higher pitch than over interconnection issues which have come before. It might have been thought that the experience of negotiating with each other over the years since competition was first introduced would have eased the process of negotiating LLU, but this is not always the case.

New entrants argue that incumbents are more resistant to LLU because it strikes at the core of the incumbent's dominant power. This essential tension has been described as follows[7]:

> *"The [FCC and regulation] must bridge the gaping rift present in communications network design today — epitomised by the debate between "Netheads" and "Bellheads. In the last several years, it has become clear the Netheads are winning technologically. However, the Bellheads are waging a war of regulatory attrition that thwarts implementation of Section 706. ILEC resistance to the unbundling of DSL-capable loops and to alternative physical collocation options share a common lineage with the Bellhead mental construct of centralized command and control, implemented by an inflexible bureaucracy. Indeed, the Bellhead "one network" mentality descends directly from the imperial, pre-divestiture Bell System. That mentality is evidenced by a stubborn aversion to change and to the cannibalization of existing, cross-subsidised revenue streams. Nethead entrants like Covad — whose only goal is to get into business and deploy advanced data communications services as soon as possible — are continually hindered by Bellhead bureaucracy, anti-competitive attitudes and perverse incentives.*

Incumbents, for their part, ascribe the delays and difficulties they faced introducing LLU to the problems of modernising their systems and exposing those systems for the first time to external interfacing.[8] LLU is more intrusive than switched interconnection in the sense that it involves processes and systems deep within the incumbent's network and organisation, many of which are legacy systems with which the incumbent itself is still struggling.

There seems to be a good deal of truth in both the new entrants' and incumbents' positions. Incumbents seem to be overconfident about the robustness and efficiency of their systems to be used for LLU and initially are dismissive of criticism. But experience, especially from the US, suggests that new entrants' systems also can be immature, and a substantial proportion of trouble reports by new entrants are attributable to their failure to comply with the business rules for LLU.

Incentive-based Approaches

LLU implementation has proceeded more effectively, in those countries where if the regulator takes an active role, but there are clear limits to how much a coercive regulatory system can achieve, especially at the level of detail required for LLU. LLU and other wholesale services seem more likely to be successful if the regulatory system, rather than "flogging the incumbent forward", can develop a better mix of "carrots and sticks".

It also would be a mistake to regard incumbents as having a monolithic attitude towards wholesale supply to new entrants. There probably will be tensions within the incumbent between the retail units, which will leave no stone unturned to hold onto their dominant market shares, and the network units, which will want to maximize usage to defray their fixed costs, regardless of whether the wholesale customers are internal or external. Regulation is most effective where it can unlock those network incentives, allowing the incumbent's wholesale business to develop its own natural business logic and momentum.

The US industry structure provided a ready opportunity for this incentive-based approach by conditioning vertical re-integration on compliance with LLU and other pro-competitive requirements. The task of finding incentives will be harder in environments where the incumbent is already vertically integrated, as is the case in most Member States. However, the ACCC in Australia found leverage through tying the launch of the incumbent's xDSL services to LLU[9].

Interestingly, OFTEL recently rejected complaints from new entrants that BT has acted anti-competitively in not using the same collocation process for its DSL services as it applied to new entrants10. OFTEL concluded that, as virtual or distant collocation was available, the relevant market was a market for any space which was suitable for DSL equipment in the local area in which the exchange was located, which required an area by area assessment of BT's market power. OFTEL also concluded that a strict requirement for BT to comply with the Bow Wave process was neither appropriate or proportionate regulation.

3. Decision Making Framework

Importance of the Decision-making Process

The decision-making framework (ie. bi-lateral negotiations, industry self-regulation or co-regulation) is of importance because:

- the comparison of countries which have a longer history of LLU shows that the resolution of technical and operational issues is an incremental process. Certain issues are launch-critical and need to be addressed at the outset. An ongoing decision-making framework allows the other issues, while still important, to be addressed down the track;

- the requirements of LLU are impacted by the retail and wholesale services which the competing carrier offers over the unbundled local loop. These downstream services themselves are in a state of evolution. When originally introduced in the US and Hong Kong LLU was only intended to support PSTN services. The main focus of LLU is now high speed data services using xDSL (digital subscriber line) technology, which gives rise to a different set of issues, including interference between the new entrants' xDSL services provided over unbundled loops and the voice services; and

- most importantly, as the discussion below shows, the implementation of LLU has proceeded more effectively, and possibly more quickly, where there is a clear, robust decision-making process in place from the outset.

In the countries we studied, there were 3 broad approaches to the multi-lateral resolution of technical and operational issues:

- *an industry-based committee*: The industry forum is established, chaired and managed by the industry. Participation in the industry forum is not legally required and the outcomes (e.g. codes) are not legally binding. The regulator stands apart from the industry forum, although staff from the regulator may attend to monitor progress. Disputed issues are referred to the regulator for formal or informal determination. This approach was adopted in Australia, France and Germany;

- *industry forum supervised by the regulator*: This approach could be described as a co-regulatory approach[11]. The regulator convenes a representative industry group which meets under its oversight, with a senior officer from the regulator often chairing meetings. The regulator sees its role as providing a moderating presence and giving informal guidance to industry participants. This approach was adopted in Hong Kong and the United Kingdom; and

- *appointment by the regulator of an independent technical expert*: The regulator appoints outside experts as its own project team to work with the incumbent on the design, testing and commissioning of the inter-operator systems needed to meet the requirements of the business rules, which are usually developed by a multi-lateral forum convened by the regulator. The independent experts operate as a "pseudo" carrier to test and verify the incumbent's processes. This approach has been adopted in most US states.

Experience

Some industry participants believed that the self-regulatory model in Australia and France had worked well for the reason that the regulator did not have an active role because:

- discussions are likely to be more informal and open than if the working group were convened as a formal advisory body by the regulator; and

- if the regulator is on hand during meetings of the industry forum, participants in the industry working group may be tempted to escalate issues for formal or informal decisions by the regulator rather than persevering in an effort to reach agreement.

However, the regulators in Australia and France were still closely involved "behind the scenes" in the workings of the self regulatory process. Individual participants, usually new entrants, would keep the regulator informed of progress and of their views on issues which were controversial in the self regulatory process. The regulator sometimes, on the request of the new entrants or of its own volition, expressed an informal view to the incumbent in an attempt to break deadlocks.

Supporters in Hong Kong and the UK of the regulator's chairing role in the industry working group (and critics in Australia and France of the regulator's formal absence) believed that the regulator's presence acted as a discipline on the incumbent. Some went even further and said that the regulator should have been more interventionist in the working group's proceedings by being prepared to cut off debate between the incumbent and new entrants and make informal, and if necessary formal, determinations, almost "on the spot".

However, OFTEL has recently acknowledged the deficiencies of the UK industry process in the course of its review of industry self-regulation processes[12].

> *"Like [carrier preselection or CPS], LLU implementation has included formal and self-regulation but mostly co-regulation. On the whole, also like CPS, co-regulation has worked better for practical than commercial issues. LLU also shows that smaller stakeholders can be prominent in such groups. Looking into the near future, one lesson from an over-ambitious approach in LLU is that it would be optimistic to expect much self-regulation where there are too many competing interests. Another lesson from the early difficulties with LLU is that good co-regulation needs to be driven, whether by Oftel or industry leadership, with the right present and adequate resource commitments from all sides, and the respective roles defined at an early stage."*

OFTEL considered but rejected the Australian approach of an ongoing industry association to handle technical and operational issues as they arise.[13] OFTEL instead proposed a series of general measures, including:

- building confidence and relationships within industry through encouraging information sharing, organising fora and establishing an industry knowledge base accessible on the Internet;
- developing different models for industry bodies which are established from time to time;
- OFTEL providing more guidance to industry bodies; and
- participants signing a memorandum of understanding when establishing an industry body to ensure a common set of expectations.

While the US approach involves a multi-lateral process in setting broad technical and operational requirements, implementation (which can involve significant changes to technical and operational requirements) is mainly a three-way process between the incumbent, the regulator and an independent project manager. In effect, the independent project manager substitutes for the new entrants in testing the incumbent's systems against the regulatory and agreed industry requirements. Involvement of the independent project manager has been seen as instrumental in achieving robust, sophisticated and largely electronic systems for LLU which provide a very high level of non-discriminatory functionality between the incumbent's retail operations and new entrants' utilising LLU:

> *"The scope and depth of KPMG's review, and the conditions surrounding it, including KPMG's independent, military style test philosophy, efforts to place themselves in the position of an actual market entrant and efforts to maintain blindness where possible, lead us to treat the conclusions of the KPMG Final Report as persuasive evidence of Bell Atlantic's OSS readiness [for LLU]"[14]*

There was a view that this was a more effective approach because the project manager was a neutral expert and could devote the resources required to test and implement LLU.

The cost of the independent expert can be significant, ranging from US $10 million to $15 million per state. However, these costs need to be weighed against the costs new entrants incur under the other approaches because they have to do the work themselves, and also the costs of the late entry to market for new entrants and consumers.

Based on our review of the experience in these countries, we believe the best practice approach is as follows:

- LLU implementation should be treated in the same way as any complex IT implementation and requires professional project management skills and expertise;

- the regulator should be directly involved in the project management process, but not in the resolution of the operational and technical issues themselves, which should be left to industry working groups. Direct involvement potentially compromises the regulator's role as the escalation point for disputes;

- the industry self-regulatory process will be more effective if there is an ongoing structure in which industry participants develop a stake and patterns of established behaviour, rather than convening ad hoc industry self-regulatory groups each time to resolve new issues; and

- LLU implementation also will be made more effective if undertaken within an incentive regulatory framework.

4. Collocation Arrangements

In most countries the provision of colocation space in the incumbent's exchanges has been the most controversial issue. There often will be more than one new entrant requesting collocation space in the incumbent's local exchanges. In some metropolitan areas, which are likely to be the focus of LLU in the short to medium term, there may be 4, 6 or more potential claimants for collocation space (although, as discussed above, the numbers have dropped away significantly in recent months).

4.1 Rollout of Collocation Space

The construction and commissioning of collocation space at the local exchange is the first step in opening the local network served by that exchange for LLU. It is unlikely that all of the incumbent's local exchanges either can be or need to be conditioned from the outset for LLU:

- as with a full infrastructure deployment, new entrants will progressively deploy the supporting infrastructure for LLU in line with their capital expenditure and marketing plans. However, new entrants may propose a fairly aggressive rollout, particularly if the incumbent already has launched its own xDSL services;

- while LLU theoretically could be as ubiquitous as the incumbent's copper network, economic and market conditions, particularly the cost of construction of backhaul and the xDSL equipment located at customer premises, will mean that LLU is not requested in many areas of the incumbent's network; and

- assessing the suitability of exchange space for collocation and constructing the collocation space, as with any building works, can be labour intensive. While the incumbent may have a substantial workforce, its resources are finite and the incumbent will have its own projects which place demands on those resources.

Experience

Many new entrants believed that the order in which incumbents decided to condition their local exchanges was overly driven by the incumbent's own administrative and operational considerations, if not by an underlying anti-competitive intention to delay entry to the most lucrative markets by conditioning exchanges in marginal areas first.

Incumbents, however, expressed frustration that they were often caught between the conflicting demands of new entrants over which exchanges they wanted conditioned and that the new entrants' forecasts of the number of exchanges to which they would roll out were over inflated.

Different approaches were taken in the countries which we studied. The United Kingdom initially used an elaborate process (known as Bow Wave) to try to strike a balance between the competing demands of the new entrants. This involved an independently administered "voting" process to determine the initial sequencing of BT exchanges for collocation conditioning. Potential LLU acquirers identified those local exchanges at which they wished to acquire LLU services, the "votes" were to be tallied by an independent third party and the 500 "most popular" exchanges were to be designated as those where conditioning would initially occur. However, this process was subsequently abandoned as the number of LLU providers and anticipated level of LLU requests began to rapidly fall away.

In Australia, the main new entrant largely determined the rollout of collocation space. The incumbent undertook basic work to identify space which was suitable for collocation in virtually all of its exchanges (space constraints were not a major problem). The new entrant then selected the exchanges it wanted and built the collocation space, including sufficient space for other operators, using the incumbent's contractors. Over 80 exchanges were conditioned for collocation space in less than a year (including the lead time to agree the technical and operational requirements for collocation).

In France, ART and France Telecom agreed on a structured roll out process which set milestones for the conditioning of local exchanges.

The significance of the roll-out issues has tended to decrease with the fall in demand from new entrants for LLU services. The lesson from the UK might well be of the dangers of an overly complex approach to addressing roll-out.

4.2 Assessment of Collocation Requests and Costs

A number of issues will need to be assessed in determining whether a particular exchange can accommodate collocation of the new entrants' equipment required to support LLU, including:

- *space availability:* Incumbents may claim that their exchange space is constrained, particularly in central business districts which will be the initial focus of LLU. New entrants are usually highly sceptical of these responses by incumbents, arguing that the incumbent is probably not efficiently utilising space and that technological developments should have progressively resulted in more space becoming available because equipment is more compact (constrained space issues are separately addressed in section 3) ;

- *structural integrity:* The equipment installed by the new entrants will add to the floor loading of the exchange building, particularly if there are multiple new entrants sharing space. The incumbent will want to undertake an assessment of the additional floor loading. New entrants will regard these studies, even if objectively necessary, as an opportunity for delay;

- *environmental system:* The new entrants' equipment will need to operate in a stable, controlled environment, as does the incumbent's own equipment in the exchange building. The incumbent will want to consider whether the existing environmental and utility systems including air-conditioning, electricity and fire protection, will need to be augmented to handle the new entrant's co-located equipment. Again, new entrants argue that, even if technically necessary, these studies are exploited by incumbents as an opportunity for delay; and

- *Ducting and MDF capacity*: an assessment will need to be made of whether there is sufficient space for the external tie cable (or backhaul) if installed by the incumbent and the internal tie cable between the collocation space and the MDF.

Experience

In many countries, the process of applying for collocation space was fraught with difficulty, confusion and controversy. New entrants complained about the time taken to process requests, and in particular the overly elaborate investigations undertaken by the incumbent on issues such as structural integrity and the impact on environmental systems. New entrants believed that the incumbents deliberately used these processes to slow down market entry. New entrants criticised regulators for failing to push incumbents to more quickly process applications, and said that the regulators were often too easily bamboozled by, or uninterested in coming to grips with, the detailed engineering issues to determine whether or not the incumbent was exaggerating those issues.

The regulators, for their part, have had to resolve issues which had little to do with telecommunications and more to do with construction, building services and the property market. OFTEL, for example, has had to consider whether asbestos removal is a cost recoverable by the incumbent, how many toilets and sick rooms the incumbent is entitled to keep in an exchange rather than converting them to a collocation space and whether car spaces should be used to install an outside collocation unit.

A large part of the problem with the collocation ordering and provisioning problem seems to lie with the incumbent processes. Carrier interconnect and regulatory personnel usually had to pass responsibility for assessment of collocation issues to a different department within the carrier, usually the building management or plant personnel. Building management personnel are not used to dealing with third party requests, tend to be very protective of assets under their control and the "dominant carrier mentality" may persist longer than in other parts of the incumbent which more directly face the new competitive environment.

The approach adopted in Australia may provide a pragmatic compromise. Concerned about the length of the construction periods proposed by the incumbent, the main new entrant proposed to the incumbent that it would build the collocation spaces itself and to address the incumbent's concerns over work quality, would only use the incumbent's own contractors. The incumbent agreed, and the new entrant negotiated a separate construction contract with the incumbent's contractors which gave the new entrant control over the construction, including costs. The new entrant was required to bear the full cost of construction of the collocation space, but was entitled to collect a contribution from subsequent new entrants on a rateable basis. While this required XYZed to assume more upfront expense, it believed that the cost was worth it to gain control of the construction process and that this was a much more effective solution than could be achieved through regulatory supervision of the incumbent's control of the construction process.

4.3 Apportioning Constrained Space

New entrants are usually very sceptical of the incumbent's rejection of collocation applications based on "no space" being available. In the early years of the US LLU implementation process, a third or more of collocation requests were rejected on this basis, which seemed an improbably high figure. As one new entrant commented[15]:

> *"What is shocking about these "no space" rejections is that they are usually factually incorrect. For instance, in its Comments to the Commission regarding SBC's 706 Petition, Covad documented that Pacific Bell had initially rejected nearly a third of Covad's applications in California for "no space" reasons.[16] After "re-surveys" of these offices, and after Covad filed an antitrust lawsuit and preliminary injunction motion against Pacific with regard to many of these offices, Pacific — surprise, surprise — magically found space in all of the San Francisco Bay Area offices that Covad brought to the Court's attention.[17] It seems that where Covad or other CLECs cast light upon anti competitive practices, ILEC's change their behaviour, but only where it has been illuminated[18].*

Incumbents express concern about being placed in a position of having to choose between parties which are its downstream competitors, where all these requests cannot be accommodated within the available space.

In some countries, the regulator has set maximum space or equipment dimensions for each new entrant using collocation space. In the UK, the carrier maximum space is a three rack bay occupying a total space, including circulation space, of 10 square metres. In Hong Kong, the space allocation is a much more generous 33 square metres.

Problems have been encountered over the ability of new entrants to reserve space. New entrants will want to secure space in a local exchange before commencing to sell their xDSL and other services in the exchange area. They also may not wish to incur the cost of acquiring and installing equipment in the collocation space until they have presold a level of services which justifies that expenditure. Therefore, a limited reservation right seems appropriate.

In some countries, such as France, a "use it or lose it" policy applies and a new entrants' reservation will be lost if equipment is not located in the space and LLU lines taken up in the exchange area within a specified period, such as 3 to 6 months. The same policy applies in France to the incumbent's reservation of space for its own purposes.

While physical proximity to the exchange MDF is usually preferred, location of the new entrant's equipment at a "distant" location and use of virtual collocation may be a solution to constrained space problems. In some Member States, such as the UK and Denmark, virtual collocation is offered as an alternative. TDC, formerly known as Tele Denmark, offers virtual collocation at a maximum distance of 750 metres from the local exchange and at no cost over and above the cost of physical collocation. The cost of the transmission link between the incumbent and the new operator's premises is covered by TDC.

4.4 Caged or Uncaged Space

Cageless space or co-mingling involves new entrants installing their equipment in open racks in an undivided or common space in which the incumbent locates its own equipment in the exchange (if there is adequate room). Co-mingling has the advantage of substantially reducing the costs of collocation and speeding up the time of its availability because so little make-ready work has to be done.

Experience

In Australia and the US, new entrants are permitted to install their equipment in racks located in common spaces which are used by the incumbent for phone equipment. There have been no reported problems with cageless collocation in Australia.

The approach in most of the other countries, such as the UK, has been to establish physically separated collocation spaces, called hostels. It is anticipated that the hostels in the major BT exchanges will accommodate 3, 4 or more new entrants, which will reduce the costs per operator of collocation. If only one new entrant has requested space at an exchange, there is a so-called mini-hostel option, which still involves a physically separated space.

Oftel, however, has recently published a draft determination in which it proposes to require the incumbent to provide cageless collocation or co-mingling unless there are objective criteria on the grounds why co-mingling is not technically practicable or would pose a security risk to the incumbent's systems. Noting that the Unbundling Regulation requires the notified operator to make an offer "in response to all reasonable requests" for collocation, Oftel stated that:

> *Oftel thus takes the view that BT is required to supply all collocation options on reasonable request — BT cannot claim it is not refusing to supply by offering a collocation option different from that requested by the OLO. If BT does refuse a reasonable request, it can only be done so on the basis of objective criteria, relating to technical feasibility or the need to maintain network integrity. The very fact that BT co-mingles itself suggests that a request for the provision of co-mingling is not unreasonable. Further, in the example investigated, BT was able to provide Oftel with estimated costs for co-mingling Bulldog equipment, which reinforced the view that BT was reasonably able to meet the request. Lastly, BT has to date offered no argument suggesting that the request from Bulldog was unreasonable[19].*

However, as Oftel noted that the costs and advantages of co-mingling may be reduced by the future costs of security measures which the incumbent might reasonably require, such as escorted access (although Oftel did not determine what were reasonable security measures).

4.5 Access

The new entrant's personnel will require access to the collocated space to regularly maintain, upgrade and replace equipment located within the space.

The requirement for supervised access is particularly contentious. The need for the new entrants to arrange for an incumbent to provide an escort adds to the cost of site visits, requires additional lead time to organise the escort and can cause inconvenience for the new entrant because its maintenance schedules have to fit with the availability of the incumbent's escort. As noted above, the restriction which incumbent's place on access lead some new entrants to support the construction of separate external entrances to common collocation spaces

New entrants argue that the requirement for supervised access is discriminatory because incumbents regularly allow attendance at exchanges on unsupervised basis by personnel from contractors, vendors and, increasingly, providers of outsourced technical and maintenance services.

Unsupervised access (to cageless space) is permitted in Australia and in the US[20]

Key access systems may provide a solution. By barring electronic access to internal rooms, the incumbent can ensure that once admitted to the exchange building, new entrant personnel can only access common walkways and the common collocation space. In Australia, the incumbent has introduced an electronic security system which permits it to remotely authorise new entrant personnel to enter particular exchange sites at times notified in advance by the new entrant.

However, several new entrants expressed concern that the incumbent was endeavouring to recover from it, as part of the cost of collocation, the costs of new key systems which the incumbent then would primarily use for its own purposes.

4.6 Incentive-based Approach

An Incentive Approach

While a more prescriptive approach by regulators may achieve some improvement in collocation arrangements, this is unlikely to be a complete and wholly effective answer. The factual circumstances of collocation in the incumbent's individual exchanges vary, it is therefore difficult to deal exhaustively on an ex ante basis with all collocation situations and there will be many situations where there is no clear answer. The close physical proximity between the incumbent and new entrants in the incumbent's facilities is likely to be a continuing source of conflict and difficulties, whatever the motivations or attitudes of either side.

It is useful to consider whether virtual collocation arrangements could provide a more stable, less controversial alternative. Currently, virtual collocation arrangements are used as a "fall back" when physical collocation is not feasible because of space constraints. Virtual collocation arrangements tend to be relatively unsophisticated in that they involve a short dedicated tie line or leased capacity from the incumbent's local exchange to an external but proximate location, such as another building owned by the incumbent where there is space or to a piece of 'street furniture', such as a pillar box, installed by the new entrant. Sometimes the new entrant pays for the external tie lines, and such as in the UK, and sometimes not, as in Denmark when the incumbent uses this option if there is no physical space available in its exchange.

More cost effective virtual collocation solutions could utilise IP transport services from the incumbent's exchange to the new entrants point of presence located in its own facilities. One such solution is depicted in Figure 1.

Figure 1

This scenario differs from a wholesale XDSL service because the DSLAM located at the incumbent's exchange does not form part of the incumbent's DSL service and network. Rather, the incumbent is providing a facilities management service to the new entrant to manage the new entrant's DSLAM. The incumbent provides, in addition, an IP 'back haul' service to transport the new entrant's data traffic from the carrier side of the new entrant's DSLAM through the incumbent's IP cloud to the new entrant's point of presence. As DSLAM output complies with common carrier standards, it should be technically possible to connect the new entrant's DSLAM and the incumbent's DSLAM, even if from different equipment suppliers, to the incumbent's IP cloud.

The new entrant needs to be able to source its own DSLAM or nominate the DSLAM which the incumbent sources on its behalf. The new entrant should not be forced to use the incumbent's DSLAMs as this could limit the new entrant's services to the incumbent's technology profile.

It can be anticipated that the incumbents may argue that it will be costly and difficult for them to manage DSLAMs types with which they are not familiar. However, while there are differences in equipment types between manufacturers, these are not likely to be that significant. An option may be to establish a list of DSLAM types from which the new entrant can choose, with the regulator approving the list as providing a reasonable range of equipment options.

A virtual collocation model should be capable of being a 'win-win' for both incumbents and new entrants. The incumbents do not have to deal with new entrants in their facilities and new entrants have the convenience of a point of presence in their own controlled space. Incumbents should be provided with incentives to promote virtual collocation. Equally, new entrants should be protected against being forced into virtual collocation arrangements which are more costly and less convenient than physical collocation.

5. Potential Limitations on LLU

The incumbent may configure its local network on the customer side of the local exchange in ways which may create obstacles to LLU at the MDF at that local exchange. Broadly, the incumbent may have:

- used "pair gain" configurations. While copper continues to terminate on the MDF at the local exchange, pair gain technology enables a multiplication of the number of pairs at the customer end compared to the local exchange end. There may be, for example, 24 copper pairs at the customer end but only 12 copper pairs terminating on the MDF in the local exchange. The "multiplied" copper pairs at the customer end may be used to serve several different customers, only one of which may be interested in the alternative dial tone service provided by a competing carrier; or

- extended fibre beyond the local exchange towards the customer premises and converted the exchange area to digital loop carrier transmission standard (**DLC**). As a result, the copper pair connecting individual customers premises served by a local exchange will not terminate on the MDF in that local exchange but at some outside point between the local exchange and the customer premises called a "remote terminal". The interface point between the fibre extending from the local exchange and the copper pairs will be a piece of equipment such as a concentrator or multiplexer. This interface point will be located in an access hole or cabinet in the street. The connection between the remote terminal and the exchange will be by a fiber or EI/TI lines (using HDSL technology) which will concentrate 24 or 30 voice lines in digital form.

Figure 2 illustrates these problematic configurations within an incumbent local network:

Figure 2

The fibre-in-the-loop problem will increase as incumbents deploy more DLC technology to support their own higher bandwidth services. The competitive consequences of the problem have been described as follows21:

> *"ILEC network modifications are increasing the extent to which copper loops terminate at remote terminals some distance away from the central office in Digital Loop Carrier ("DLC") systems. As digitalisation is extended further towards residences, in no small part because of ILEC promises of xDSL offerings, the number of DLC based loops will increase. DLC implementation inherently involves interface circuits (either analog or digital) which must be placed in a remote terminal between the residence and its serving central office. Since the xDSL "modem" at the residence must electronically match the digital interface at the remote terminal, if ILECs seek to limit equipment that can be placed at the remote terminal, those ILECs will be impeding the consumers right to select their own broadband CPE and the ability of CLECs to provide consumers with their choice of broadband CPE.*

A number of problems arise:

- *Dislocation and Migration:* if the incumbent introduces DLC technology in the local loop after a new entrant has deployed xDSL services in the exchange area, the new entrant's arrangements will have to be re-configured, probably at the risk of significant additional costs, wasted investment and loss of customers. However, it would be unrealistic, and contrary to the interests of consumers, to "freeze" the incumbent's network as it stood on the day LLU was first made available to end-users;

- *In-street Collocation:* one choice for the new entrant is to build out its own network to the new "copper head-end". The new entrant will need to have the right to connect and collocate, such as in a street cabinet or access hole (space constraint can be a bigger issue).

- *Backhaul Transport*: an alternative solution is to use the incumbent's HDSL or other IP backhaul transport from the remote terminal to the exchange. This raises the issue of the charges for that service, and whether it is to be cost-orientated; and

- *Constraints of xDSL services:* the customer equipment must be compatible with the line card on the subscriber side of the remote terminal. Unless the new entrant can insert line cards in the remote terminal which match its own type of xDSL service (which may not be the type being offered by the incumbent), the new entrant may be limited in the DSL services it can offer. US new entrants have described this as a "new bottleneck".

Experience

These problems, particularly with the extension of fibre into the local loop beyond the incumbent's local exchange, have arisen in several countries which have implemented LLU, particularly Australia and the United States. The extent of the impact varies between different local exchange areas depending on how advanced the incumbent carrier is in upgrading its local exchange network to DLC technology. New entrants in Australia estimate that currently 7-10% of the incumbent's local exchange lines are affected by DLC issues (known as "cutting the copper"). The incumbent itself estimates that 25% of lines will be impacted in 5 years' time. In the US it is estimated that up to 30% of lines in densely populated areas will be affected by the rollout of fibre.

These issues have not yet arisen in Europe. New entrants seemed to feel that there were more urgent "bread and butter" issues to deal with and that network problems of this nature were not urgent. The only place where this appears to be an issue is in the five German Länder (formerly the German Democratic Republic).

It does not either seem practicable nor in the interests of consumers, to restrain incumbents from upgrading their local networks to support higher speed data services for their customers, even if this does restrict implementation of LLU at the exchange MDF. However, regulators should implement prior notification requirements to ensure that new entrants have reasonable notice of proposed upgrades of the incumbent's local exchange areas where new entrants are currently utilising unbundled local loops (eg: six months). In addition to sub—loop unbundling, regulators may need to consider requiring supply of IP backhaul services to the nearest local exchange. Finally, regulators should also consider common and open standards for remote terminals to facilitate access and interconnection at the sub-loop level.

6. Forecasting, Pre-ordering and Ordering Processes

OSS refers to the operations support systems used by an operator to support its services, including to process orders for new connections and record or track trouble or fault reports. While OSS may be partly or fully automated, we use OSS here in the sense of whatever processes are used by the incumbent and new entrant, including manual systems.

Figure 3 illustrates the new entrant's OSS functions which may need to interface with the incumbent's OSS. We discuss the forecasting and ordering processes in this section and cutover, trouble administration and billing in subsequent sections.

Figure 3: PROCESS STEPS FOR LLU

6.1 Pre-ordering Access to Information from the Incumbent

The information which the new entrant might seek from an incumbent prior to lodging individual orders for unbundled local loops falls into three categories:

- *network information*, such as number of exchange lines per local exchange area and the availability of collocation space at the MDF;
- *line qualification information*, which indicates whether an exchange line will be suitable for LLU and to provide the particular type of services (eg. the type of xDSL service) proposed to by a new entrant; and
- *individual customer information*, ranging from basic information about account details, such as billing name and address, through to details of the current services which the subscriber takes from the incumbent over the exchange line.

Network information helps new entrants to plan their services utilising unbundled local loops by identifying those local exchange areas with the densest concentration of suitable exchange lines and available collocation space this can then be cross-referenced with publicly available information such as demographics and market profile of the potential LLU service areas.

Line qualification information enables a new entrant to make a preliminary assessment of whether it is feasible to provide its services to a customer before that customer contractually commits to the services. Different types of xDSL services are affected by the characteristics of the particular copper line, including the distance between the customer premises and the local exchange and the presence of equipment (such as loading coils).

Provision of customer information in the pre-order stage is much more controversial. Many potential customers for the new entrant's retail services supplied by unbundled local loops are not necessarily fully aware of all of the details about their current service.

Experience

In most countries, network level information is available to new entrants which are considering using unbundled local loops. In the UK, information is available, via secure internet access on the location of MDF sites, postcodes served by each MDF site, MDF sites at which collocation facilities have been established, MDF sites where collocation space is available (although not on a committed basis) and MDF sites where collocation is not currently readily available.

In France, new entrants can obtain a PDF file (for 600 francs) which provides information on the location of local exchanges, the size of the local exchange (by units of 5,000 lines), and a coverage map.

In some European countries, such as the UK, the incumbent requires the new entrant to have signed a supply contract before the new entrant is given access to network information. While network level information does have some commercial sensitivity and wide dissemination could have security implications, requiring new entrants to negotiate and sign for supply arrangements before obtaining access can result in significant delays. Shorter form confidentiality arrangements would seem to be sufficient.

Line qualification information also is available in many of the studied Member States. In Denmark, the incumbent will provide a response about the availability and suitability of proper lines for LLU within 10 days of the new entrant's request.

In France, once a new entrant has identified a potential customer, it is entitled to receive basic information about the line, including its length, its diameter and whether there is an NTU or other similar device on the line which would need to be removed to condition the line for LLU. The new entrant does not need to establish or verify that it has a committed order before requesting the line-qualification information. The regulator's approach is that sufficient information should be available to allow new entrants to deal with general customer queries, such as the suitability of a line for unbundling, etc. By the end of 2001, ART expects that this information will be available in a computerised database and that new entrants will be able to make online enquiries.

Customer information is generally not available in most countries. The exception is the United States where OSS rules require disclosure of information in the pre-ordering stage. The new entrant can view many parts of the incumbent's customer service record to verify the lines which the customer wishes to transfer, the telephone associated with those lines which will need to be ported, the service addresses for individual lines and line qualification information. The new entrant also can access the incumbent's ordering and provisioning system to view available appointment dates for field visits should that be necessary.

6.2 Ordering

Figure 4 depicts a simplified order lodgment process:

Figure 4: STEPS IN ORDERING PROCESS

Experience

Complaints from new entrants about the incumbent's ordering and provisioning process were remarkably similar across the studied countries, as follows:

- the order forms which the new entrant is required to complete and provide to the incumbent require extensive detail about customers. These details go beyond what is reasonably necessary to identify the customer, are difficult to obtain and, in the absence of access to pre-order information, difficult to verify;

- the incumbents are accused of taking a pedantic approach to checking and verifying information contained in LLU applications. Applications are rejected for minor inconsistencies when there could be no doubt about the identity of the customer to which the form relates: for example, in several studied countries, new entrants repeated similar stories about incumbents rejecting churn forms because for example the customer's address was recorded on the churn form as "Brown St" but in the incumbent's database as "Brown Street";

- as a result, the rejection level for application is unreasonably high, ranging from 15 to 30% or more. The incumbent often will seek to charge a churn rejection fee for the costs of reviewing and rejecting the application. Even if that charge is in some way cost orientated, the total of the churn rejection fees and of the application fees when the application is finally accepted, adds significantly to the new entrant's cost of sale;

- in addition to complex inter-operator forms, incumbents often insisted on complex and legalistic wording in the customer authority forms which the new entrant was required to obtain from customers. Some incumbents also initially sought to require customers to directly contact the incumbent to disconnect their current service, arguing that as the customer had a current contractual relationship with the incumbent it was appropriate that the customer cancel its service directly with the incumbent rather than through its new service provider. However, most incumbents desisted from this position and accepted the authority of the new entrant to act on the customer's behalf in terminating the customer's existing services with the incumbent;

- some incumbents sought to require the new entrant to produce proof of the customer's authorisation when the new entrant lodged the interoperator order forms for LLU. The requirement to produce the customer authority added to the complexity of the ordering process and provided further opportunities for rejection of the new entrant orders if customer names as completed by the new entrant on its form and by the customer on his or her authorisation did not exactly match;

- some incumbents require manual, paper based application processes, such as lodgement by fax. While some incumbents may permit electronic lodgment (by email file) for simpler LLU applications such as for residential customers, paper based applications are still required for multi-line customers. These customers are often the most time sensitive, and paper-based application processes could significantly impact upon the lead-time for service commencement;

- even if the incumbent permits electronic lodgement of batch files, the incumbent may reject an entire batch of files for errors in a limited number of individual applications and charge the rejection fee for each application in the batch file;

- even though applications can be filed electronically, the incumbent must still manually process the applications printed from the electronic file; and

- bureaucratic processing chains are used by incumbents which delay the processing of applications. For example, in one EU country, new entrants are required to lodge LLU applications with regional offices but those offices forward the applications to a central processing unit which checks and verifies the application and then returns it to the regional office for implementation.

In relation to accusations of their pedantic attitude to simple errors on churn forms, incumbents respond that they need to be cautious in order to protect themselves from legal liability.

The incumbent in Hong Kong proposed an approach, which while initially unattractive to the new entrant, has substantially reduced the level of churn form rejections. The incumbent will be prepared to process a churn if a limited set of factual information is correct (notwithstanding other errors in the form) provided that the new entrants indemnify the incumbent against liability if the wrong customer is churned based on the information provided by the new entrant. As a result of this transfer of liability and growing experience between the incumbent and new entrants, the level of churn rejection has fallen from over 30% to approximately 10%. This churn rate compares favourably with the United States, which utilises full electronic information exchange processes, including the ability for the new entrant to check customer details in the pre-order stage.

7. Cutover

The cutover process requires co-ordination between the incumbent and new entrant to disconnect the line from the incumbent's network and reconnect it to the new entrant's network. Cutover usually will involve a period of dial tone outage as the jumper cable at the MDF is disconnected from the incumbent's network and reconnected to the new entrant's tie cable. That work must probably be undertaken by the incumbent's personnel for network safety and operational reasons.

Experience

While the back office or OSS functions are capable of automation, the cutover process remains fundamentally an "old-fashioned" manual process requiring the incumbent to make skilled personnel available. As a US participant remarked, "while LLU might be used for space age data services, the reality is that every key aspect of the process has human hands on it".

Incumbents complain that new entrants expected them to have technicians on call "like hot and cold running water" but are unprepared to pay the full costs of the additional resourcing required. As noted above, incumbents also complained that the new entrants had substantially, if not wildly, over-forecasted demand and that the incumbents had set aside resources to handle demand which failed to materialize. The incumbents continued to be sceptical of the new entrants' demand forecasts, and several regulators shared the incumbents' views of over-forecasting by new entrants.

In some of the countries, the incumbent has placed upper limits on the number of individual lines which it will unbundle per day in each exchange area. For example, in Hong Kong, the incumbent has set this limit at 36 lines per exchange area per new entrant (there being three competing operators entitled to utilise LLU). Telstra in Australia applies a similar limit of 40 lines per exchange per day.

The new entrants complain that these restrictions impair their ability to provide services to customers, particularly if the "quota" is used up or exceeded by churning of a multi line business customer. Some incumbents complained that the new entrants demanded higher quotas for cutovers despite the fact that they did not fully utilise their existing quotas.

New entrants report that incumbents miss required cutover times regularly, which makes it difficult for the new entrant to manage its relationship with its new customer. In opposing Bell Altantic's petition to re-enter the long distance market, Covad said that nearly half of the lines provisioned to it were cutover beyond the 7 day period required by regulation.

Cutover problems are less severe where the incumbent's network is engineered with a spare copper pair, as in Australia, to each customer premises. This allows the incumbent to leave connected to its network the first pair which it is utilising for its services and to connect the second pair as the unbundled local loop to the new entrant's network.

8. Fault Reporting and Maintenance

Figure 5 illustrates the high level elements of the possible electronic interface between the incumbent and the new entrant on fault and maintenance processes.

Figure 5: FAULT PROCESS

The incumbent's technicians may require access to the customer premises for the purposes of repairing faults. It will be necessary to develop the following processes between the incumbent and the new entrant:

- contact with the end-user by the new entrant to determine an appropriate time for the incumbent's personnel to attend;

- confirmation by the incumbent of attendance;
- notification by the incumbent that site access was not available;
- rescheduling of site attendance; and
- notification by the incumbent's field staff to the end-user that field staff were called but were unable to obtain access (e.g. in the form of a business card left by the incumbent's field staff visiting the access seeker end-users).

There will also need to be charges agreed for site visits where no access is obtained.

Experience:

The main issues which have arisen across the studied countries include:

- *lack of service level commitments:* incumbents have sometimes refused to provide fixed SLA commitments (particularly with rebates) on the basis that as LLU is a regulated service provided on a regulated cost basis, service level commitments equivalent to those provided for commercially costed services are not appropriate. While the incumbent may be subject to a non discrimination standard it can be difficult to determine whether this non discrimination standard is met in the absence of either committed SLAs which implement the standard or performance reporting which compares performance against the incumbent's own services.
- *manual fault reporting process:* the incumbent may require fault reports to be lodged by facsimile. The incumbent's response, including requests for further information, may also be dealt with by fax. Even if an electronic lodgement of fault reports is permitted, it is usually only by email and still involves a manual process at the incumbent's end. The exception is the United States where incumbents are required to provide direct electronic access to their fault reporting and tracking systems in substantially the same manner as the incumbent's own customer service personnel have access for the purposes of reporting and tracking faults with the incumbent's own services; and
- *lack of information and progress in restoring service:* once the new entrant reports the fault, the incumbent's progress in investigating and restoring service is a "black box". Sometimes no acknowledgment of the receipt of the fault report is provided, no progress reports are provided and service restoration may only be confirmed after the service has been restored. This lack of information makes it difficult for the new entrant to manage the customer relationship and to provide information on the likely service restoration times. The electronic interfacing required in the United States permits the new entrant to track the progress of fault investigation and service restoration in the same manner as the incumbent's own customer service personnel.

There was little evidence in the studied non-EU countries that the incumbent exploited contact with the new entrant's customer during the course of maintenance and fault repair services to market its own services.

However, new entrants in some countries expressed concerns about the high level of marketing calls by incumbent personnel to customers who were churning to the new entrant, particularly shortly after the original order for unbundling is lodged. Most new entrant complaints related to the lack of coordination between the new entrant and the incumbent which sometimes meant that the customer received a confused picture or was left with the impression that the incumbent was more on top of the issues or more confident than the new entrant.

These problems with maintenance and fault repair services are not, of course, unique to LLU and can be more critical in relation to other services to which the incumbent provides access and interconnection because those services continue to involve the provision of connectivity and functionality by the incumbent. The faults which are the incumbent's responsibility in the case of LLU services are usually simpler because the incumbent is only providing an inert copper wire (e.g. water in the local ducting system which effects service provided by the new entrant over the copper wire). Fault reports in line sharing situations are more comparable with the types of faults which arise in the supply of activated services by an incumbent.

9. Electronic OSS and Other Systems

All modern telecommunications carriers have sophisticated suites of software which are used as the operations, administration, maintenance and provisioning systems of the carrier (called collectively OAMP systems or more broadly as the OSS). Typically, these systems are loosely integrated with the carrier's billing systems. The FCC has recognised the competitive significance of the incumbent's databases, both call-related and off-network systems:

> *"We believe that the inclusion of these terms in the definition of "network element" [required to be supplied by incumbents] is a recognition that the massive operations support systems employed by incumbent LECs, and the information such systems maintain and update to administer telecommunications networks and services, represent a significant potential barrier to entry. It is these systems that determine, in large part, the speed and efficiency with which incumbent LECs can market, order, provision, and maintain telecommunications services and facilities. Thus... "[o]perational interfaces are essential to promote viable competitive entry."[23]*

However, problems arise with OSS interfacing because there is a substantial element of legacy in the incumbents OAMP systems. Often, the OAMP systems have been built piecemeal over time. Carriers behave conservatively and have an "if it ain't broke don't fix it" philosophy. The OAMP system is also designed for operation at a network operations centre rather than at a switch level. This can be illustrated in the way that "trouble tickets" are written. These tickets are a call for a technician to do something. In many cases, the technician's time can be better managed if the trouble tickets are sequenced to provide the shortest time between faults. Although the OAMP system generates the tickets, in many cases the routing of the technicians is done locally, sometimes with manual re-entering of the trouble ticket data.

This makes it difficult to "unbundle" the OAMP system and for an outside party to establish an interface at some point to substitute its own initial processing steps or to require the carrier system to operate in a different way or to trap and provide information about the process.

Few regulatory regimes have imposed explicit OSS electronic interfacing requirements as in the US, although all countries have the basic requirement of non-discriminatory treatment on which the US has based the electronic bonding requirement. In Australia, the ACCC considered a requirement for electronic bonding, but decided to wait and see the outcome of industry discussions. The ACCC stated:

> *"While there can be a "grey area' between describing a service and the terms and condition upon which the service is supplied, the Commission's preference is to treat OSS issues as a matter more appropriately addressed through the terms and conditions of supply. These arrangements can be developed bi-laterally or as part of an industry-wide approach rather than through inclusion within the description of the service to be declared. Moreover, if an access provider and access seeker are unable to agree on the arrangements, subs 152CP(2) of the Act provides that that in arbitrating a dispute about access to a declared service, the Commission can make a determination about 'any matter relating to access' by the access seeker to the declared service. In light of these considerations the Commission has not included reference to OSS in the description of the services that it proposes to declare. However, if this proves to be an inadequate way of handling these issues, the Commission will consider whether particular declarations should be varied, or other measures undertaken to ensure appropriate levels of OSS access."[24]*

In the settlement of proceedings relating to Telstra's alleged anti-competitive conduct in local call churn processes, the ACCC and Telstra agreed that Telstra would contribute $4.5 million towards the costs of new entrants, especially smaller players, bringing their churn systems online with Telstra's systems.[25]

The French regulator has encouraged FT to make available online the basic information about loop characteristics and suitability for unbundling, and this should be completed by the end of this year. The objective is to allow the new entrants to make online inquiries while the customer wanting service is on the telephone with the new entrant's sales representative. In Germany, DT initially had some form of electronic access but this was discontinued by DT and a manual system is now used. BT's OSS interface which was originally due in July has now been delayed until November. This has caused resourcing problems for many new entrants who were expecting automatic functions to be available and who are now required to continue to support manual processes.

10. Interference

The deployment of broadband services over copper pairs involves much greater utilisation of bandwidth than would otherwise be used for voice. These wideband signals radiate energy, causing interference through electromagnetic coupling between unshielded twisted pairs within the same cable, commonly referred to as cross talk. This interference can potentially degrade the performance of services deployed over that cable and compromise network integrity.

The level of crosstalk experienced on a copper pair depends on a number of parameters, including:

a. cable length and the variation in the proximity of pairs within a cable; and

b. signal frequency and strength.

Consequently, the approaches listed below can be an effective means of limiting the risk of crosstalk:

a. limiting the length of the cable over which xDSL systems can be deployed and controlling the number and placement of xDSL systems in a cable; and

b. limiting the power spectral density of xDSL signals.

To ensure effective use of the unbundled local loop, both incumbents and competing service providers must abide by a set of guidelines governing deployment of broadband services aimed at:

a. maximising effective use of the local loop; and

b. protecting network integrity.

In most countries, codes and or plans on interference have been developed by industry representatives (eg France, UK and Australia). In addition ETSI has developed a number of standards dealing with interference issues. The following table outlines some of the differences in approach between Australia, France and the United Kingdom

Deployment of broadband systems	**Australia**	**UK**	**France** **(recommendation only)**
Restrictions on system deployment	A system must not be deployed if: • it causes another system to be degraded below its predefined performance benchmark; or • the maximum transmit power is in excess of the PSD of all deployment class systems.	The spectrum and power that can be used at the exchange and customer premises ends of the wire pair are limited by 4 PSD masks: • downstream from the MDF; • upstream from the NTP of a near customer; • upstream from the NTP of a mid distance customer; • upstream from the NTP of a	It is recommended that a standardised (eg ETSI) system may be deployed if it complies with the following PSD masks: • downstream from the exchange; • upstream from the end-user.

		far customer.	
Deployment rules	A series of deployment classes and rules have been defined to assist service providers comply with the deployment requirements. Each class has a set of deployment rules, including: • length of deployment; and • pair separation requirements.	Not defined.	Not defined.
Flexibility to introduce new technologies	Processes for the introduction of new deployment classes have been defined.	Processes for implementing changes to the various PSD masks have been defined.	Processes for changes to the various PSD masks have been recommended.
Protection of legacy systems	Yes	Yes	Recommended.
Pair separation	Yes. Australia requires pair separation between various systems.	No. Allows deployment: • over any pair; and • all pairs in the same cable can support the same system (100% fill).	Not recommended. Allows deployment: • over any pair; and • all pairs in the same cable can support the same system (100% fill).

Deployment from a point remote from the exchange	Has been contemplated but unable to agree a set of rules. A moratorium of 6 months has been established.	Not contemplated.	Not contemplated.

11. Conclusion

The provision of LLU can seem deceptively simple because it only involves the supply of inert copper by the incumbent and gives the new entrant near to complete service autonomy because it provides its own dial tone over the capper. However, implementation of LLU is several orders of magnitude more complex than any form of access and interconnection previously undertaken. The failure of regulators to understand and tackle this complexity is the single largest factor in the failure of LLU implementation.

In many countries, technical and operational issues have been passed to the industry self regulatory bodies without adequate thought about the scope, structure and resourcing of industry bodies. Too little thought also has been given to incentives, and not only to the penalties, for the incumbent's participation in LLU implementation.

LLU, as regulators intend when introducing it, strikes at the core, of an incumbent's power and the incumbent can be expected to resist. However, if LLU does provide the ability to break through the final barrier of the incumbent's monopoly endowment, regulators need to give some thought to what the regulatory environment will look like after LLU implementation and provide some guidance to the incumbent in which direction it is heading.

The current "tech wreck" may well obscure that a good proportion of the blame for failed LLU processes lies with the inadequate, if not bumbling, approach to managing the complex technical and operational issues involved in LLU implementation.

Endnotes

1. Peter is a partner in Gilbert & Tobin based at their Hong Kong joint venture with Arculli and Associates. Annemaree is a senior lawyer in the Sydney office specialising in competition and regulatory issues. Some of the research in this paper was undertaken for the European Commission and a discussion paper will be forthcoming. The views expressed in this paper (or the final report) are not necessarily the views of the Commission.

2. *DSL Update — Slowdown on the fast track*, http://www.totaltelecom/view.asp Article 1D=35696 & Pub = CW1 & Category 1D = 705.

3. "Handicapping the Cable DSL Horse Race" December 4 2000, Cable Datacom News

4. "Europe Will Close Broadband Gap, Report says", *TechWeb News*, April 1998, cited in "ADSL: Prospects and Possibilities", Jana Harrison, Elizabeth Fife, Francis Pereira, and Richard Worthington,

http://www.adsl.com/mrp_exec_summary.html. Despite the market decline, many industry analysts and market participants remain optimistic about the future of DSL.

5. "ECTA updates LLU scorecard" 5 April 2001 http://www.totaltele.com/view

6.

7. Comments of Covad Communications Company. CC Docket NO 98-147 September 25, 1998

8. Note, however, that the incumbents in France and Germany did not feel this was a problem although new entrants in each country complained about the lack of electronic interfaces and the reliance on manual processes.

9. This approach proved less successful in France. The "*Conseil de la Concurrence*" required France Telecom to delay ADSL rollout until specific requirements had been met, including a resale offer to competitors. However, the fact that France Telecom was nonetheless able to roll out ADSL ahead of its competitors indicates that this approach was not entirely successful — even if it did buy some time for the new entrants.

10. LLU — BT's non-participation in the Bow Wave Process (the non-discrimination complaint), 11 July 2001.

11. Although the first approach also could be described as co-regulatory because the regulator informally participated and could formally resolve issues which were deadlocked at the industry committee level, the difference is the point at which the regulator participates.

12. OFTEL *The Benefits of Self and Co-Regulation to Consumers and Industry*, July 2001, www.oftel.gove.uk

13. "Self and co-regulation cannot become much more extensive unless sufficient stakeholders are committed to it [responses to OFTEL's discussion paper] revealed that there was in general a low level of enthusiasm for a formal independent stakeholder body like Australia's ACIF. Given these views, it is difficult to see how, in the absence of formal powers, such a body could be established. For this reason alone, Oftel does not see any scope to establish such a body within the current regulatory framework. Further, Oftel does not consider that such a body would necessarily be any better than effective alternative measures on a less formal basis. The previous experience of self and co-regulation already gives some good examples of success based on stakeholder co-operation, and it is questionable in Oftel's view whether compelling co-operation within a formal body would give any better outcomes. Further stakeholder involvement in self and co-regulation may evolve naturally towards more formal structures, but whether this is the chosen route remains to be seen." OFTEL *The Benefits of Self and Co-Regulation to Consumers and Industry*, July 2001, www.oftel.gov.uk

14. *In the matter of the application by Bell Atlantic under section 271 of the Communications Act to provide In Region Inter Lata Services in the State* of *New York, memorandum, opinion and order cc doc number*

99.295, paragraph 100.

15. Covad Comments, 25 September 1998, CC Docket No 98-147, at pp 6-7.

16. Comments of Covad Communications Company in CC Docket No. 98-91, filed June 24, 1998. Space clearly existed in those spaces for xDSL equipment because subsequent to filing its 706 Petition, Pacific filed a tariff with the FCC offering ADSL service from 20 of these ostensibly "no space: offices. Pacific Bell Telephone Company, Pacific Tariff F.C.C. No. 128, Transmittal No. 1986. June 15, 1998, Section 17.5.4. Thus, while Pacific found space in those twenty offices for its own DSL equipment, it was simultaneously claiming that there was no space to collocate Covad's DSL equipment.

17. Aug. 19, 1998 Order Denying Motion for Preliminary Injunction, Covad Communications Co v. Pacific Bell, No C98-1887 SI (N.D. Cal) (noting that SBC had found space in 16 of 20 disputed offices). Subsequent to the Court's Aug. 19, 1998 decision, SBC found space in the remaining four offices.

18. In Massachusetts, within days of the deadline for the state commission's ruling on Covad's arguments for cageless physical collocation in that state, Bell Atlantic miraculously discovered space for cages in several important and ostensible "no-space" central offices, such as the important location of Cambridge, MA.

19. OFTEL — LLU provision of collocation in the form of co-mingling, 27 June 2001 para. 1.12.

20. Bell South in its agreement for collocation space provides that the new entrant can have access to the collocation space 24 hours a day 7 days a week

21. Covad, Defining "Digital Loops" — "Avoiding Re-monopolisation in a Digital World" June 4, 1998 page 3, www.covad.com

22. First Report & Order In the Matter of Implementation of the Local Competition Provisions of the Telecommunications Act of 1996. FCC Docket No 96-98, FCC 96-325, Released August 8 1996, para 516.

23. Australian Competition and Consumer Commission "Declaration of local telecommunications services" A report on the declaration of an unconditioned local loop service, local PSTN originating and terminating services, and a local carriage service under Part XIC of the Trade Practices 1974. para 3.8.2.

24. Australian Competition and Consumer Commission, *ACCC and Telstra reach agreement on commercial churn*, media release, 23 February 2000. http://www.accc.gov.au/media/mediar.htm

back to index

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back to index

Who Controls the Internet?

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View Abstract

1. Introduction

The conventional wisdom about the Internet characterized the medium as decentralized, democratic and diffused. As a "network of networks"[1] the Internet's basic architecture apparently forecloses concentration of control in view of the many interconnected networks operated by different ventures. Absent such control users presumably have greater freedom to derive from the Internet customized services and applications. The predominant, current view of the Internet assumes that users have greater sovereignty and power with a commensurate reduction in control by the operators that provider services via the Internet.

This paper rejects the prevailing wisdom, because incumbent telecommunications carriers have consolidated ownership of most Internet long haul backbone networks and continue to operate bottleneck local exchange networks that serve as the first and last link to the Internet. If it ever stood separate and apart from its telecommunications transport roots, the Internet now has become fully integrated into a multifaceted, but consolidated Information Communications and Entertainment ("ICE") marketplace. Such convergence has proven disruptive to preexisting regulatory orientations, because changed circumstances prevent the application of established semantic dichotomies that have created different and inconsistent regulatory treatment based on service definitions, e.g., basic versus enhanced services[2], and telecommunications versus information services.[3] However convergence creates greater incentives to accrue economies of scale and scope, to extend reach, to leverage dominant market share and to exploit ownership of essential facilities. At this critical time regulation must guard again incumbent extension and expansion that thwarts competition, but it must change to respond to changed circumstances. Simply applying "legacy regulation" has the potential for handicapping incumbent telecommunications carriers' entry into convergent ICE markets where the incumbent lacks market power and may not be able to leverage its incumbency. On the other hand, blind confidence in marketplace solutions to any Internet-mediated service, has the potential for expanding the scope of incumbent carrier dominance.

2. Convergence Confounds Regulatory Definitions and Dichotomies

Market defining service classifications can work only if technological and business factors support such segmentation.[4] For example, a telecommunications service provider operating as a common carrier might care to concentrate on transporting content and leave the content creation to others. Market defining service classifications cannot work in today's ICE environment where few barriers to market entry exist as the Internet can provide a medium for a variety of different services, previously subject to different degrees of regulatory oversight.[5] For example, Internet Service Providers ("ISPs") now offer the functional equivalent to incumbent telecommunications services, e.g., Internet-mediated voice telephony[6], commonly referred to as Voice Over the Net[7], or Internet Telephony.[8] For their part, telecommunications service providers now offer Internet-mediated services as transporters, processors, repositories, or creators of content on a wholesale and retail basis.

Such a proliferation of services and expanded wingspans challenges tactical, business, operational, legislative and regulatory assumptions. ISPs initially offered unregulated, non common carrier ICE services carried over the telecommunications transport facilities of regulated common carriers. Telecommunications service providers initially considered the Internet primarily as a vehicle for expanded private line sales and not a threat to voice service revenues, a core offering, or a major source for additional revenues. ISPs and other Internet-based ventures could largely operate free of regulatory oversight. Given the lack of regulatory oversight, even though governments were instrumental in incubating initial Internet development, and the largely libertarian attitudes of most Internet stakeholders, a "Nethead" culture developed substantially different from the "Bellhead" culture of telecommunications service providers.[9] These cultures derived from the perspective and orientation of the people involved in the telecommunications and data processing worlds. In the non-convergent past, Netheads and Bellheads worked in substantially different environments with little commonality.

3. A Clash of Cultures

Regulatory dichotomies exacerbate the clash between Bellhead and Nethead cultures. Having initially operated in data processing markets, which qualified for little if any regulatory oversight, Netheads assume they can foreclose government intervention in perpetuity regardless of the markets they enter and the potential for adversely impacting preexisting regulatory programs, including subsidization of specific telecommunications services and consumers. Some Netheads have deluded themselves into thinking that mediation via the Internet can largely insulate any transaction from governmental oversight, even if such transaction had triggered government involvement in a direct, non-Internet mediated environment. Regardless of how integrated data processing and telecommunications might become, some Netheads extend their non-regulated assumptions to new markets. Similarly, some Bellheads have ignored the need to respond to changed circumstances by thinking that the status quo will persist and legacy regulation will extend to new circumstances largely insulating telecommunications service provider incumbents from Internet-mediated competition.

3.1 Revenge of the Bellheads.

With all the buzz and hype surrounding the Internet's ascendency, one can easily conclude that a New World Order will offer services incumbent players somehow cannot or will not offer. Slogans like faster, better, smarter, cheaper and more convenient describe the characteristics of what new "out of the box" thinking generates, a mindset largely lacking in the regulation-numbed, and competition-insulated world of incumbent telecommunications operators. The conventional wisdom largely relegates telecommunications service providers to low margin transmission of bitstreams generated by others who add value and accrue greater profits. Nethead information economy players apparently have the mental nimbleness and other skills to thrive while their Bellhead counterparts only can muddle through.

Pity the Nethead who underestimates the Bellhead's ability to exploit their market dominance in facilities ownership at the local and long haul level and their ability to game the legislative and regulatory system to thwart change, or to dominate larger, convergent ICE markets. Netheads offering "the next best thing" typically fail to appreciate fully the role of telecommunications in making or breaking their business plans. While the Internet creates many new market opportunities, it has yet to diminish powers held by enterprises providing the underlying bit transmission, particularly where traffic must traverse different networks thereby requiring physical interconnection of facilities and often triggering a payment from the customer of bit transport to the carrier providing the delivery service. While Bellheads may bank too much on the their continuing ability to maintain toll booths along the information superhighway, Netheads largely fail to appreciate that unless and until they vertically integrate throughout the service chain, they must rely on Bellheads ready, willing and able to exploit bottlenecks and superior expertise in working the regulatory process. Indeed the Nethead managers of major Internet backbone providers, many of which incumbent telephone companies own[10], recognize the power of gateway access control and have adopted some of the pricing and interconnection tactics of their Bellhead counterparts.[11]

Bellheads and Netheads do not understand each other, largely because they speak different languages, operate from fundamentally different assumptions about their businesses and have generated substantially different cultures. Few in either camp realize that success depends on the acquisition of skills resident in the both groups, e.g., the Netheads' keen interest in competing and embracing change, coupled with the Bellheads' ability to attend to details, including cost recovery, manage complex networks, and effectively provide all the functions required by their business including customer service, accurate billing and maintaining high quality of service. Because of the distrust between Bellheads and Netheads, perhaps both camps should work harder to understand the other. Technological and marketplace convergence means that different types of people will work within a single company, or have to reach consensus in the joint provisioning of a service.

4. Netheads Dominated Early Internet Development, Because Bellheads Saw No Harm in It.

The short history of the Internet evidences little ongoing management and planning by both governments and incumbent telecommunications carriers, despite the fact that governments financially underwrote development and incumbent carriers engineered and provisioned the telecommunication networks that constitute the Internet.[12] Understandably Netheads can point to this "hands off" approach as a primary reason for the Internet's success. As well Netheads may have inferred that they alone possessed the skills needed to provide "light handed" governance in those limited areas requiring coordination, e.g., establishing and fine-tuning technical standards, including the Transmission Control Protocol/Internet Protocol used to manage traffic across disparate networks and route traffic based on World Wide Web letter addresses.

During the Internet's incubating years, when governments and academic organizations served as anchor tenants, a loose set of voluntary standard setting and coordinating bodies benignly offered non-binding recommendations for optimizing the Internet and connectivity.[13] Operating in a generally noncommercial environment, Internet stakeholders emphasized connectivity, coordination and consensus building. Most ISPs agreed to interconnect their networks at centralized locations known as Public Peering Points or Network Access Points.[14] Most ISPs agreed to handle any other ISP's traffic on a settlement-free, zero cost basis. The emphasis on building out the Internet and making it work predominated over commercial issues such as determining whether a particular ISP caused another ISP to incur higher costs to accommodate the traffic requirements of the other ISP. Accordingly, most ISPs agreed to a "bill and keep," "sender keep all" financial arrangement[15], on the possibly erroneous assumption that traffic flows were roughly symmetrical thereby obviating the need to meter.

The emphasis on achieving global connectivity and promoting the Internet could be emphasized when the financial underwriters did not expect near term profitability. These goals also promoted a democratic philosophy welcoming the participation of anyone, other than government officials. Most volunteers serving on the non-binding standard and policy making forums represented Internet stakeholders and expressed Nethead views. Telecommunications service providers had little to say outside the technical realm.

Vounteerism and participatory democracy quickly waned as the Internet privatized and became more businesslike. In 1995, the United States National Science Foundation ("NSF") largely withdrew from financially underwriting Internet development, drawing to a close the government's Internet incubation and promotional activities.[16] Telecommunications service providers, which had been contractors to NSF, assumed responsibility for operating the backbone networks that provide much of the long haul transport between peering points. Unlike the federal government, these carriers realized the potential upside and downside financial stakes involved. On the upside, becoming a major Tier-1 ISP provided the opportunity for telecommunications carriers to lease substantial bandwidth and to serve an increasingly important data communications market. On the downside, telecommunications carriers quickly saw the need to determine who was triggering expanded bandwidth requirements and to charge them for the expanded bandwidth and services these ISPs required.

Managers at telecommunications carriers also recognized the financial importance of Internet line leasing, particularly in light of a growing trend toward substantial growth in data communications demand and relatively flat growth in voice communications demand.[17] Even before visions of a data-centric, Internet-based telecommunications marketplace, telecommunications carrier officials sensed the Internet's ascendancy and the need to manage it. As lessors of both local and long haul bandwidth, Bellheads had an easy time in assuming control and replacing ambiguous Nethead policies with specific telecommunications rules, responsibilities and rates.[18]

5. Evidence of Bellhead Control

5.1. The Internet's Conversion From a Flat to Hierarchical Structure

During the Internet's initial developmental years ISPs concentrated on promoting connectivity and growth with little consideration of traffic flows and cost causation. The relatively small number and homogeneity of ISPs in terms of size, bandwidth, subscribership and geographical coverage made it plausible to assume that traffic flows were symmetrical. ISPs considered the cost and complexity of traffic metering not worth the bother. ISPs emphasized the accrual of positive networking externalities, an economic term more recently recast as Metcalfe's Law: the value and utility of a network increases as the number of access points grows.[19]

The decision not to meter traffic, or to charge other ISPs for access to an ISP's network, evidenced a pioneering shared mission for the Internet. However, as the Internet grew and matured a "rough justice" model of cost recovery proved unsustainable. First, the number of ISPs grew substantially.[20] Second, the nature and type of ISPs proliferated such that homogeneity was non-existent. Third, only a small subset of the larger ISP community continued to expand their networks to achieve national coverage with ever increasing bandwidth. Fourth, burgeoning demand for Internet access and Internet-mediated services generated congestion, particularly at the public peering points initially used to coordinate interconnection between different ISPs' networks. Fifth, the biggest Tier-1 ISPs, having made the largest investments in response to demand, no longer could rely on governments for reimbursement. Sixth, these carriers responded to public peering congestion by creating a private peering alternative.

5.2 Private Peering Bifurcated ISPs into Either Peers or Customers

The decision by Tier-1 ISPs to exit, avoid or augment public peering with a private alternative has resulted in three major consequences:

Management, governance and control of the Internet has become more hierarchical;

Tier-1 ISPs have leveraged their superior bargaining power to assume primary control over the Internet; and

As telecommunications service provider incumbents own most of the Tier-1 ISPs, the Bellhead culture and mode of operation have become dominant.

Public peering offered a democratic, but possibly inefficient mechanism for interconnection among networks. If an ISP, of any size, customer base and inventory of bandwidth, could achieve interconnection from larger ISPs, then "free rider" opportunities[21] would readily occur. Smaller ISPs have less incentive to incur their fair share of infrastructure investment burdens if they can hand off traffic to other more conscientious, larger ISPs for transit[22] or delivery to the final destination. "Hot potato routing"[23] refers to just this strategy: some ISPs exacerbated Internet congestion problems by finding ways to shift the bit transport burden onto other ISPs. Particularly in times of congestion, carriage of additional traffic triggers costs that ISP-1 can partially shift to ISP-2 if the latter agrees to handle traffic sent to it from the former. ISP-

1 can maximize its cost avoidance by routing traffic over its owned or leased facilities to the closest peering point near the sender rather than keeping the traffic over its facilities and handing it off to the closest peering point near the recipient.

In response to hot potato routing, the proliferation of small ISPs with regional network coverage, congestion at public peering points and rising infrastructure expansion costs, Tier-1 ISPs unilaterally changed interconnection terms and conditions. What had been a bill and keep arrangement with no transfer payment, became one where funds flowed from small ISP to larger ISP. The Internet became more hierarchical when peering remained an option only for the major Tier-1 ISPs at private peering points, with all other ISPs now bearing a financial obligation to compensate Tier-1 ISPs for the use of their networks. In essence a traditional financial settlement, metered access charge arrangement replaced the previous rough justice unmetered regime.

The terms and conditions of such settlements, while untariffed and blocked from widespread scrutiny by nondisclosure agreements, appear quite like a telecommunications service arrangement. One could reasonably infer that these access agreements have such characteristics, because the authors of many such agreements typically work for telecommunications service providers and many have Bellhead credentials. Now Tier-1 ISPs operate at the top of a more hierarchical pyramid with a larger set of smaller ISPs operating lower in the pecking order. The Tier-1 ISPs have consolidated their control of the backbone facilities that constitute the Internet and in the process have converted former peers into customers of Tier-1 ISP facilities.

5.3 Bellheads Continue to Control First and Last Mile Access

Technological innovations in telecommunications and information processing have triggered visions of robust competition where consumers have sovereignty and the upper hand. While we are moving to that scenario, currently many businesses and just about all residential consumers still have but one primary telecommunications link to the rest of the world.[24] A twisted pair of copper wires provides most residential subscribers with access to the Internet. In time, the incumbent telephone company will have upgraded the bandwidth of this plant at roughly the same time as cable television, electric utility and possibly wireless options also become widespread. Until that time incumbent telecommunication operators control a bottleneck through which most residential and business traffic originates and terminates.[25] Bottleneck control provides the last best shot for incumbent telecommunication carriers to thwart and delay the onset of robust competition. One should not underestimate the power of incumbents to slow the transition, as inevitable as it may be.

5.4 Incumbency Offers Deep Pockets and Resources to Delay Change and to Respond to Changed Circumstances

Incumbent telecommunication players even now have the best chance for surviving, if not thriving, in the convergent ICE marketplace. They simply have to establish the desire and resolve to change throughout the corporation and not solely in the office of a newly installed, Nethead-savvy Chief Executive Officer. Incumbent carriers typically have ample retained earnings to pursue strategic mergers, acquisitions, alliances and new carrier privatization opportunities. Many will be content to limit their expansion to new telecommunication opportunities abroad. A few will more boldly embrace the Internet and the Nethead world, no matter how awkward it might feel.

6. Implications for Bellhead Domination of the Internet

One should not underestimate the consequences resulting from incumbent telecommunications carrier domination of the Internet particularly if regulators continue to abstain from subjecting the Internet to close scrutiny. Ironically, incumbent carriers can achieve much of their hotly contested deregulatory agenda by concentrating on Internet market entry initiatives, in lieu of seeking relief in courts and regulatory agencies. Provided they are willing to create a separate, enhanced service subsidiary, Incumbent Bell Operating Companies can secure interexchange, long distance service opportunities via the Internet loophole without having to meet the fourteen point competitive check list established by the Telecommunications Act of 1996.[26]

Incumbent local and interexchange carriers have available the opportunity to extend their market reach throughout Internet market segments. Better yet for these carriers, the substantially unregulated Internet provides an extraordinary financial and regulatory arbitrage opportunity to offer cheaper and unregulated services that constitute functionally equivalent to regulated telecommunications services. Heretofore, incumbents telecommunications carriers, particularly the Bell Operating Companies have not exploited this opportunity, primarily because they would have to make substantial investments to retrofit their networks to make them Internet-centric. Competitive necessity may require such investments, but until then it appears that incumbent carrier strategic planners have failed to factor in new market access opportunities, as offset by some cannibalization of existing revenue flows.

7. Conclusions

Internet issues, particularly ones involving traditional telecommunications matters like interconnection, cannot avoid a telecommunications law and regulation component. Netheads may couch issues, possibly subject to government oversight, in terms of Internet "governance"[27] and may not see links to telecommunications rules of the road, but the parallels exist. The parallels grow stronger and more obvious as telecommunications carriers consolidate ownership and control over many Internet market segments. For example, the pay for interconnection, transit and delivery requirements imposed by Tier-1 ISPs closely track a telecommunications settlements/interconnection regime.

Telecommunications carriers own just about all of the Tier-1 ISPs who operate the Internet's telecommunications backbones. These carriers establish the terms, conditions and payment requirements for internetworking, and they operate from a telecommunications perspective. The telecommunications perspective understands the role of regulation and ways to evade, thwart or dilute the efficacy of such regulation. In one future scenario-possibly worse case for Netheads-telecommunications carrier managers and their ISP colleagues establish telecommunications rules of the road, ostensibly subject to government oversight, but regulation in name only. Under this regime, Netheads lose both control of the Internet and lack an effective forum for redress.

Consumers also may face a worse case scenario if the Bellheads consolidate control of the Internet, further develop Internet-mediated telecommunications services and manage to qualify these services for unregulated status.[28] Some may find the prospect of unregulation attractive, particularly Netheads. But a prematurely unregulated telecommunications services marketplace offers Netheads and consumers alike no accessible forum, outside a costly court room, to resolve issues like abuse of bottleneck control, predatory pricing, discriminatory interconnection policies, and refusals to interconnect. The incentive exists for both Bellheads and Netheads to restrict access and to favor affiliates, e.g., cable companies want to restrict if not deny access to non-affiliated ISPs.[29] In the Bellhead world compulsory interconnection responsibilities, imposed on telecommunications common carriers limits the scope of bottleneck abuse, discrimination and corporate favoritism. In the Nethead world no such safeguards exist and the conduct of a dominant player, Microsoft, demonstrates the potential for abuses.

Regulators, legislators and judges will have to guard against instances where the unregulated Internet provides a loophole or arbitrage opportunity to evade regulatory responsibilities. A telecommunications common carrier providing a telecommunications service simply should not be able to rebrand the service as Internet telephony and thereby qualify for no regulation, no access charge financial burden and no duty to contribute to universal service funding. We have not yet seen the telecommunications marketplace become so competitive as to foreclose the need for government oversight, nor has Internet-mediation become the primary conduit through which every type of information, communications and entertainment service travels.

So long as a regulatory dichotomy exists between the Internet and telecommunications ISPs will avoid being classified as telecommunications service providers even when providing functionally equivalent services. Similarly telecommunications service providers have every incentive to migrate services to the unregulated Internet category if little revenue cannibalization results. Much attention has been focused on ensuring that legacy regulation does not amoeba like flow through to Internet markets. Equally compelling, but largely ignored is the need to ensure that Bellheads not use Internet mediation as a cleaver vehicle for avoiding still needed regulation in view of the current level of competition and consumer choices.

Endnotes

[1] "The Internet as we know it today was privatized; it attracted tens of billions of dollars of investment in the network of networks that we know today as the Internet." Robert Pepper, "Policy Changes Necessary to Meet Internet Development," *2001 Law Review of Michigan State University Detroit College of Law*, 255 (Summer 2001).

[2] The FCC initially created a basic versus enhanced service regulatory dichotomy to separate the regulated common carrier delivery of telecommunications services and the unregulated delivery of data

processing and other information services that use telecommunications for transmission. The Commission initially established a "bright line" distinction between these services by requiring telecommunications common carriers to establish separate enhanced services subsidiaries who must lease lines from basic service corporate affiliate on tariffed terms and conditions that do not discriminate against non-affiliates. *See* Computer I Final Decision, 28 F.C.C.2d 268 (1971) (establishing structural separation between communications and data processing and allowing common carriers other than the AT&T/Bell system to provide data processing), *policy aff'd sub nom.* Computer and Communications Indus. Ass'n v. FCC, 693 F.2d 198 (D.C. Cir. 1982) (determining that enhanced services were competitive and should not be regulated); The FCC later eliminated the separate subsidiary requirement. Provisions of Enhanced Services, Notice of Proposed Rulemaking, 10 F.C.C.R. 8360 (1995). For background on the basic/enhanced services regulatory dichotomy and its impact on Internet and Internet Service Providers see Robert Cannon, Where Internet Service Providers and Telephone Companies Compete: A Guide to the Computer Inquiries, Enhanced Service Providers and Information Service Providers, 9 *Commlaw Conspectus*, 49 (2001); *see also* Robert M. Frieden, The Computer Inquiries: Mapping the Communications/Information Processing Terrain, 33 *Federal Communications Law Journal*, No. 1. 55-115 (1981); Robert M. Frieden, The Third Computer Inquiry: A Deregulatory Dilemma, 38 Federal Communications Law Journal, No. 3. 383-410 (1987).

[3] The Telecommunications Act of 1996 defines an information service as, "the offering of a capability for generating, acquiring, storing, transforming, processing, retrieving, utilizing, or making available information via telecommunications." 47 U.S.C. § 153(20) (Supp. III 2000).

[4] "There are many reasons why this 'service-determinative' approach to regulating convergence technologies has been so widespread. From a statutory standpoint, service definitions have been an historical dividing line by which existing regulatory regimes have been separated. The FCC has built upon these statutory service distinctions to create further separate regulatory constructs using a service definition as a basis for determining inclusion in one regulatory framework versus another." Todd G. Hartman, The Regulation of Convergence Technologies: An Argument For Technologically Sensitive Regulation, 27 *William Mitchell Law Review*, 2193, 2196 (2001).

[5] Nevertheless business ventures undertake a cost/benefit analysis in assessing whether to accept the rights and responsibilities of common carrier status instead of the less regulated non common carrier status applied to enhanced services providers. For an examination of the trade offs in either classification see James H. Lister, The Rights of Common Carriers and the Decision Whether to be a Common Carrier or a Non-Regulated Communications Provider, 53 *Federal Communications Law* Journal, 91 (Dec. 2000).

[6] "Voice can be converted into data packets and sent over the packet-switched networks of the Internet just like any other form of data. There are currently two main types of IP telephony. 'Computer-to-computer' IP telephony requires both parties to the call to have compatible software with microphones on their PCs and to be connected to the Internet at the same time. 'Phone-to-phone' IP telephony, which connects to the public switched telephone network (PSTN), generally works through a 'gateway service.' The FCC has tentatively defined "phone-to-phone" IP telephony as services in which the provider (1) 'holds itself out as providing voice telephony or facsimile transmission service;' (2) 'does not require the customer to use CPE

different from that CPE necessary to place an ordinary touch-tone call (or facsimile transmission) over the public switched telephone network;' (3) 'allows the customer to call telephone numbers assigned in accordance with the North American Numbering Plan, and associated international agreements;' and (4) 'transmits customer information without net change in form or content.' The gateway service performs the function of transforming the circuit-switched call to IP data packets, and routing the call to the destination gateway. The destination gateway connects the call to the user through a voice switch." Antonia M. Apps and Thomas M. Dailey, Non-Regulation of Advanced Internet Services, 8 *George Mason Law Review*, 681, 701-702 (2000)(citing Report to Congress, at 11,541-45).

[7] For background on how Internet telephony works see Charles Pappas, How Does Internet Telephony Work? *Yahoo! Internet Life*, available at http://www.zdnet.com/zdhelp/stories/main/0,5594,903525,00.html.

[8] See Federal-State Joint Board on Universal Service, 13 FCC Rptrs. 11,501, 11,538 (1998) (hereinafter Report to Congress)(acknowledging that ISP-provided services might constitute the functional equivalent to telecommunications services, but declining to change regulatory classifications without a full notice and comment rulemaking and further scrutiny). *See also* Robert M. Frieden, Dialing For Dollars: Should The FCC Regulate Internet Telephony?, 23 *Rutgers Computer and Technology Law Journal*, 47, 63 (1997).

[9] One of the first published references to Bellheads and Netheads occurred in 1996: Steve G. Steinberg, Netheads vs. Bellheads, *Wired* 4.10 (Oct. 1996) available at http://www.wired.com/wired/archive/4.10/atm.html. see also Dawn Bushaus, Bellheads vs. Netheads, *Tele.Com Magazine* available at http://www.teledotcom/0598/features/tdc0598cover1_side1.html.

[10] ISP size measurements and ranking track several criteria including market share, number of interconnection points, available bandwidth, subscribers, revenues, etc. For all major criteria except for subscribership, the largest ISPs are owned and operated by major telecommunications carriers. A measurement of U.S. market share by revenue in 1999 identified the largest ISPs as MCI Worldcom with 38%, GTE Internetworking (now Genuity, largely owned by Verizon) with 15%, AT&T with 11%, Sprint with 9%, Cable & Wireless with 6%. Telegeography, Inc., *Hubs and Spokes*, Providers, Figure 1, p, 62 (2000). A measure of Internet backbone control by market share and number of interconnections identifies the following ISPs: MCI Worldcom, Sprint, Cable& Wireless, AT&T, Verio, now a subsidiary of NTT, GTE Internetworking (now Genuity), PSINet (in bankruptcy reorganization), SAVVIS, Intermedia (acquired by MCI Worldcom) and Qwest. *Id.* at Figure 2, p. 63.

[11] See Rob Frieden, Does a Hierarchical Internet Necessitate Multilateral Intervention? 26 *North Carolina Journal of International Law and Commercial Regulation*, No. 2, 361-405 (Spring, 2001)(examining the conversion from a sender keep all, zero charge interconnection regime to a settlement based system except for the largest Tier-1 ISPs who continue to use zero charge "peering").

[12] For background on the Internet's history and evolution see National Research Council, Computer Science and Telecommunications Board, *The Internet's Coming of Age*, (Washington, D.C.: national Academy Press, 2001), available online at http://www.nap.edu/books/0309069920/html/. See also, Barry M. Leiner, Vinton G. Cerf, David D. Clark, Robert E. Kahn, Leonard Kleinrock, Daniel C. Lynch, Jon Postel,

Larry G. Roberts and Stephen Wolff, *A Brief History of the Internet*, available at http://www.isoc.org/internet/history/brief.html.

[13] Economists refer to positive network externalities when the cost incurred by a user of the Internet does not fully reflect the benefit derived with the addition of new users and points of communications. See, e.g., Joseph Farrell & Garth Saloner, Standardization, Compatibility and Innovation, 16 *Rand Journal of Economics*, 70, (1985); Michael L. Katz & Carl Shapiro, Network Externalities, Competition and Compatibility, 75 *American Economics Review*, 424, 426 (1985). Positive network externalities refer to an accrual in value, including increased access to information, increased ease of communication, and a decrease in a variety of transaction and overhead costs. See United States v. Microsoft Corp., 84 F. Supp. 2d 9, 20 (D.D.C. 1999) (findings of fact) ("A positive network effect is a phenomenon by which the attractiveness of a product increases with the number of people using it."); "Network effects, also known as positive network externalities, arise when the value of a network increases with the number of its users. A single firm, perhaps because it is the first mover, becomes or threatens to become the only supplier of certain products or services because of the value of compatibility or interoperability. Consumers are more likely to remain with the established network because of their sunk costs (sometimes referred to as "lock-in") and suppliers of complementary products will tailor those products to the established network and resist preparing products for would-be challengers." Robert Pitofsky, Antitrust Law Journal 2001 Symposium: Antitrust at the Millennium (Part II) Challenges Of The New Economy: Issues at the Intersection of Antitrust and Intellectual Property, 68 *Antitrust Law Journal*, 913, 916 (2001).

[14] "The [National Science] Foundation designated a series of Network Access Points ('NAPs')--on ramps--by which private commercial Internet providers could 'interconnect' to the backbone." Julian Epstein, A Lite Touch on Broadband: Achieving The Optimal Regulatory Efficiency in the Internet Broadband Market, 38 *Harvard Journal on Legislation*, 34, n. 34 (Winter, 2001).

[15] Bill and Keep and Sender Keep All pre-date ISP usage. Telecommunications carriers use these terms to refer to an traffic interconnection and routing arrangement where no monetary transfer takes place. For example, two local exchange carrier may agree to accept the traffic of each other to achieve a broader local, toll-free geographical service area. Local exchange carriers typically agree to hand off and receive traffic at a "Meet Point."

[16] "NSF had already begun funding cooperative private-sector Internet research and development in 1986 and continued to do so on an increasingly large scale until 1995." A. Michael Froomkin, Wrong Turn in Cyberspace: Using ICANN To Route Around The APA and the Constitution, 50 *Duke Law Journal*, 17, 19 (2000).

[17] *See* Dr. Tim Kelly, When and Where Will IP Overtake Voice?, a Powerpoint presentation at TeleNor Carrier Event (29 Aug-1 Sept. 2000), available at http://www.itu.int/ITU-D/ict/papers/.

[18] Even for policy and standard setting areas dominated by Netheads, the stakes and complexity of issues has created the need for greater specificity, permanence and formality. *See, e.g.*, Jonathan Weinberg, ICANN and the Problem of Legitimacy, 50 *Duke Law Journal*, 187 (2000); David R. Johnson &

David G. Post, And How Shall the Net Be Governed?: A Meditation on the Relative Virtues of Decentralized, Emergent Law, in *Coordinating the Internet*, 62-91 (Brian Kahin & James H. Keller eds., 1997); David G. Post, Governing Cyberspace, 43 *Wayne Law Review*, 155, 157 (1996); David R. Johnson & David Post, Law and Borders--The Rise of Law in Cyberspace, 48 *Stanford Law Review*, 367, 1367-1402 (1996).

[19] More specifically Ethernet inventor Bob Metcalfe came up with a formula to represent the increasing value of expanding networks: "The power of a network is N squared, where N is the number of nodes . . .. The reason [for squaring] is that the network gets more valuable to me if you come on it." Stephen Segaller, *Nerds 2.0.1: A Brief History of the Internet*, 283 (1998); *see also* George Gilder, Metcalfe's Law and Legacy, Forbes ASAP, Sept. 13, 1993, at 158, 160; Mark A. Lemley and David McGowan, Legal Implications of Network Economic Effects, 86 *California Law Review*, 479, 483-84 (1998).

[20] The leading directory of ISPs reports that as of March 2001, 7,288 ISPs in North America registered with it. *See* Todd Judd Erickson, *Introduction to the Directory Of Internet Service Providers*, 13th Edition, available at http://www.ispworld.com/isp/Introduction.htm.

[21] Free riders take advantage of opportunities to avoid or reduce expenses by foisting costs onto others.

[22] "Internet backbone providers ('IBPs') and ISPs can generally exchange traffic directly through one of two interconnection arrangements: 'transit' or 'peering.' Through 'transit' service, an ISP, small IBP, or other corporate customer purchases a dedicated access facility linking it directly to the transit provider's Internet backbone network. That transit service provides the purchaser full Internet connectivity, i.e., the ability to send and receive traffic through the purchaser's IBP to any other network or destination on the Internet. Under a transit arrangement, the customer pays a fee for the connection in addition to the fee paid for transit service. A transit provider does not pay any fee for access to its transit customers' networks." United States of America v. WorldCom, Inc. and Sprint Corporation, paragraph 23 (opposing the merger of Sprint and MCI Worldcom) *reprinted in* Sean Lindsay, A. Douglas Melamed and Sharon J. Devine, Antitrust Issues In The Converging Telecommunications Industry: Mergers, Intellectual Property and Competition - Domestic and International, 645 PLI/Pat 537 (March 2001).

[23] Hot potato routing involves both a routing strategy and routing agreement among ISPs. In the former, a free ridership opportunity may arise: "The 'hot-potato routing' that characterizes peering arrangements may also lead to actual or perceived free-riding, as a result of the decision on the part of some backbones to specialize in providing service mainly to one type of customer, such as content providers. . . Suppose that ISP Y, a customer of backbone B, provides service mainly to content providers, while ISP X, a customer of backbone A, provides service mainly to end users. Given hot-potato routing, when a end user customer of ISP X requests content that is hosted by ISP Y, backbone B will carry the request from the East coast to the West coast, while backbone A would carry the requested content back from the West coast. As a rule, content such as Web pages involve more bits of data than the corresponding requests for the content. Therefore, backbones such as A that carry the Web pages would transport more traffic than would backbones such as B that carry the requests for these Web pages. Backbones may thus refuse to peer with backbones hosting a high proportion of content providers on the grounds that they are bearing the

expense for more capacity than the backbone that is actually hosting the content that utilizes this capacity." Michael Kende, *The Digital Handshake: Connecting Internet Backbones*, p. 19, Federal Communications Commission. Office of Plans and Policy's Working Paper Series No. 32 (Sep. 2000), available at http://www.fcc.gov/Bureaus/OPP/working_papers/oppwp32.pdf
In the latter ISP peers agree to "pass traffic to another backbone at the earliest point of exchange. As an example, . . . backbones A and B are interconnected on the West and East coasts. When a customer of ISP X on the East coast requests a web page from a site connected to ISP Y on the West coast, backbone A passes this request to backbone B on the East coast, and backbone B carries this request to the West coast. Likewise, the responding web page is routed from backbone B to backbone A on the West coast, and backbone A is responsible for carrying the response to the customer of ISP X on the East coast." Id. at 5-6.

[24] In 2000 incumbent local exchange carriers serve 95.4% of the residential and small business consumers in the United States. Federal Communications Commission, Local Telephone Competition, (May 2001), available at
http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/lcom0501.pdf.

[25] The Federal Communications Commission reported that in 1999 Competitive Access Providers and Competitive Local Exchange Carriers accrued 4.1% of all local service revenues, with resellers and other alternative carriers accruing an additional 0.5% percent. See Federal Communications Commission, Common Carrier Bureau, Industry Analysis Division, *Trends in Telephone Service*, August 2001, Table 9.6, Nationwide Local Service Revenues and New Competitors' Share, p. 9-8, available at http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/trend801.pdf.

[26] *See* Federal Communications Commission, Common Carrier Bureau, Telecommunications Act of 1996 Section 271 Long Distance Application Summary of 14 Point Competitive Checklist (1999), available at http://www.fcc.gov/Bureaus/Common_Carrier/News_Releases/1999/nrc9101b.html.

[27] *See* Milton Mueller, ICANN and Internet Governance Sorting Through the Debris of 'Self-regulation,' 1 *Info*., No. 6, 497-520 (Dec. 1999)(arguing that Internet self-regulation involves policy issues subject to government regulation).

[28] Proposed Congressional legislation would authorize the Bell Operating Companies provide high speed data and Internet services on an unregulated basis and without having to comply with terms and conditions established in the divestiture of the AT&T Bell System, including the 14 point competitive check list to ensure full and fair local exchange competition. *See* 107th Congress, 1st Session, H.R. 1542, Internet Freedom and Broadband Deployment Act of 2001, introduced April 24, 2001, current status available at http://thomas.loc.gov/cgi-bin/cpquery/R?cp107:FLD010:@1(hr083); *see* especially, House Rpt. 107-83 Part 1 - INTERNET FREEDOM AND BROADBAND DEPLOYMENT ACT OF 2001, available at ftp://ftp.loc.gov/pub/thomas/cp107/hr083p1.txt
and House Rpt. 107-83 Part 2 - INTERNET FREEDOM AND BROADBAND DEPLOYMENT ACT OF 2001, available at ftp://ftp.loc.gov/pub/thomas/cp107/hr083p2.txt. The proposed legislation would amend the Communications Act of 1934 to define "high speed data service" as a service capable of transmitting

electronic information at a rate generally not less than 384 kilobits per second in at least one direction. The bill would prohibit the FCC and state public utility commissions from regulating the rates, charges, terms or conditions for, or entry into the provision of, any high speed data service or Internet access service, or to regulate the facilities used in the provision of such service. Additionally, the proposed legislation would prohibits the FCC from requiring an ILEC to: (1) provide unbundled access to any network elements used in the provision of any high speed data service, other than those elements described in FCC regulations; or (2) offer for resale at wholesale rates any high speed data service. However, the bill does establish quasi-common carrier interconnection and access obligations on ILECs.

[29] *See* AT&T Corp. v. City of Portland, 43 F.Supp. 2d 1146 (D. Ore. 1999)(municipality's approval of a cable television franchise ownership transfer conditioned on open access to multiple ISPs preempted by FCC regulation of telecommunications services).

back to index

Abstract

This paper assesses the marketplace and regulatory consequences when information communications and entertainment markets converge. The paper identifies commercial developments in the Internet to support the view that incumbent telecommunications carriers now control the Internet at least insofar as the terms and conditions for access among networks. The paper suggests that incumbent telecommunication operators ("Bellheads") have outmaneuvered new information and Internet ventures ("Netheads") through ownership of both the major long haul backbones and first and last mile local links.

back to index

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Rob Frieden serves as Professor of Telecommunications at Penn State University where he teaches courses in management, law and economics. He also provides legal, management and market forecasting consultancy services in such diverse fields as personal and mobile communications, satellites and international telecommunications business development. Professor Frieden has written several books, published dozens of articles in academic journals and provided commentary in a variety of trade periodicals. In 1999, Professor Frieden and three colleagues completed a ten year project culminating in publication of a three volume comprehensive treatise on communications law. His most recent book, Managing Internet-Driven Change in International Telecommunications provides a comprehensive, 480 page examination of converging information, communications and entertainment technologies.

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back to index

Monday, 14 January 2002
1600–1730
Coral II

M.2.5 Regulation in Converging Markets

Chair:
LIZ WILLIAMS, Director, AAS Consulting, *Australia*

M.2.5.1 Regulating Broadband Networks Now that Deployment is a Reality

MICHAEL REEDE, Partner, Paul Weiss Rifkind Wharton & Garrison, Hong Kong SAR, *China*

M.2.5.2 Regulation of Evolving Utilities Companies as "Traditional Telcos"

PETER BURGE, Partner, Deacons Grahams & James, *Hong Kong SAR, China* and EMILY LUK, Trainee Solicitor, Deacons, Graham & James, *Hong Kong SAR, China*

M.2.5.3 Comparison of Official Bodies Established to Address the Convergence of Telecommunications, Broadcasting and IT in Asia Pacific (View Abstract)

KUNDAN MISRA, Product Strategist, Clarity International, *United Kingdom*

M.2.5.4 Policy, Regulation and Issues of Network Convergence in China (View

Abstract)

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back to sessions

Conference Sessions

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Michael Reede is a partner of Paul, Weiss, Rifkind, Wharton & Garrison, resident in the Hong Kong office and a Hong Kong registered Foreign Lawyer. He is a member of the firm's Communications and Technology Group, and was previously a partner of a leading telecommunications law firm in Australia.

Mr. Reede has worked extensively throughout the Asia Pacific region assisting fixed and mobile telecommunications carriers, pay television operators, broadcasters, software developers, Internet and e-commerce providers and industry regulators. He advises clients on joint ventures, acquisitions, capital raising, venture capital transactions, general commercial transactions, major capacity and content acquisition, regulatory strategy, communications market liberalization, competition law, Internet regulation and intellectual property.

Mr. Reede has worked on major communications projects in Hong Kong, Australia, Singapore and South Africa, including a variety of substantial joint ventures, national integrated communications service and infrastructure investments, license tenders and auctions, network financing and rollout, global network service arrangements, broadband wireless network deployment, government license negotiations and policy proceedings.

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His significant representations include advising Hong Kong's largest carrier on its transition to a fully liberalised market, including extensive negotiations with the Government of the HKSAR that resulted in a restructuring of Hong Kong's telecommunications sector; advising U.S.-based clients on the establishment of Australia's first broadband HFC network; advising broadband and cellular mobile carriers in Australia on transactions and major regulatory proceedings; acting for a major European carrier in relation to its investments throughout the Asia Pacific Region; advising the South African telecommunications regulator; and representing major Internet portal providers, financial institutions, telecommunications carriers and media companies in relation to their Internet business plans and joint ventures.

A graduate of the University of New South Wales, with a post graduate Master of Arts degree in Asian studies, Mr. Reede is a frequent speaker at communications industry conferences and a contributor to publications in the fields of communications law and regulation. He has been identified as a leading communications law practitioner for the last four years in Asia's Leading Lawyers and is listed as a leading communications lawyer in Chambers Global 2000-2001, the European Counsel Global Communications Industry Report 2000, Euromoney's Guide to the World's Leading Telecommunications Lawyers 2000 and Australia's Legal Profiles.

back to index

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- Interconnection, access and peering arrangements
- Content and distribution agreements
- Global outsourcing and industry specific commercial arrangements and documentation
- Competition and anti-trust law

Mergers and Acquisitions

- Takeovers
- Single jurisdiction and cross-border acquisitions of public and private companies
- Venture capital, strategic and direct investments
- Joint ventures

Corporate Finance

- Public listings, placements and underwritings
- Listing rules, compliance and advice

Publications/Articles

"Surrender by HKTI of its international licence", *Asia Law*, February 1998.

"The Role of Competition Law and Dominant Player Regulation Markets; Developing Telecommunications and Related Industries: An Asian Perspective." *Asian Lawyer*, September 1999 and paper abstract at 16th Annual LAWASIA Conference, Seoul, Korea.

"The Deacons' Guide to Telecommunications in Asia", co-author, *Asia Law & Practice*, January 2001.

Languages

English

back to index

Abstract

Official government bodies set up in the Pacific Rim and in the European Union ("EU") will be considered and compared. The EU is introduced for comparison only. In the Asia-Pacific area, several countries have largely replaced their separate regulatory agencies for telecommunications, broadcasting and IT with a single body. Malaysia's "Vision 2020" is visibly underway with the Multimedia Supercorridor initiative, resulting in the landmark Communications and Multimedia Act 1998. The Malaysian government has merged broadcasting, telecommunications and other online services into the Department of Information. Singapore has its convergence vision embodied in the "IT2000 Masterplan" leading to the establishment of Singapore ONE. Chinese Taipei's Asia-Pacific Regional Operating Centre ("APROC") goal has telecommunications as one of its seven legs. Through APROC, Chinese Taipei aims to become a telecommunications regional operating centre for the Asia-Pacific. APROC documents show a belief that capitalizing upon convergence is key to Chinese Taipei's achieving this aim. Convergence is at the heart of Chinese Taipei's National Information Infrastructure ("NII") programme. The NII is headed by the NII Steering Committee, which directs a slew of bodies to realize the NII, such as the Institute for Information Industry and the Chung Shan Institute of Science and Technology. Australia has not set up any official body focused on convergence. However, Australia's federal Department of Communications, IT and the Arts ("DCITA") has emphasized digital television, which has been reflected in policy through high-definition television ("HDTV"). Developing countries in the Asia-Pacific area such as Thailand are notable in their efforts to expand basic telecommunications infrastructure in a way that is consistent with an eventual converged communications infrastructure. The differences in approach to convergence reflect the political climate of the country or union under consideration, as well as constraints imposed from within. Examples of such constraints are powerful interest groups in the case of Australia. It is of course largely a combination of technology, technology vendors, carriers and standards bodies such as the ITU-T that are driving convergence. The dissonance between these bodies, which are driving convergence, and the approach taken by different countries will affect the extent to which those countries are able to deliver the benefits of convergence to consumers and businesses.

back to index

Conference Sessions

Kundan Misra

Kundan Misra has been a telecom industry analyst with Clarity International for 18 months – for 6 months based in Australia and for the last 12 months in the UK. He is presently halfway through his PhD in Theoretical Computer Science. He has a degree in Pure Maths and a Bachelor of Laws from the University of Sydney. His business background includes several software and other technical project management roles, and business process reengineering for EnergyAustralia (where he developed groundbreaking call centre management tools). He has been published in such forums as the 2001 European Summer School for Logic, Language and Information in Helsinki and the industry magazine CommunicationNews. He is presently under contract with McGraw-Hill to write the technical/professional book "OSS for Telecom Networks: A Provider's Guide to Network Management", due for completion December 2002.

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back to index

Conference Sessions

Abstract

This paper presents the market model of various services provided by the telephone, data, and media (TV) networks in China. The model is based on the telecom regulation of network convergence that is being constituted. The issues and paths of convergence are discussed as well as the ways foreign and Chinese-based companies can enter the market.

back to index

Conference Sessions

Prof. Zhu Qiliang

On graduating in telecommunication from Moscow Institute of Telecoms in 1961, he joined Beijing University of Posts and Telecommunications (BUPT). From 1984 to 1987 he worked in Engineering Department of ALCATEL BELL in Antwerp, Belgium, participating in software design for distributed telephone switching system and software testing.

Professor Zhu has lectured widely on Telecommunications and Computer Software since 1961. Being a member of IEEE, his major research work is directed to the network management system of mobile communication and enterprise operation support system.

At present, Professor Zhu is president of Wholewise Information Research Institute.
Professor Zhu was nominated as International Man of the Year 1991/1992 in recognition of the services to management and education by the International Biographical Center of Cambridge, England.

Professor Zhu was also included in the International Directory of Distinguished Leadership (fourth edition) for achieving great standing in profession and community by the American Biography Institute, Inc in 1992.
In 1996, he honorably received the Lifetime Award for management leadership by American Biographical Institute, Inc.

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back to index

$ Economics & Financing

Monday, 14 January 2002
1400–1530
Tapa III

M.1.6 Fostering and Sustaining an Innovation Economy in Washington State

Chair:
LOUIS FOX, Vice-Provost, University of Washington, *USA*

Speakers:

Fostering Innovation
SUSANNAH MALARKEY, Executive Director, Technology Alliance, *USA*

Building Washington's Reputation as a Technology Leader
MARTIN SMITH, Partner, Preston, Gates & Ellis LLP, USA

Creating a Quality K-20 Education System
LOUIS FOX, Vice-Provost, University of Washington, *USA*

Business, Education, Government & Philanthropy: Working Towards the Common Good
BRYAN CHEE, Director, Smart Tools Academy, *USA*

Washington State has adopted a regional approach to sustaining and strengthening the region's technology economy – what is often referred to as the "innovation economy." Such a strategy has required a strong partnership among the business, education, and governmental sectors. This session will explore this partnership, highlighting its priorities and its projects. The panel, made up of representatives from all of the sectors above, will give a brief history of this partnership and an overview of its priorities and recent projects.

back to sessions

$ Economics & Financing

Monday, 14 January 2002
1600–1730
Honolulu Suite

M.2.6 Alliances & Strategies for Corporate and National Development

Chair:
ROBERT FRIEDEN, Professor of Telecommunications, Pennsylvania State University, *USA*

M.2.6.1 New Models for Network Deployment and Financing—The Impact of Global Trends (View Abstract)

PETER WATERS, Partner, Arcull & Associates/ Gilbert & Tobin, *Hong Kong SAR, China* and ROB SIMPSON, Partner, Gilbert & Tobin, *Australia*

Presenter:
ROB SIMPSON, Partner, Gilbert & Tobin, *Australia*

M.2.6.2 Developing Telecom Infrastructure in West China (View Abstract)

MIN YI, Analyst, Asia-Pacific, Ryan Hankin Kent, *USA*

back to sessions

Rob Frieden

Rob Frieden serves as Professor of Telecommunications at Penn State University where he teaches courses in management, law and economics. He also provides legal, management and market forecasting consultancy services in such diverse fields as personal and mobile communications, satellites and international telecommunications business development. Professor Frieden has written several books, published dozens of articles in academic journals and provided commentary in a variety of trade periodicals. In 1999, Professor Frieden and three colleagues completed a ten year project culminating in publication of a three volume comprehensive treatise on communications law. His most recent book, Managing Internet-Driven Change in International Telecommunications provides a comprehensive, 480 page examination of converging information, communications and entertainment technologies.

Before accepting an academic appointment, Mr. Frieden served as Deputy Director International Relations for Motorola Satellite Communications, Inc. In this capacity, he provided a broad range of business development, strategic planning, policy analysis and regulatory functions for the IRIDIUM mobile satellite venture.

Mr. Frieden has held senior policy making positions in international telecommunications at the Federal Communications Commission and the National Telecommunications and Information Administration. In the private sector, he practiced law in Washington, D.C., and served as Assistant General Counsel at PTAT System, Inc. where he handled corporate, transactional and regulatory issues for the nation's first private undersea fiber optic cable company.

Mr. Frieden holds a B.A., with distinction, from the University of Pennsylvania (1977) and a J.D. from the University of Virginia (1980).

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back to index

New Models for Network Deployment and Financing the Impact of Global Trends

Peter Waters and Rob Simpson [1]
Gilbert & Tobin
Hong Kong and Sydney

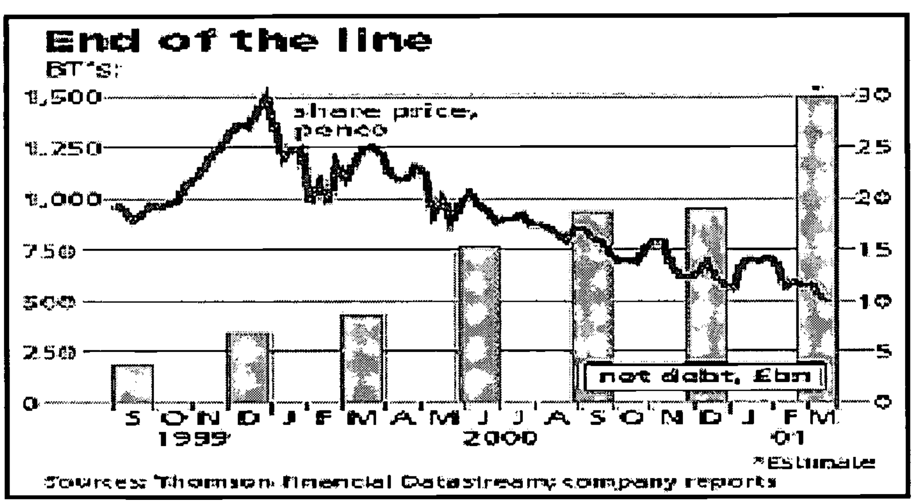
(View Abstract)

Introduction

The global telecommunication industry is (yet again) going through a major, very painful upheaval. The confidence of financial markets in the industry has collapsed, carriers are struggling under mountains of debt, and long held assumptions policy are being turned on their head. As Larry Summers, the former US Treasury Secretary has said "you can move from irrational exuberance to irrational gloom" [2]

The upheaval in telecommunications markets is illustrated by the fate of British Telecom, which has been regarded as being one of the most successful incumbents in making the transition from monopoly to a competitive environment:

Figure 1



BT was caught in a "damned if you do/damned if you don't" position: the markets would have punished it for failing to secure 3G spectrum but punished it anyhow for paying the high auction prices necessary to get the spectrum.

As we discuss in this paper, the problems run deeper than the temporary dislocation caused by the "tech wreck". There seem to be fundamental underlying industry changes, which call for new models for the deployment, financing and operation of network infrastructure.

Trends in Global Telecommunications Markets

Telecommunications markets globally are facing a "capital revolt" by major investors which is affecting incumbents and the "first generation" of new entrants alike:

"The communications industry is witnessing a rapid value migration phenomenon that is fundamentally reshaping the relative position of all businesses in the industry. Value migration is characterised by the flow of economic and shareholder value from businesses with increasingly outmoded designs — including those of incumbents, fully integrated second entrants, traditional mobile operators and some Internet ventures — to businesses with new designs that are better configured for creating customer utility and company profitability. Trailblazer operators with radical new business designs are winning against both incumbents and traditional second entrants, and are increasingly dominating the fixed-line, mobile and Internet sectors."[3]

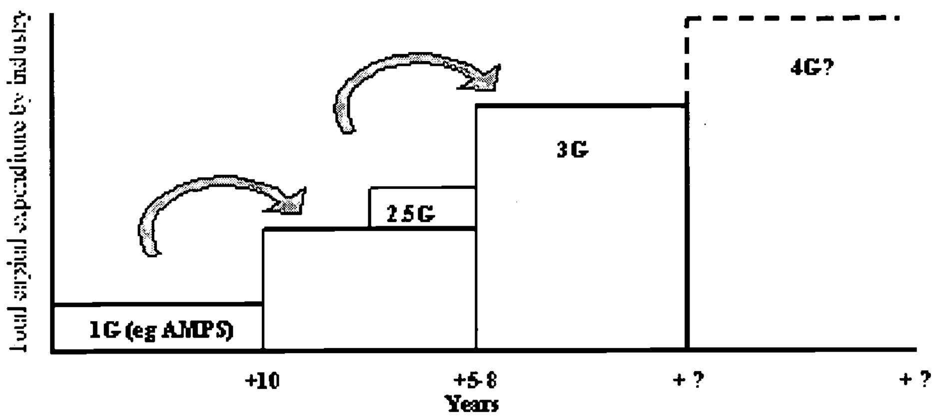
The main trend has been a shift away from the full service model, which was, for both former monopoly carriers and new entrant carriers, the basic assumption underlying their business cases. Integrated fixed and mobile networks and telephony and IP networks were seen as offering opportunities for economies of scope and scale and for innovative bundled products. Now the reigning theory is specialist carriers, with the mobile-only Vodafone as the primary and most successful example:

"The telecoms giants have believed, as an article of absolute faith, that huge scale and vertical integration would be critical advantages in the battle against entrepreneurially nimble challenges. All reckoned that sheer size would help them to dictate the pace of technological change. In particular, they thought it would allow them to manage a gradual transition from their legacy circuit-switched voice networks to data networks based on Internet Protocol (IP) standards. Yet almost all now trade at a discount to the sum of their past, a clear sign that investors no longer believe in the virtue of science." [4]

It has always been well understood that telecommunications requires huge fixed, sunk and irreversible capital investment, which makes it a high risk undertaking. In the days when telecommunications technology was relatively stable, most of the pain was over once the initial investment was made and, with some ongoing upgrading, networks had a life span of 8 to 15 years or more.

However, we are now facing successive waves or generations of network technology, particularly in mobile services. Operators are required to invest in new generation networks before they have recouped their investment in the current network infrastructure. As a result of this phenomenon of "serial" networks, capital expenditure into telecommunications is now fixed, sunk, irreversible and **recurrent**. This trend is depicted below in relation to mobile networks:

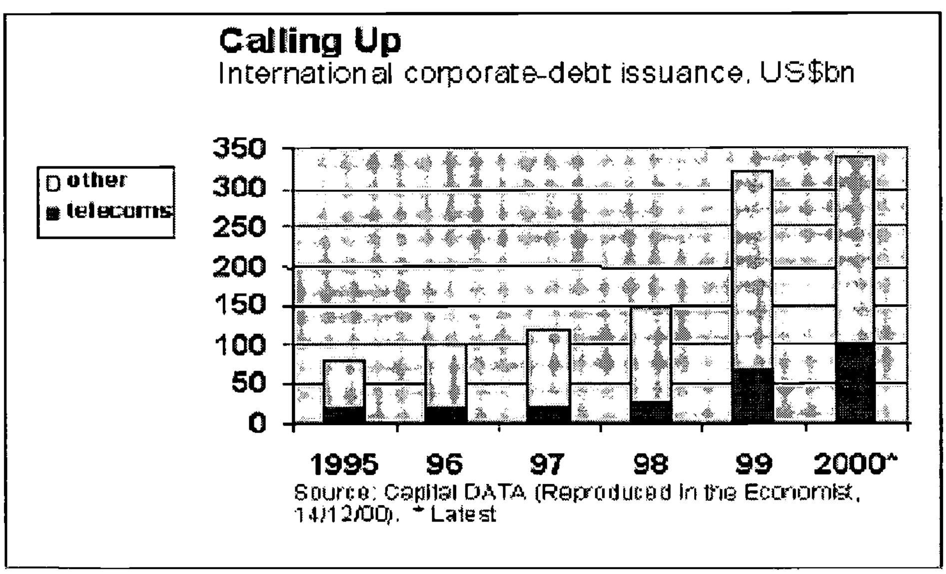
Figure 2. SERIAL NETWORKS



Even if the operator has recouped all or most of the current investment in its current network, the imperative to migrate from one generation of technology to another provides the opportunity for Governments to "punch the ticket" again and collect further payments for spectrum from operators. The temptation to see spectrum as a substantial revenue opportunity has persisted even notwithstanding the subsequent fall out from the high prices paid in the European auctions. The Hong Kong Government decided to use a royalty based mechanism in which bidders would bid for spectrum based on a royalty amount calculated against the connectivity revenue. The Government said it was adopting the royalty to avoid the burden of the huge upfront cash payments seen in the European auctions. However, as the rules were developed it became apparent that, despite its protestations, revenue rasing remained a strong motivator. The minium royalty was set at 5 per cent and at 7.5 per cent rate, a Hong Kong licence would be worth more than two and a half times the cost of a 3G licence in Australia.

The impact of funding technology is seen from the following table, which shows how telecommunications is accounting for an escalating proportion of total global capital:

Figure 3. CARRIER DEBT



These forces are driving changes in how networks are built and owned by operators, and even more fundamentally, challenging the assumption about whether multiple networks need to be built at all. This strikes at the primary philosophy of infrastructure-based competition, which has underpinned deregulation in many countries, and a number of regulators are distinctly unhappy with this direction.

New Models for Building Networks

(a) The Virtual Operator

A striking change over the last 18 months has been the emergence of the "virtual network" (**VNO**) model, which allows an operator to have the economic, technical and operational attributes of a carrier without the need to make a substantial investment in network infrastructure.[5]

MVNOs should appear to end users, to all intents and purposes, to be an independent mobile network operator. Unlike mobile network operators, however, MVNOs do not have a governmental licence to use radio spectrum, but have access to one (or, in theory, perhaps more) of the radio elements of a mobile operator and are able to offer services to subscribers using such elements. At minimum, these radio elements are:

the radio transmission link, its control functions and the mobility management functions that keep track of exactly where mobile handsets are located so that calls can be delivered to them; and

some transmission and switching facilities needed to link the radio facilities to the points of interconnection, either with the MVNOs' systems direct, or with transit network operators.

An MVNO differs from a reseller, and mimics a carrier, in three ways. First, as the MVNO is acquiring a virtual network, the charges for the network capacity should be at a level, which places the MVNO in substantially the same position as it would have been if it had built its own network. This usually will mean that the MVNO charges are substantially below retail charges and existing reseller charges.

Second, as the MVNO is using a virtual network, the MVNO will pay for each and every time its subscribers use the network. Just as with the network operator, the MVNO must incur cost whether the call is originated by the MVNO customer or is received by the MVNO customer. The MVNO, therefore, will pay for inbound calls even if retail customers (and therefore resellers) do not pay for inbound calls.

Third, the MVNO is also entitled to any inbound call termination revenue from operators terminating calls to MVNO subscribers. As the MVNO charge paid to the network operator is usually lower than the mobile terminating charge, the result in practice is the MVNO gets to share in inbound termination revenue.[6]

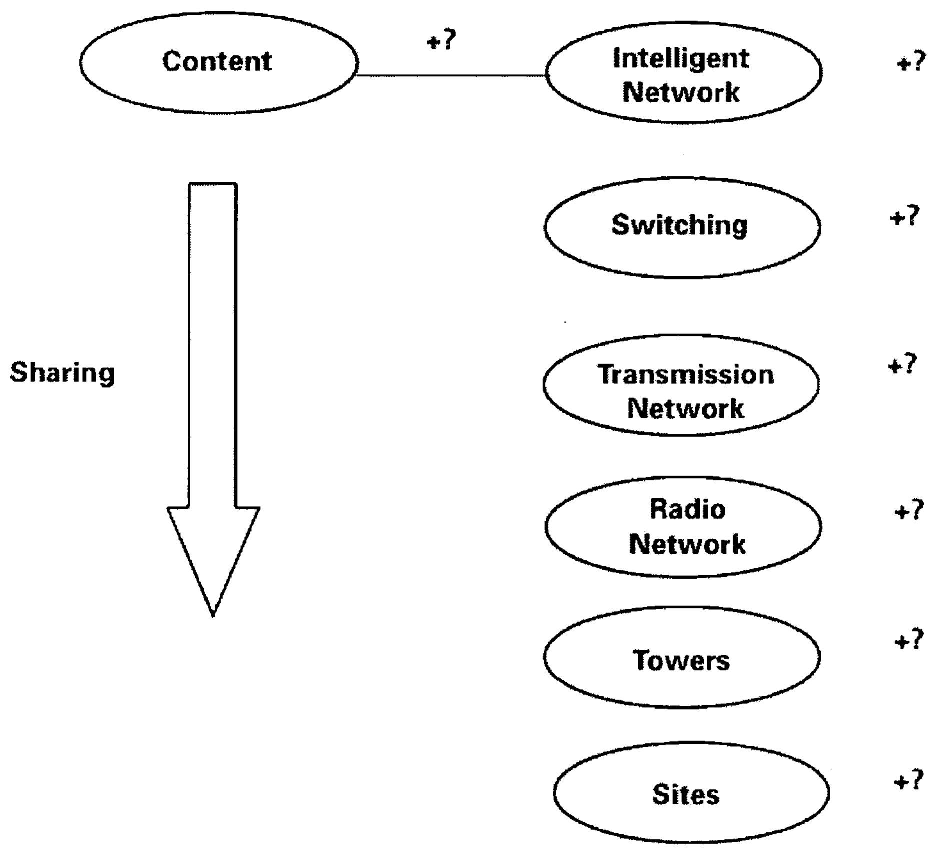
MVNOs have mainly been commercially negotiated with the MNO holding an equity stake. Virgin Mobile has established an Asia-wide MVNO with SingTel, a UK MVNO with DT/One2One and an Australian MVNO with SingTel/Optus. However, Hong Kong has mandated MVNOs in its 3G auctions. The successful bidders for 3G spectrum are required to make up to 30 per cent of their network capacity available for MVNOs, and OFTA will retain a reserve power to arbitrate in the event that the network operator and the MVNO cannot agree on terms. OFTA will determine MVNO charges based on long run incremental costs, the first time the cost model developed for incumbent fixed networks has been comprehensively extended to mobile networks and newly built network infrastructure.

(b) The Big Guys Get Involved

The move to de-emphasis infrastructure ownership has got its biggest boost from the co-operative arrangements between 3G operators in Europe as they seek ways of reducing the huge burden of the cost of spectrum. While the operators would be reluctant to describe these arrangements as MVNOs, they involve many similar elements, although as a horizontal relationship between carriers rather than as a vertical supply relationship. However, unlike with the "pure" MVNO model, these arrangements involve the participants owning, jointly or individually, infrastructure.

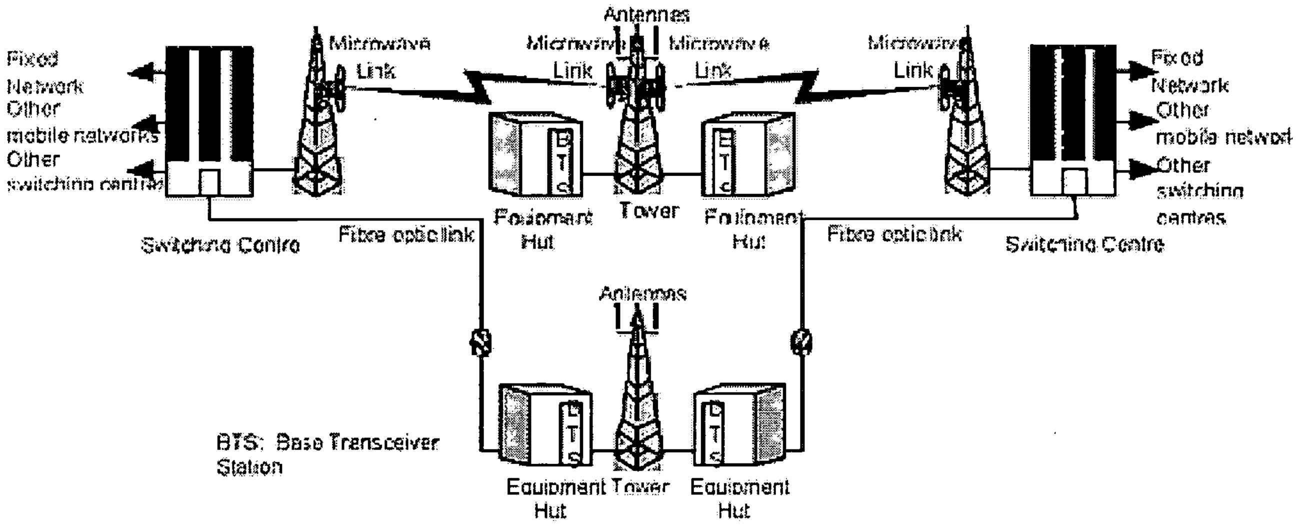
The threshold question for 3G operators (and for regulators in approving these arrangements) is how far down in the vertical lawyers of the network to share:

Figure 4. POTENTIAL SHARED ELEMENTS



The first model is the fairly familiar approach of tower and site sharing. In the past these arrangements were usually site by site, but 2 operators may now agree to allocate site location and construction responsibilities in different parts of a country between different countries. The BT-DT arrangement seems to involve sharing of towers and sites between Germany and the United Kingdom.

Figure 5. COMPREHENSIVE TOWER SHARING



Under this model, each operator acts as the other operator's "tower co" in designated areas. The benefits are not only the actual access to the site, but the "local" knowledge and contacts, which comes with the experience of having built a site in the location in the past. The operators continue to build (and fund) separate antenna, Mode Bs, backhaul and core networks. Hence, while achieving some significant savings, and reducing environmental concerns, each operator still must expend considerable capital building its own networks.

As sites can vary between areas and even within each area is value (usually measured not only as the cost of the ground rent but also the difficulty of replicating the site for environmental reasons), it can be difficult to work out the charging mechanism between the operators. There will need to be incentives to ensure that each puts as much effort as the other into finding and developing sites. One approach may be a "knock for knock" approach in which a high balancing charge is payable when one party shares more sites than it provides for sharing. However, it is important to construct these charges (and the notional charges for the sites which are netted off against each other) to preserve the ability for tax purposes to recognise a charge and to depreciate the investment in the site.

The second model involves construction of a shared radio network (or UTRAN). The towers, antennas, Mode Bs and backhaul are shared as a common network. Traffic of both operators is pooled over the UTRAN and is only disaggregated at the MSC level.

Figure 6. SHARED RADIO NETWORK

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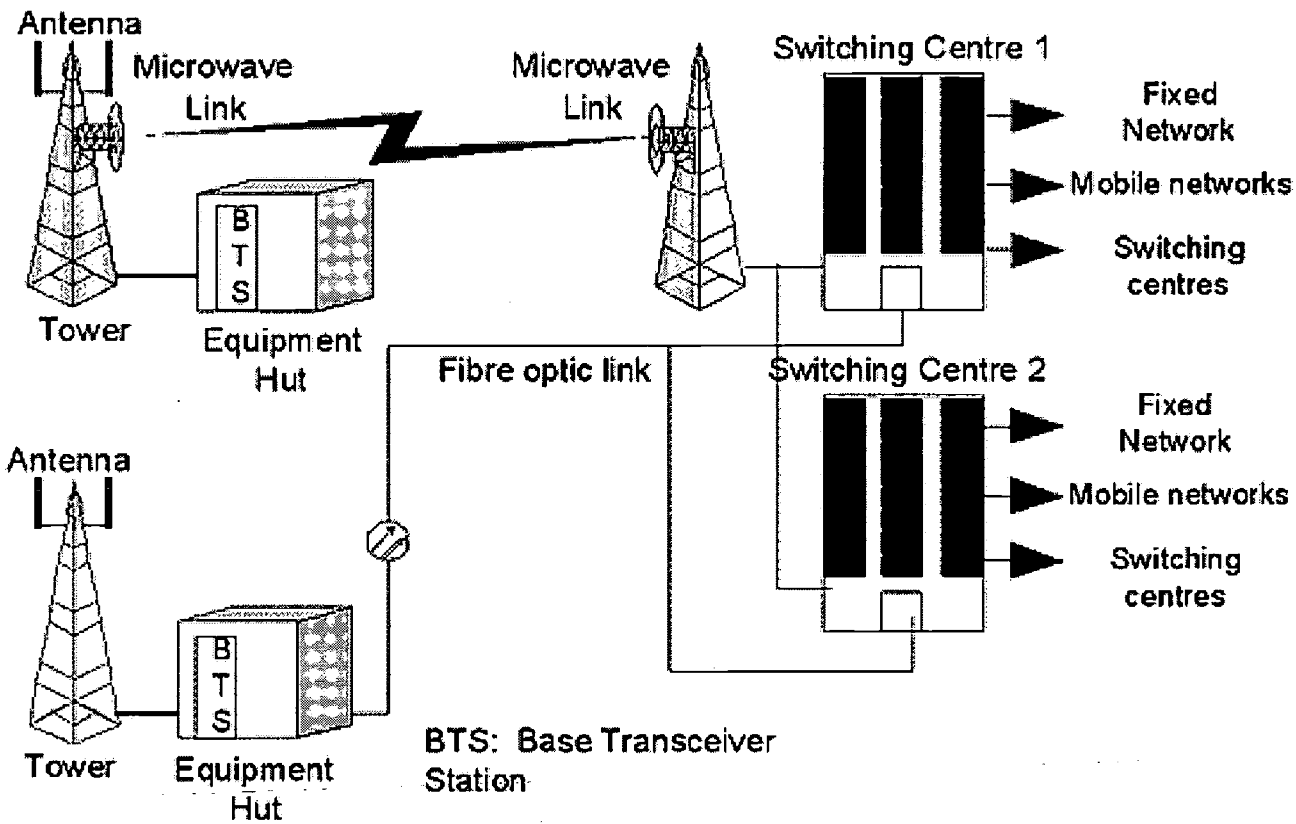


This model involves substantial sharing in infrastructure costs, with the UTRAN representing 80 percent or more of total costs. The two carriers operate as virtual operators, in much the same way as MVNOs, connected to a commonly owned and operated MNO. The arrangements between Hutchison and Europolitan in Sweden use this model for areas outside the main cities.

Currently, the core networks of each operator would be connected through a MSC within the common MNO, but the vendors are working on a solution which would allow separate core networks to be directed corrected at the Radio Access Mode level.

As this model involves the sharing of local access network connectivity, complex issues arise about how the operators are to deploy and share the network given their interdependence on each other:

- Rate of network rollout: as the network is being built jointly, each party has to be prepared to spend the same amount of capital at the same rate. The parties will need similar capital resources, otherwise one party is held back by the capital constraints of the other party;

- Selection of a common vendor: as it is a single network, the operators will need to select a single vendor for the UTRAN (or radio access node). While connection of different vendor equipment to a common core network is possible, the technical complexities may drive the 2 operators to a high level of common equipment even at the value added level;

- Network capacity: the operators will base their arrangement on an equal sharing of capacity, but this paradigm is unlikely to occur in practice. The operators will not be equally successful. Their relative success may change over time. Capacity demands will respond to marketing campaigns of each operator. There will need to be a mechanism, which allows departure from the 50:50 rule (with a compensating mechanism to the low use operator). One operator may want to expand the capacity of the network faster than the other party, which raises issues about whether one party can force the other party to spend further capital (or suffer a dilution of its equity and/or capacity);

- Functionality: the network functionality, which each operator requires, will depend on the services it is proposing to offer and when those services will be introduced. As competitors, the operators will have different priorities for functionality. They will need to agree on the functionality, which is built into the initial network, and upgrade pathways. Again, there may need to be a mechanism which allows one operator to fund new functionality for its own use to the exclusion of the other party;

- Service quality: as the spectrum cannot be partitioned, the usage of one operator impacts on the quality of service of the whole network, and therefore on the other operator's services. As network management is a dynamic process, there will need to be mechanisms, which allow the network managers to turn down or turn off usage of the operator, which is causing the problem. This obviously reduces the autonomy of each operator;

- Charges: the operators may start with the paradigm that the usage on the network should be "free" to each operator as they are using half each. However, this is an unsustainable approach for economic, regulatory and practical reasons. The network funding will need to come into the jointly owned network company, and it may be better to come in as revenue than as capital because of potential tax and other advantages to the two operators. A "free" charge between the operators and the jointly owned network operator will raise concerns about non-discriminatory treatment of other users of the network and may encourage a low third party access charge. A significant access charge could end up being a real charge for one operator if their traffic is out of balance and one is using more than half of the network capacity;

- Confidentiality: the closeness of the relationship required to run a common network means that each operator will gain an intimate knowledge of the other operator's business and strategy (including the launch of new products where that requires network changes or capacity); and

- Controlling the network company: while the network company is intended to be subsidiary to the 2 operators, there is a risk that the independence of operation from the parents required to achieve a balance between the operators will encourage the development of the network company as a third force, outgrowing its parents.

It would be theoretically possible to partition the spectrum between the joint bidders by using polarisation diversity in antennae. This would enable traffic to be separated at the antennae and individual cell level, with separate nodes, backhaul and MSCs. However, this approach results in a significant loss of efficiency through:

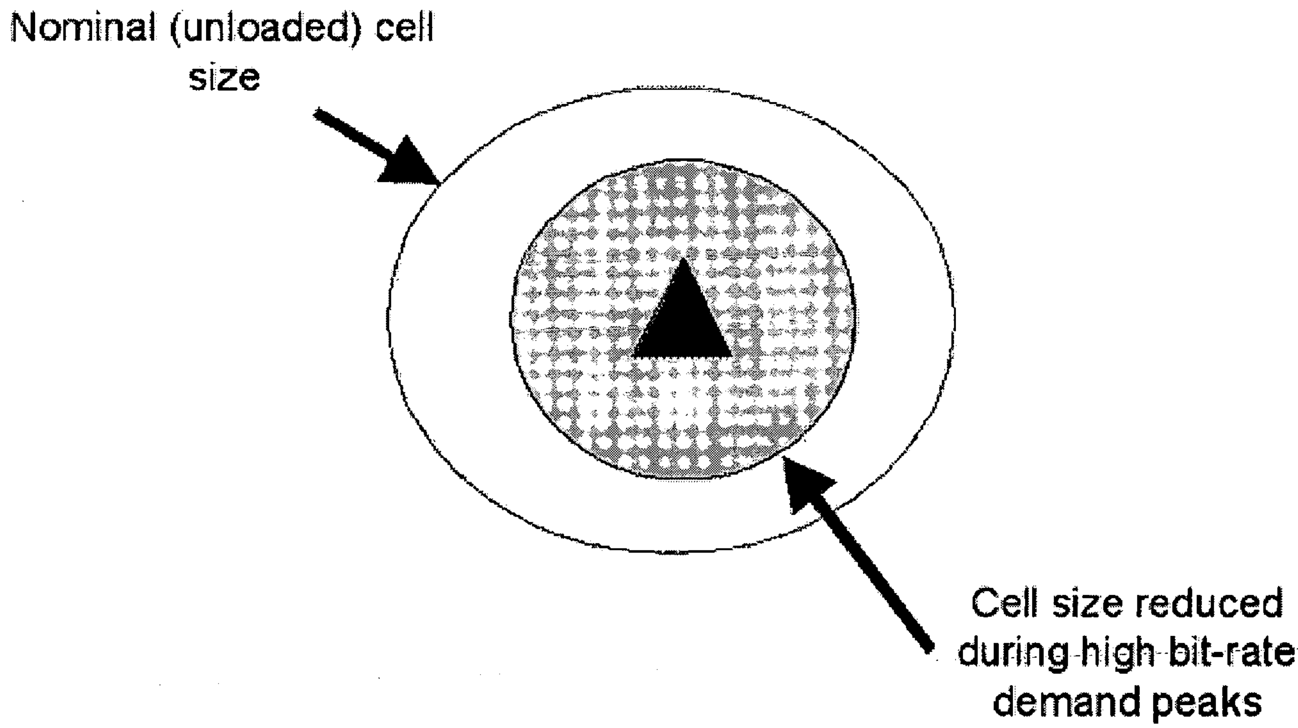
- duplicating trunking;

- inefficiency in use of spectrum (including because the parties' traffic levels will differ from time to time and will rarely be 50:50);

- spectrum inefficiencies compounded by mobility requirements (ie: inter-cell handover is less efficient); and

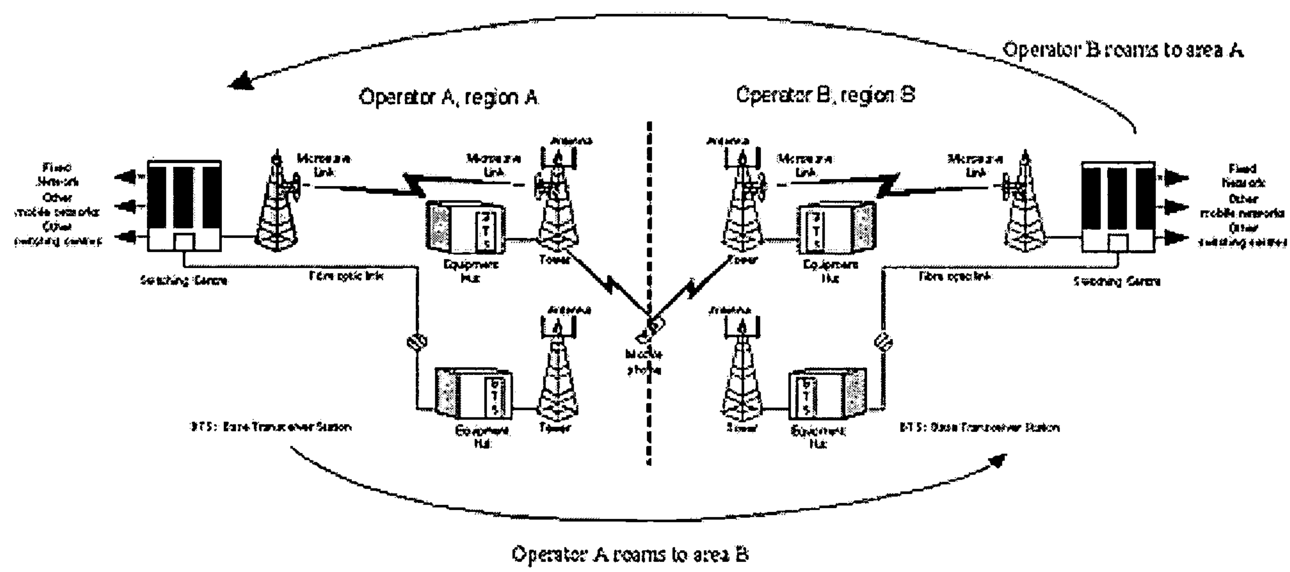
- in 3G, risks of limiting bit rate of advanced services because of accelerated "cell shrinkage" or "cell breathing" as a result of the less efficient use of spectrum by reason of its partitioning. Cell breathing is illustrated below.

Figure 7. CELL BREATHING



The third model involves each operator constructing network in one part of the country and the operators "roaming" on each other's network: the "half network" contributed by each creates a "whole" network.

Figure 8. GEOGRAPHICAL SPLIT PLUS ROAMING



While the use by each operator of the other operator's network is described as roaming, the arrangement more closely resembles an MVNO. Many of the same issues about capacity arise as within model 2. However, there is more balance in the relationship because each operator has an equal amount of network of its own and each is equally dependent on the other. This balance creates a natural circuit-breaker in their relationship: a "do onto others as you would have them do onto you".

The efficiency of this model can be significantly increased if each operator can, in its part of the country, pool its own spectrum and that of the other operator. This allows more capacity to handle joint demand. However, national regulatory restrictions may prevent sharing or subleasing of spectrum, which is the case in many European countries. The cost, therefore, of this model is the 'wastage' of half of the spectrum acquired by the operators.

Models 2 and 3 need not be necessarily used for an entire country or deployment region. It may be that the operators will each deploy their own networks inn the more densely populated regions and then use an infrastructure sharing model along the lines of model 2 or 3 in less densely populated regions. This is likely to be more saleable to a regulator because it meets the political imperative of ensuring more coverage for rural populations while preserving the full model of infrastructure competition in cities.

View of the regulators

Collaborative arrangements have received the support of regulatory authorities. The German regulator has announced that the sharing of sites, antennae and base stations is, under certain conditions, not in breach of 3G licence regulations. The central issue for the German regulator is that both individual network control and the competitive independence of the 3G operators should be guaranteed. This may preclude sharing of a common UTRAN.

Not all regulatory authorities support network collaboration. Hong Kong's OFTA intends to impose build out obligations on the four 3G licensees to prevent the sharing of infrastructure and ensure that there are four complete, facilities-based operators. Competition in the market for 3G services is sought to be encouraged by the mandating of access as for MVNOS and simple resellers.

The European Commission (**EC**) has given mixed signals about network collaboration in 3G network build. In March this year the Information Society DG of the EC directed Member States to remove restrictions on infrastructure sharing and obligations to deploy network infrastructure so as to facilitate the emergence of common network platforms and virtual operators. Erkki Liikanen, the EC Telecommunications Commissioner, has encouraged EU member states and telecommunications operators to consider network sharing as a way of cutting heavy debt burdens.

However, Mario Monti, the EC Competition Commissioner, has the application of competition rules to the issue of network sharing will depend on a number of factors, the most important of which are the number of operators in a specific market and the depth of co-operation between such groups.[7] According to a report published as recently as August 2001, Monti supports legislation that will stop any co-operation even if UMTS licensees remain competitive between themselves, with such legislation having retrospective operation to strike down collaborative deals.[8]

Despite concerns expressed by some that such collaboration is anti-competitive, the pro-competitive benefits of network co-operation have been recognised by the United States of Justice and US Federal Trade Commission, in its Anti-trust Guidelines for Collaborations Among Competitors:

'In order to compete in modern markets competitors sometimes need to collaborate. Competitive forces are driving firms towards complex collaborations to achieve goals such as expanding into foreign markets, funding expensive innovation efforts and lowering production and other costs. Such collaborations often are not only benign but pro-competitive.

Conclusion

It would be rash to say that the traditional model of carrier built, owned and operated networks is redundant. It is rarely the case that an existing business or competitive model is completely substituted by new models, which come along. Rather, the telecommunications market is fragmenting. There is no one standard benchmark model for network ownership and financing. This can make analysts' job more difficult in undertaking comparative valuations.

Carriers and capital markets also are no less susceptible to fashionable trends than the consumers of communications products. MVNOs are currently a hot topic, but their ultimate sustainability will depend on whether they can maintain a decent margin spread between their retail prices and the bulk capacity charges payable to the carrier.

It may be that, like in the dot com boom, the real revolution occurs when the models developed by the (failed) pioneers are taken up by existing, large operators. Network issues would begin to look very different when the big players like BT, Hutchison, Telia and DT begin to line as Virtual Operators or network sharers.

The main stumbling block is whether regulators who have worshipped at the altar of infrastructure-based competition can be converted to this new world.

Endnotes

1. Peter Waters and Rob Simpson are Partners with the specialist communications firm Gilbert & Tobin. Peter is based at their Hong Kong joint venture with Arculli & Associates and Rob is based in the Sydney office.

2. Quoted in James Atlas, Davos Inc, *Vanity Fair*, May 2001.

3. Joao Baptiste, Mercer Consulting, the New Profit Zones: Growing shareholder value in the communications Industry, 1999.

4. Economist.com, When Big is No Longer Beautiful, 14 December 2000.

5. for more detailed discussion of MVNOs, see James Edwards, "Virtually Here, Mobile Virtual Networks", www.gtlaw.com.au

6. Of course, there is no inbound termination revenue unless an A party charging model applies.

7. EU to look at Network Sharing on a Case-By-Case Basis, in the Industry Standard at

www.thestandard.com/article, 11 June 2001.

8. EC may stop 3G network sharing, 3 Newsroom at www.3newsroom.com, 6 August 2001

back to index

Abstract

The global telecommunications industry is (yet again) going through a very painful upheaval. Since last year's PTC Conference, we have gone from "irrational exuberance to irrational gloom". Underlying the collateral damage caused by the tech wreck, there are fundamental shifts in the carrier business models driven by:

- the phenomena of "serial" networks and the resulting mountain of debt;
- the perceived failure of the multi-network, multi-product business model;
- realisation that the vertically integrated, horizontally integrated business model may owe more to the history of PTTs than to rational commercial strategy; and
- the demands of financial markets for greater transparency and "homogeneity" in businesses.

These factors are driving the way in which networks are built, owned and operated by new entrants and incumbents alike. Business models developed by industry pioneers have been adopted by the large incumbents. Although often carefully unacknowledged, infrastructure sharing by mobile incumbents for 3G networks mimic virtual network operators. Incumbents have " found religion" on wholesale, sounding like the early network-based new entrants such as MCI, and have abandoned vertical integration models. Equipment manufacturers, burnt by the crash of new entrants, are much more cautious about vendor financing models but are still seeking alternatives ways to drive acquisition and financing of their equipment.

However, the main hurdle to these new network deployment models may be the attitude of regulators who have long worshipped at the alter of infrastructure-based competition: e.g. the European Commission has already sought to restrict the scope for infrastructure sharing.

back to index

Peter Waters

Peter joined Gilbert & Tobin as a partner in 1989 and specialises in communications and technology. He completed his Master of Laws at Harvard Law School on a Fulbright Scholarship. Peter is based with Arculli & Associates, the firm's joint venture partner in Hong Kong.

Peter is recognised as one of the leading communications lawyers in Asia Pacific. He has worked on regulatory, interconnection, wholesale contracting, numbering, IP peering and spectrum licensing issues throughout the region. He has been the principal external adviser on interconnection arrangements and regulation to Optus Communications in Australia, and Hongkong Telecom in Hong Kong, and CLEAR in New Zealand. During 1998-9 Peter was seconded to Cable & Wireless plc in London as acting Director of Regulation, with responsibility for the Group's global regulatory affairs.

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back to index

Developing Telecom Infrastructure in West China

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(View Abstract)

Executive Summary

Since the end of 1999, the central government of China has targeted twelve areas in West China as especially in need of economic and telecommunications development. These areas have relatively poor telecommunications infrastructures, mainly due to geographic constraints. Developing telecommunications networks in China's vast western areas will be a long and arduous task.

Favorable policies from China's central government will be the biggest incentives for both national and foreign carriers to invest in the region. China Telecom, China Mobile, and China Railcom are currently the three major players in the west, and they are likely to remain major players in the future since they already have extensive fiber-optic networks in the region. Which foreign carriers will pursue development in West China is unknown at this point, since they are still evaluating the benefits of the government's policies and whether a move into West China will generate sufficient profits to justify the investment.

There are three technology options for building telecommunications infrastructure in West China: terrestrial fixed networks, radio, and satellite. Each technology has already been deployed in the west. Currently, the decision of which technology to deploy is not only influenced by geographic conditions, but it is also determined by the Ministry of Information Industry (MII), which instructs Chinese carriers on which technology to use. Unfortunately, because the selection of technology is often intertwined with other political and regulatory considerations, the selection made is not always the most cost-effective. China's admission to the World Trade Organization (WTO) will likely change this scenario, as the MII is expected to loosen its control over technology deployment decisions. This will allow Chinese carriers in the west to choose the technologies that best fit their needs, from the vendors that best support their businesses.

After China attains WTO status, vendors that can provide the most cost-effective technology will be in greater demand. For the time being, carriers are more likely to buy the most advanced products from vendors, regardless of whether they are the most cost-effective. There are two reasons for this: first, in order to avoid cuts in future budgets, carriers feel compelled to spend the entire budget allocated by their parent company; secondly, these carriers also want to demonstrate that they are the most advanced. China

Telecom has another special consideration when purchasing products from vendors: it tends to purchase products that could help the company gain more users for its network, since each year the Chinese government mandates China Telecom to meet a set quota of new users.

Key findings and Analysis

Currently, the MII still makes decisions on the telecom infrastructure technologies to be used in China. China's admission to WTO is expected to give a strong push to the liberalization of China's telecom market, including giving Chinese carriers the freedom to select the most cost-effective technologies.

There are three technology options for building telecommunications infrastructure in West China: terrestrial fixed networks, radio, and satellite. When a carrier evaluates its options for building a network in the west, the key factors that will influence its decision include the following:

- Feasibility of technologies (particularly in light of challenges due to geography)
- Target market(s)
- Regulatory factors
- The fit with the carrier's plans for West China

Some technologies are not feasible in certain areas due to the geographic constraints. For example, in the south of Tibet, where the mountains are the highest in the world, laying fiber under the ground is impossible.

Generally speaking, the western part of China is less developed than the eastern part; therefore most users in the west have less income and spend less on telecommunications services than users in the east. It takes a much longer time for carriers to recoup the cost of installation of a phone line in the west, so the cost of deployment has to be carefully calculated and is a key criterion when comparing technologies.

Currently it is taken for granted that China Telecom, the incumbent carrier, has the obligation to provide universal service inside China. In preparation for the entry of China into the WTO by the end of 2001, the government is in the process of setting up a universal telecommunication service fund or subsidy that will be collected from carriers. The extent and distribution of those fees will influence both Chinese and foreign carriers' decisions to enter and build telecom infrastructure in the western telecom market.

All of the current national carriers (China Telecom, China Mobile, China Unicom, China Netcom, China Railcom, China Satellite, and Ji Tong) have some presence in the west, but not all of them are building or expanding existing networks. For example, China Netcom has focused mainly on the eastern part of China and has very limited activities in the west. The three major players in the west are China Telecom, China Mobile, and China Railcom. They have all built fiber-optic networks in the western region. When asked which technology they preferred to use, most of the carriers are in favor of building fiber-optic networks wherever it is possible because of its bandwidth and reliability.

Which foreign carriers will pursue development in West China is unknown at this point, since they are still evaluating the benefits of the government's policies and whether a move into West China will generate sufficient profits to justify the investment.

1. Overview of West China

1.1 West China

The twelve western areas targeted for development are one municipality, five autonomous regions, and six provinces. Figure 1 shows China's western provinces.

FIGURE 1: CHINA'S WESTERN PROVINCES

Source: People's Republic of China

Table 1 summarizes the areas and their populations.

Table 1: China's western areas (1999)

Province/Region	Area (1,000 sq km)	Population (millions)
Chongqing Municipality	82	31
Inner Mongolia Autonomous Region	1,183	24
Guangxi Zhuang Autonomous Region	236	47
Ningxia Hui Autonomous Region	66	5
Tibet Autonomous Region	1,220	3
Xinjiang Uygur Autonomous Region	1,600	18
Gansu Province	450	25
Guizhou Province	170	37
Qinghai Province	720	5
Shaanxi Province	205	36
Sichuan Province	488	86
Yunnan Province	394	42
Subtotal (West China)	6,814	358
Total for China	9,600	1,259
Percentage in West China	71%	28%
Source: People's Republic of China		

This region covers more than 70 percent of China's land area, but less than 30 percent of the population. In addition, only 30 percent of the industries in China are located in the west, and the region contributed only 18.6 percent of China's GDP in 1999. In the past few years, the region has attracted approximately 5 percent of total foreign direct investments (FDI) in China.

The region's poor telecommunications infrastructure is a hindrance to overall economic development; the government of China expects the development of telecommunications in the west will stimulate economic growth and bridge the gap between the east and the west. According to Andrew Hardy's methodology, economic development leads to more investment in telecommunications, and improvements in telecommunications contributes to economic development.

As shown in Table 2, the penetration rates in China's western region is below the national average rate.

Table 2: Teledensity in West China

Province/Region	Teledensity	
	Fixed	**Wireless**
Nationwide	12% (March 2001)	7.7% (March 2001)
Inner Mongolia Autonomous Region	NA	4% (April 2001)
Ningxia Hui Autonomous Region	10% (April 2001)	NA
Tibet Autonomous Region	4.7% (end of 2000)	NA
Xinjiang Uygur Autonomous Region	12.5% (March 2001)	4% (April 2001)
Sichuan Province	7.2% (May 2001)	NA
Guizhou Province	4% (end of 2000)	1.1% (end of 2000)
Yunnan Province	7.1% (March 2001)	NA

Source: The Ministry of Information Industry of China (MII)
Note: NA means not available.

This disparity is mainly due to challenges posed by the region's geography, which makes it very difficult to build telecommunications infrastructure in the west. For example:

- In Yunnan, with a population of 42 million, 94 percent of the land is mountainous or partly mountainous.
- Xinjiang, the largest region in China, contains some of China's tallest mountains ranges, deserts, and basins.
- In Tibet, the average height above the sea level is more than 4,000 meters. There are three different geographic areas in Tibet: the Tibetan plateau to the west, valleys in the south, and mountains and valleys in the east. The Tibetan plateau covers two-thirds of Tibet's total area, but 85 percent of the population lives in the southeast.

1.2 Go West Policy

China has already adopted some special policies for the five autonomous regions of the west. Most of the people living in these five regions are minority nationalities. But in order to increase political stability in the entire west region and bridge the gap between the west and the east and between minority nationalities and "Han" Chinese, China's central government has established a "Go West" policy. It includes the following:

- Increasing investment in the western areas
- Improving the investment environment, which includes incentives such as a 15 percent corporate tax (instead of 33 percent) rate for a limited period for certain industries
- Opening the region more widely to investors from other parts of China, and other countries. This includes increasing foreign investments in the telecommunications sector.

The Chinese government is encouraging foreign and domestic investors to move from the relatively saturated east coast to western areas. In order to increase investment, the Chinese government will place more emphasis on building infrastructure facilities and on improving the environment in these areas. At the same time, it offers some favorable policies, such as preferential tax treatment, to investors that invest in the west.

The central government has also decided to raise the ratio of the central financial construction funds allocated for the west region, with 70 percent of state treasury bonds, as well as large sums of state-appropriated funds and loans from foreign governments and international organizations, going to help the economic growth of the western regions. By the end of 1999, the State Development Bank had already granted a total of Rmb400 billion (U.S.$48.19 billion) in loans to support the construction of railways, oil and natural gas fields, and hydropower stations in western area.

1.2.1 The telecom component of Go West

The MII expects China's carriers, mostly China Telecom, to invest $14.5 billion in West China in the next five years to improve the telecommunications infrastructure.

The costs for building and operating telecom networks in China's western areas are relatively high, with fairly low profits (if any) due to the relative poverty of the population (compared to the east). With competition, carriers, especially China Telecom, are shifting their focus from increasing the number of users to maximizing profits. With traditionally low profits in the west, no carriers will want to develop telecom infrastructure in that region without monetary incentives. In order to solve this problem, China plans to set up a universal telecommunication service fund to help the western regions and other rural areas and impoverished outreaches with telecommunications development. Carriers that provide universal services in the west will be subsidized from this universal fund, and all carriers in China will be required to contribute to the fund. However, the MII has yet to publish a clear and complete plan on how the fund will be administered. The MII will also propose flexible tax and financing policies for the region.

The government believes that the development of telecommunications will stimulate economic growth in the west. It also believes it will help investors to create economic value from the many natural resources in the western areas. For example, Xinjiang has barely tapped its desert oil reserves, which are estimated to be three times greater than those in North America.

2. Infrastructure Options in West China

2.1 Overview of Current Network Solutions in West China

2.1.1 Terrestrial fixed network

Fiber-optic networks have reached all of the western areas. In some areas, fiber has reached small towns. In other areas, it has gone deeper into villages. Despite the many obstacles, some carriers are making progress in expanding their fixed networks in the west. Some examples include the following:

- Yunnan: Yunnan province started to build a fiber-optic network earlier than the other western regions. Fiber has reached all small towns in Yunnan. Yunnan Telecom (a local company of China Telecom) has 6,000 fiber route-km in Yunnan. Yunnan Telecom has a ring-based network topology, with four to seven nodes per ring. It has three rings and two chains (the extensions of the rings). Currently, Yunnan Telecom is using 2.5 Gbps SDH technology and 16 channel WDM systems in its provincial networks, and has one small deployment of metro WDM. All fiber in Yunnan Telecom's network is single-mode fiber (G.652), but G.655 is planned for future backbone deployments in order to accommodate high channel count WDM.
- Xinjiang: According to Xinjiang Communications Administration, in 2001, Xinjiang will invest approximately $482 million in fiber-optic networks and mobile communications to provide high-speed data services to users and enterprises
- Tibet: At the end of 2000, a fiber-optic network with a total route length of 5,318 km covered 69 percent of Tibet. Fiber has reached all towns in Tibet. The local subsidiary of China Telecom has used the most advanced technologies and eliminated the need to upgrade systems.
- Chongqing: Chongqing, which serves as the regional capital city of West China, is implementing a 10 Gbps-based SDH network and aims to become a "broadband city."

Other than Yunnan Telecom, mentioned above, several western carriers have already deployed WDM, as shown in Table 3.

Table 3: WDM deployment in West China

Network	Carrier	Number of channels	Vendor
Qinghai provincial backbone	China Telecom	NA	Huawei
Guizhou provincial backbone	China Telecom	16	Huawei
Guizhou national backbone	China Telecom	32	ZTE
Inner Mongolia provincial backbone	China Telecom	16	Huawei

Chongqing mobile network	China Mobile	16	Huawei
Yunnan provincial cable network	SARFT	16	NA

Source: RHK

Note: NA means not available.

WDM deployment in the west should grow significantly as investment flows into the region. So far, Chinese vendors have been most successful, mainly due to pricing and their proximity and greater capability to support carriers with deployment and maintenance.

2.1.2 Radio networks

Personal access system (PAS) is a wireless access technology, and is one of the cheaper solutions to last-mile access. PAS phones can roam inside a fixed line network to make domestic and international calls. This is often called "fixed mobility."

UTStarcom is one of the vendors that provide PAS systems. As of September 2001, it has 2 million users in approximately 180 cities in China. In the western areas, it has 200,000 users in Guangxi, 240,000 users in Shaanxi (mainly in Xi'an, the capital), and 120,000 users in Yunnan. It also has approximately 100,000 users in Ningxia and Xinjiang, where UTStarcom signed a contract in May 2001. The contract in Xinjiang covers five cities.

Most of the users of PAS systems in the west are in bigger cities. This has put UTStarcom's PAS system in a position to compete with GSM systems from China Mobile and Unicom. When China Mobile and Unicom reduced the price of their GSM services, UTStarcom dropped the price of its system from Rmb1,000 ($120) per line to Rmb700 ($84) per line. After adding the cost of a PAS phone, the price will be Rmb1,300 ($157) per line, although the price of the phone is dropping as well. UTStarcom claimed that in the cities, the return on investment is two to four years (currently, China Telecom requires an ROI of five years or less), assuming an average usage of between Rmb60-80 ($7-10) per month. UTStarcom is also expanding its market to smaller cities in the country, where the users are more price-sensitive and the cost to set up one line is more expensive.

Some local subsidiaries of China Telecom started to use PAS technology a few years ago in order to expand their markets. China Mobile and China Unicom believe that PAS has harmed their interests and the companies have been engaged in a dispute with China Telecom over the matter. The MII has reiterated a ban on new projects involving PAS construction. Nonetheless, the local subsidiaries of China Telecom are still signing contracts with UTStarcom without reporting to the MII since they can gain approval from MII's local representative offices (Provincial Communication Administration Bureaus) and use the frequency needed to build PAS systems. Hopefully, China's admission to the WTO, and the subsequent anticipated liberalization of China's telecom market, will resolve any further conflict.

2.1.3 Satellite networks

In China, satellite is mainly used for the backup of networks. Many people believe that satellite can play a big role in providing universal services in China's most rural western regions, especially in Tibet, Xinjiang, and Inner Mongolia, where telecom infrastructures are very difficult to build. Some of China Telecom's local subsidiaries are looking into the possibility of using satellite to connect the users in villages where the alternative optical fiber network would cost at least Rmb20,000 ($2,410) per line.

Globalstar, a global mobile satellite telephone service provider, is an active player in China's satellite sector. It started its commercial service in China in May 2000 and targets the areas outside the range of existing cellular and fixed-line telephone systems. It has three landing stations in China: Beijing, Guangzhou, and Lanzhou (the capital of Gansu Province).

China Spacecom , Globalstar's partner in China, is responsible for gateway (landing stations) operations and customer development. Once a roaming agreement is signed with China Mobile, it will also offer cellular services with its satellite phone service through a multi-mode phone. When users are in the area with cellular coverage, the phone works like a traditional cellular phone; when users are outside an area covered by radio base stations, the phone will switch to satellite mode.

China Railcom, which was spun off from the Ministry of Railways and given a commercial telecom operating license in March 2001, currently focuses its operations in the western part of China. In August 2001, it announced it would buy a 20 percent stake in Shin Satellite Plc., Thailand's top satellite operator, to gain access to a new communications satellite scheduled for launch in 2003. It will use the satellite to provide a high-speed Internet access and wireless video-on-demand service. There may be some future satellite applications in the west from Railcom.

In Xinjiang, fifteen satellite signal-receiving stations have been built. In Tibet, there are seventy-seven VAST/TES stations. This makes it possible for both regions to form a three-dimensional transmission system, in which telecommunications can extend from the air to the ground by means of satellite, microwave, and optical fiber cables.

As discussed previously, the key criterion influencing carrier purchase decisions is shifting from user acquisition to profit maximization. From this perspective, satellite is often viewed as very expensive with few applications, mostly as a short-term solution for the western part of China. In the long run, one of the biggest drawbacks is that the bandwidth that satellite can provide is much less than fiber.

As a result, very few satellite phone applications have emerged in the west due to high cost. Satellite is still a complementary technology to terrestrial wire network and wireless technologies, and cost will be an important factor in determining satellite's ultimate role in the west.

2.2 Factors That Influence the Choice of Technology

When comparing the technologies to build telecom infrastructure in the western areas, there are several factors involved including the following:

- Feasibility of technologies (particularly in light of challenges due to geography)
- Target market(s)
- Regulatory factors
- The fit with the carrier's plans for West China

2.2.1 Feasibility of technology

In certain areas, due to the geographic constraints, some technologies are not suitable. For example, in Xinjiang, which contains some of China's tallest mountains ranges, deserts, and basins, it is very difficult to build a fiber-optic network. Radio and satellite networks are more cost-effective solutions. In fact, Xinjiang Telecom (a subsidiary of China Telecom) signed a contract with UTStarcom in May 2001 to build a wireless network to cover five cities in Xinjiang.

2.2.2 Target market(s)

The telecommunications market in the west (excluding enterprise users) can be divided into basically two segments: users in the big cities, and the rest. The telecommunications expenditures of users in big cities are similar to those of average users in the eastern areas: approximately Rmb60-100 per month per fixed phone (or roughly $7-12). The rest of the users in the western areas are in small towns and villages, and they spend approximately Rmb20-50 per month (or roughly $2-6).

The cost to install a telephone line in a village varies from Rmb20,000 ($2,410) to 50,000 ($6,024). In Tibet, the cost is even higher. It costs between Rmb100,000 ($12,048) to 150,000 ($18,072) to install a telephone line in a small town. Based on the interviews with the carriers, it would take at least 167 years or 2,008 months to recoup an investment in a small town in Tibet, keeping other factors constant. This explains why most of China Telecom's western subsidiaries are unprofitable, and rely heavily on subsidies. The subsidies are mainly from the profitable local subsidiaries of China Telecom, such as Guangdong Telecom, Fujian Telecom, Zhejiang Telecom, and Jiangsu Telecom.

2.2.3 Regulatory factors

Currently, the MII still makes decisions on which technologies are used in China. Carriers expect that China's entry into the WTO will change this, and hope the anticipated liberalization of the telecom market includes the government no longer specifying which technologies must be used by Chinese carriers.

China Telecom, as the incumbent carrier, still has an obligation to provide universal services inside China.

Each year, the government of China sets up a targeted number of users and mandates China Telecom to fulfill the quota. Hence, traditionally, when China Telecom selects a technology, it mainly considers whether this technology would gain more users. Cost-effectiveness and profit maximization have been secondary considerations. This scenario is changing with the deregulation of the telecom market in China; China Telecom is now much more concerned with the cost-effectiveness of technologies.

2.2.4 Carriers' plans for West China

Several of China's seven national carriers already have plans for developing the west.

China Telecom

As the incumbent carrier in China, China Telecom has to support the government's development plans for West China, especially the bridging of the "Digital Gap" between Eastern, Central, and Western China. It will continue to provide basic telecom services in the region and try to connect more users to its network. China Telecom also expects to receive subsidies from the universal fund.

China Mobile

China Mobile plans to invest $2.4 billion in the western areas in the next three years. It has set three policies on investments including:

- Increase the investment in fiber-optic networks from 70 percent to 85 percent of the total investment in the west (the rest is on GSM radio base stations and others)
- Profits from the western areas will be reinvested in the same areas
- Increase the company's debt/equity ratio. The current ratio is relatively low compared to ratios of most foreign carriers, which are approximately 50-60 percent.

China Railcom

China Railcom is building a southwestern China ring covering Chongqing Municipality and eight other provinces and regions with 110 DWDM nodes.

Two other major carriers, China Netcom and Ji Tong, may not be very active in the west in the near term. Ji Tong is struggling with financing to build its backbone. In the short term, it won't have an aggressive plan in the west. Netcom is busy building its national backbone, and is currently connecting the two nodes on its backbone: Xi'an (the capital of Shannxi Province) and Chengdu (the capital of Sichuan Province). After completion, Netcom may have some plans in the west, but most likely will focus on big cities.

Information current as of November 2001.

Endnotes:

Hudson, Heather. *Global Connections: International Telecommunications Infrastructure and Policy* (New York: Van Nostrand Reinhold, 1997), p.188.

China Spacecom, founded on May 4, 1998, is a partnership between China Telecom, ChinaSat, and China Space Technology Group. It has exclusive rights to provide mobile satellite telecommunications services in China.

back to index

Abstract

West China refers to twelve regions in the northwest, west, and southwest of China, and includes one municipality, five autonomous regions, and six provinces. This report provides an overview of the current status of the telecom infrastructure in West China and briefly analyzes the three different technologies that are being deployed to provide telecom services in the region and factors that affect their deployment. The information in this report was mainly drawn from interviews with the carriers in the region and data published by China's government.

back to index

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back to index

Social/Cultural

Tuesday, 15 January 2002
1100–1230
South Pacific I - II

T.1.1 Social Shaping of E-Commerce

Chair:
YOSHIKO KURISAKI, Senior Manager, SITA

T.1.1.1 Economic, Social and Cultural Factors Affecting the Adoption of E-Commerce Applications in Small and Medium Size Enterprises: A Cross Country Analysis (View Abstract)

ELIZABETH FIFE, Principle Researcher and FRANCIS PEREIRA, Principle Researcher, Center for Telecommunications Management, Marshall School of Business, University of Southern California, *USA*

T.1.1.2 E-Commerce Via Satellite in Japan (View Abstract)

KENG-JIN LIAN, Marketing Manager, Asia Pacific Business Group, Hughes Network Systems, *USA*

T.1.1.3 Emerging Wireless Data Services Markets—An Asian Perspective (View Abstract)

A. LEE GILBERT, Associate Professor and SUNANDA SANGWAN, Market Researcher, Nanyang Business School, *Singapore*

back to sessions

Economic, Social and Cultural Factors Affecting of Adoption of E-Commerce Applications in Small and Medium Size Enterprises: A Cross-Country Analysis

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View Abstract

1. Introduction

The continued exponential growth of the Internet, coupled with its growing ubiquity around the world has provided firms with a means to finally realize the promised economic benefits of electronic commerce; reduced transaction costs, increased geographical scope and enhanced customer support. The ability to transfer internal business functions from paper to electronic-based transactions has brought demonstrated benefits to companies such as Dole Asia, Dell Corporation, Wal-Mart, and Cisco Systems and has encouraged many other corporations to adopt these applications. Estimates of these savings are shown in Figure 1.

FIGURE 1. E-COMMERCE IMPACT ON VARIOUS DISTRIBUTION COSTS (US$ PER TRANSACTION)[1]

	Airline Tickets	Banking	Bill Payment	Insurance Policy	Software Distribution
Traditional Systems	8.0	1.08	2.22-3.32	400-700	15.00
Telephone-based		0.54			
Internet-based	1.0	0.13	0.65-1.10	200-350	0.20-0.50
Savings (%)	87	89	67-71	50	97-99

Increases in business efficiencies have resulted from better internal coordination and improvements in supply chain management. It has been estimated that with today's diversified production processes, some 100 companies are needed to produce a single finished product, and as a result, for every US$100 paid out in the manufacturing process, some $50 on average is wasted.[2] Also, through the use of IP-based applications, such as online auctions in the procurement process, corporations have been able to achieve gross savings of between five to forty percent, with fifteen percent being typical for most corporations. For corporations that are earning some twenty percent in gross margins, a US$1 reduction in cost has the same effect as increasing top line sales by US$5.[3] This presents an enticing proposition for companies facing competitive downward pressures on prices and gross margins.

Many U.S. corporations made substantial investments in IT throughout the 1990s in order to achieve greater efficiencies and lower costs, yet found the reality of implementation more difficult than anticipated. In addition, to having sufficient financial resources, the prerequisites for successful implementation include having a competent IT staff in addition to aligning the company's culture, product and organization closely with the technology. A substantial reorganization within the company must occur in conjunction with IP-based network deployment. Firms like Dell and Marshall Industries were able to fully exploit the benefits of IP-based applications only with a radical re-engineering of core business processes.[4]

Although the corporate market accounts for a significant share of the Gross Domestic Production of most countries, small and medium size enterprises (SMEs) generally outnumber large firms, especially in rural areas. Preliminary research indicates that the adoption of IP-based applications in this sector is extremely slow and results to date are unclear. Most SMEs seem to have failed to successfully leverage the promise of electronic and Internet commerce.

SMEs are clearly different from large corporations in many respects, including access to resources, corporate focus and operational scale. In addition, SMEs in specific industry segments that produce customized products, or carry out research and development or precision manufacturing, may not be able to exploit the efficiencies of e-commerce applications stemming from economies of scale. Such differentiation presents challenges to SMEs in adopting e-commerce applications.

These challenges are many and varied, and some, like the resolution of both domestic and international e-commerce regulations, may have a profound effect on adoption rates of e-commerce applications.[5] The real effect of most of these issues on e-commerce is uncertain at present.

2. Economic Challenge: The Need for Capital

A fundamental characteristic of most economies is the predominance of small businesses. In the United States, for example, SMEs number some 21 million and comprise over sixty percent of all firms in the United States. Additionally sole-proprietorships comprise seventy-four percent of all businesses, although their business revenues amount to only about one-half that of large corporations. U.S. small business revenue is some $870 billion compared to corporate revenues of $15,890 billion.

To understand the resource base of small firms, it should be noted that most small firms are extremely small. Eighty-nine percent of all sole-proprietorships have annual business revenues of less $100,000 and sixty-nine percent of these firms have annual business revenues of less than $25,000.[6] Some eighty percent of all sole-proprietorships are home-based businesses.[7] Furthermore, some sixty-five percent of companies have less than 10 persons and eighty percent of all small businesses operate without any employees.[8]

SMEs play a crucial role in the economies of Asia-Pacific countries. This is true even in the highly developed city-state of Singapore, where SMEs constitute some sixty-two percent of all businesses.[9] Small local firms have flourished in Singapore due to the presence of transnational corporations that have created a demand for electronic components and supporting industries like metal stamping, mould and die-making, electronics subassembly as well as others. These small firms have differentiated themselves from competitors in nearby countries by producing very high quality goods and services. Globalization has created opportunities for small firms in Singapore through linking into the supply chains of transnational corporations.[10] Singapore's government has recognized the contribution of small firms to the national economy and has taken efforts to make small firms more competitive as well as to better their abilities to attain close relationships with global corporations.[11]

In Taiwan, China also, SMEs play a critical role in the national economy and make up the foundation of industrialization efforts. Transnational firms have facilitated the growth of small Taiwanese electronics firms that supply goods and services to foreign companies. Despite the importance as well as the preponderance of small firms, both in terms of annual revenues and total number of employees, there are significant challenges to the adoption of IP-based applications. Studies of the United States, as well as many other countries, such as Malaysia,[12] and the Organization for Economic Cooperation and Development (OECD) economies suggest that access to capital and availability of skilled labor are universally the major concerns. Furthermore, Li Rongrong, chairman of the 8th APEC SME Ministerial Meeting states that SMEs in Asia as well as the rest of the world face problems such as "obsolete technology, difficult financing situations, and a lack of talented people."[13]

An OECD survey similarly attributes the slow adoption rate of e-commerce by European SMEs to the lack of capital and access to technical skills and argues that SMEs "are often too busy employing scarce human and financial resources to make their initial business plans succeed and are reluctant to allocate resources to implementing a new electronic commerce strategy without a clearer understanding of the benefits and risks.[14]

A recent survey in Australia similarly attributes the low adoption rates of E-commerce applications by SMEs to the cost, lack of awareness of the benefits, problems with understanding the technical aspects, perceptions about risks, concerns about fraud, a shortfall in skills and training, time concerns and maintenance requirements.[15]

FIGURE 2 . AVERAGE COST STRUCTURE OF SMALL AND MEDIUM SIZE ENTERPRISE[16]

	Percentage of Total Receipts	**SME with Revenues of $25,000**	**SME with Revenues of $100,000**
Business Deductions	78.57	$19, 643	$78,570
Cost of goods sold	36.71	$9,178	$36,710
Salaries, Wages and Commissions	7.89	$1,973	$19,730
Car and Truck Expenses	4.44	$1,100	$4,400
Rents, Utilities and Repairs	6.71	$1,678	$6,710
Insurance and Interests	2.78	$675	$2,780

Depreciation	3.29	$823	$3,290
Taxes	1.58	$395	$1,580
Other Expenses	15.19	$3,798	$15,190
Net Income	21.54	$5,385	$21,540

Lack of capital is perhaps the most significant challenge to the adoption of IP-based applications by SMEs. Most estimates put the average initial cost of implementing an e-commerce web-site utilizing IP-based applications at some $10,000 to $15,000 in the United States, with an additional twenty percent for the launch cost, annually for maintenance and support.[17] Estimates for SMES in the United Kingdom establishing e-commerce sites are comparable at some UK£6,000 to £10,000.[18] In Singapore the minimum cost for launching a simple e-initiative like putting up a company's website is pegged at some S$25,000 while web-sites offering full-fledged e-transactions could cost the firm $100,000 or more.[19]

Many SMEs are faced with severe cost constraints, such that allocating more than one percent of their total cost structure to the Internet and the use if IP-based applications is simply unacceptable.[20] Figure 2, above illustrates the budgetary constraints of typical SMEs with annual business revenues of less than $25,000 and $100,000, respectively. The problem is also exacerbated when IT consultants are brought in who lack the specific industry knowledge needed to advise SMEs.

3. Social Challenges: The Need for Re-engineering

One of the fundamental challenges facing all SMEs is the continual need to remain competitive. Thus, the core business processes of many SMEs were already highly efficient even before the Internet. Also, in many cases SMEs operate a highly capital intensive business which presents a major challenge. Costs are clearly defined, but the potential benefits from adopting e-commerce applications often are not.

For example, in a recent survey of small businesses in the United Kingdom, forty-eight percent of businesses questioned did not have web-sites, and forty-five percent of those did not understand the benefits that building one would have on their business. Furthermore, only fifty percent of companies that had web-sites were using them to sell goods or services online. Another survey of IT directors in the UK finds that a mere fourteen percent believe that their company is equipped to take advantage of supply chain management opportunities. The major impediment is believed to be lack of support from senior management.[21]

In the U.S. where sixty-two percent of SMEs surveyed reported not having web-sites and only twelve percent of companies that had web-sites were using them to sell goods and services.[22] In Asia, many of the regions' SMEs are family-owned and have been slow to see the benefits of e-business. There is sometimes a belief that e-business is unnecessary and that personal contact has much greater value. This is even the case in Hong Kong where over fifty percent of SMEs are not yet considering e-business.[23]

For many large corporations, re-engineering core processes has allowed them to improve their customer service, speed, and product innovation through refining their supply chains.[24] Information sharing is used to improve the synchronization of production, inventory and delivery schedules. The advantages to both suppliers and customers are apparent: risks and resources can be shared, product innovation is faster, costs are lowered, and new businesses can develop. In sum, the cost benefits can be substantial.

For example, Dole Asia, through better supply chain management, has been able to reduce warehouse costs by some thirty percent.[25] Similarly, Dell Corporation has been able to reduce its sales, general and administrative costs (SG&A) from fifteen percent in 1993 to just below ten percent in 1998, as compared to its competitors, such as Gateway which actually has seen its SG&A costs increase from seven percent to some fourteen percent in the same period. For Dell, reducing its SG&A costs by five percent translates to an annual savings of at least $166 million annually. Supply chain management is only effective when all the companies in the chain can share information freely and use the same applications easily, however.[26] Effective supply chain management can allow companies to achieve other economic efficiencies, such as better demand forecasts, lower defect rates and improved abilities to meet their customers' needs all leading to lower costs for goods sold.[27]

SMEs are an integral part of the supply chain of many corporations. It is estimated that in Europe, for example, some eighty percent of all SMEs are part of some supply chain.[28] As such, corporations will only be able to achieve cost savings if the SMEs they are working with participate in supply chains. Since costs remain a fundamental issue to SMEs, and since corporations stand to benefit significantly from such cost savings, there may be economic benefits for large corporations to absorb some of the costs of SMEs adopting IP-based applications and systems. This kind of business model, in which the seller absorbs the transaction costs, may be feasible given the preliminary success of Buyingpower and Monster.com.[29] Furthermore, as transnational firms focus on their core competencies, subcontracting to maintain product differentiation and customization is a trend that will continue. SME suppliers often provide tremendous value in terms of local knowledge and technological innovation. This situation has been referred to as reverse transfer, and has been identified in Singapore as an exchange of technological ideas, market and cultural knowledge between foreign companies and local SMEs that has burgeoned in recent years.[30]

4. Role of Governments

Governments can also have a significant effect on adoption rates of E-commerce by implementing various aid packages and incentive schemes. This has been the case to a greater degree in Singapore, South Korea and Taiwan, China, and China than in the United States. Since costs are a significant issue for SMEs, policies designed to reduce costs should encourage SMEs to adopt IP-based applications and embrace e-commerce more fully. Policies should include a faster depreciation of information technology equipment and software, up to fifty percent in the first year, and as proposed in Malaysia, the abolition of taxes on microprocessors and other IT-related equipment.[31]

Singapore's Economic Development Board (EDB) has initiated a program that would assist businesses in their e-commerce strategy by supporting up to fifty per cent of their external consultants' costs in formulating a business plan or business collaboration venture, conducting feasibility studies, or providing assistance in implementation, up to a maximum limit of S$250,000.[32] The government also unveiled a three-year, $11.7 million plan to prod the city's growing logistics industry into doing more with the Internet as its transport and logistics industry contributed more than 7 percent to gross domestic product last year.[33] The government expects business to business e-commerce to grow overall by twenty percent at year's end, with e-transactions in the hotel and real-estate sectors growing by 216% and 166%, respectively.[34]

The South Korean and Taiwanese governments similarly are instituting various tax and incentive packages to accelerate use of electronic business as a means to improve competitive advantage and enhance supply chain management. In South Korea, a package of tax incentives will be offered to Korean businesses later this year in a bid to spur e-commerce. Additionally, the government intends to propose revisions to the law to provide more tax breaks to businesses engaging in electronic commerce and trade to accelerate the growth of a digital economy in South Korea.

Under current regulations, businesses in Seoul are barred from tax incentives as part of government measures to limit the concentration of businesses in main metropolitan areas. These revisions will specifically allow self-employed persons to deduct from their income tax twenty percent of electronic sales, or fifty percent of any sales increase from the previous year. SMEs will also get a five percent tax break on investment in equipment and facilities for electronic trade. Large corporations will be eligible for a 3% rebate. The government is also reportedly working on an electronic tax receipt to be used for paperless e-trade on the Internet.

Furthermore, the South Korean Ministry of Commerce, Industry and Energy believes that the shift to online-based electronics-industry commerce and to joint ventures as well as a steady stream of mergers and acquisitions will increase the need for Korean manufacturers to move their operations to the electronic marketplace. Hence, the ministry said it would establish an electronic marketplace among domestic companies through joint ventures that focus on business-to-business (B2B) e-commerce in nine industry sectors.

To promote standardization in each sector, the ministry is forming a B2B Standardization Association that will include Korean companies, an industry group called the EC Association, the Korea Institute for Electronic Commerce and the government's Agency for Technology and Standards. The commerce ministry intends to rearrange the hodgepodge of current electronics industry marketplaces into different classifications to improve competitive position. The strategy is to transform the current system into a potential B2B e-commerce hub for Asia with ready access to commodity electronic items and products. Reshaping the domestic marketplace to reflect the strengths of related companies is intended to improve efficiency and productivity.[35]

In Taiwan, China, the Ministry of Transportation and Communications has designated eight transport-related businesses, that include rail transport, maritime harbors and terminals, air cargo, integrated Internet service providers and satellite mobile and fixed-line telecommunications, as emerging strategic industries that are eligible for investment tax credits. Concurrently, the Industrial Development Bureau launched the Taiwan Industrial Global e-Marketplace, or TIMGlobe, to accelerate the island's growth into an e-commerce center.

The TIM project is designed to encourage greater intra-industry co-operation and to play the role of maximizing Taiwan, China's industry presence on the Internet. The government believes that the Internet has created entirely new business conditions around the world. Taiwan, China's industries, which have relied heavily on exports, can use e-marketing to connect buyers and sellers and further expand the potential for international sales that could help maintain competitiveness after Taiwan, China joins the World Trade Organization.[36] The active approach of the South Korean and Taiwanese governments may account for their high ranking in terms of e-commerce readiness.[37]

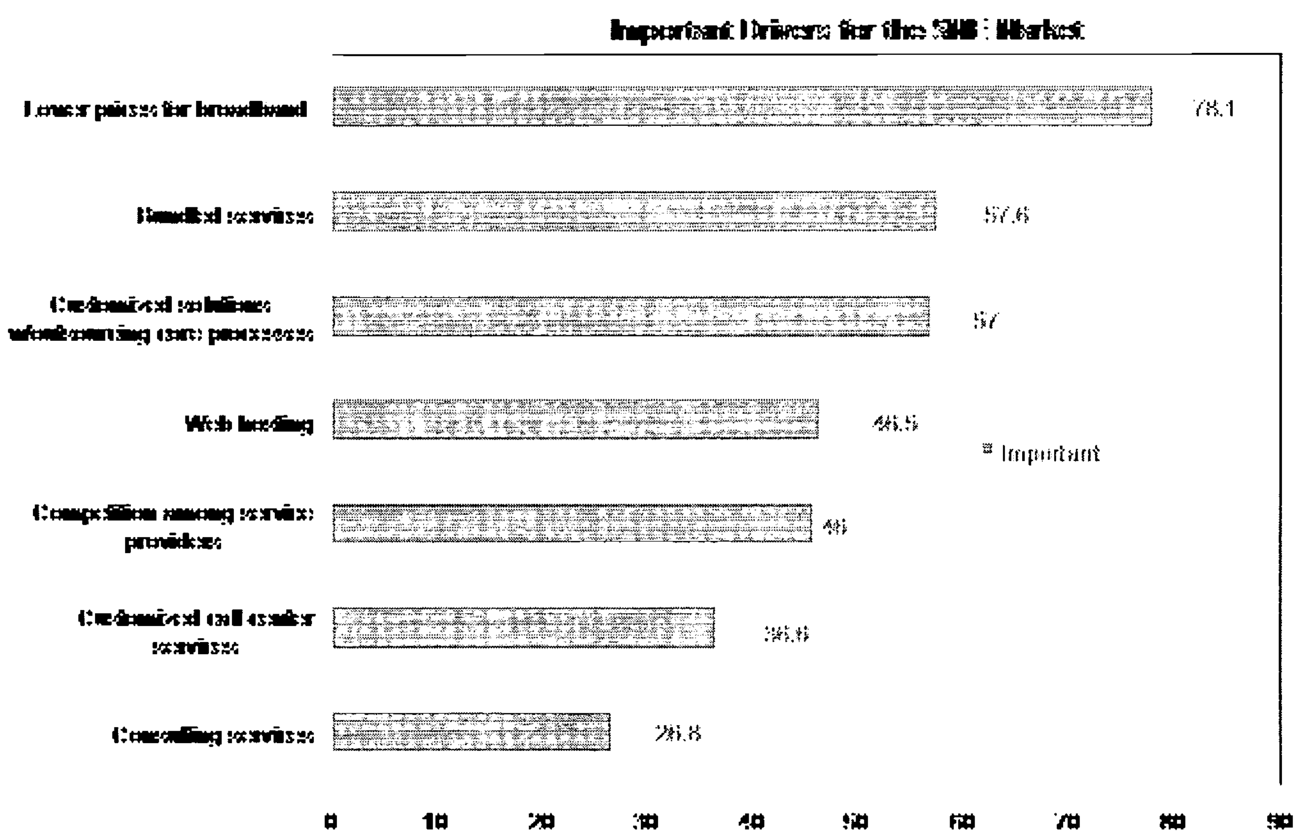
The benefits to the economy as a result of such government initiatives can be substantial, ranging from reduction in the size of the government bureaucracy to increase in national competitiveness and economic growth. It is estimated that increases in productivity as a result of an e-business revolution could boost the Gross Domestic Product of some Asian economies by some five to twelve percent in the long run, and some five percent for the world's industrialized countries.[38]

Similarly, Singapore's TradeNet, an Internet-based electronic network that facilitates the processing of ninety-nine percent of all trade declarations in the country, is expected to generate annual savings of some $2.8 billion Singapore dollars when fully implemented by the end of 2001.[39] In the United States, it is estimated that it would cost the Internal Revenue Service US$0.40 to process an electronic tax return as opposed to US$1.60 for a paper return. The potential savings to state governments are substantial in light of the fact that some forty percent of state expenditures are consumed by the delivery of services.[40]

5. Serving SMEs: theory vs. reality

Reinforcing the view that SME market remains elusive, the results of a CTM survey of telecom experts indicate the view that opportunities from a service provider stand point currently have limitations.[41] As shown below in Figure 3, when asked about opportunities for serving the needs of SMEs and SOHOs with web-hosting services, survey respondents are not overly enthusiastic about near term possibilities.

FIGURE 3. IMPORTANT DRIVERS FOR THE SME MARKET.



The OECD finds that SMEs have much to gain from employing IT and utilizing e-commerce: from researching global markets, learning about customer tastes and preferences, reaching targeted audiences, to back-office efficiencies in procurement and production, logistics and coordination, supply processes and inventories, monitoring production costs, and quality control. Despite the potential, SMEs still lag in their ability to exploit e-commerce.[42]

Clearly, a gap exists between knowledge of SMEs and industry perceptions.[43] As previously noted, lack of capital and skilled personnel and the significant and often under-stated cost of e-commerce applications remain challenging impediments to SME adoption rates.

Service providers have not fully taken into account some of the characteristics of small firm that separate them from the large firm in terms of their communications and IT needs. Since many small firms are preoccupied with stretching their human and financial resources, they are unwilling to divert resources towards implementing an e-commerce initiative without fully understanding the gains that are possible.

6. Affordable Broadband Access is Initial Step to Opening SME Market

Nearly eighty percent of the survey respondents believe that affordable broadband access is the important issue to encourage SME adoption of e-business. In terms of precisely what services or applications SMEs require, there is much less clarity.

Survey respondents do not perceive web-hosting, call centers, or consulting services to be services with great potential. There is greater confidence that bundled services and customized solutions are key areas that providers should target. However, the diverse nature of small firms, along with their capital constraints means that customizing solutions for this market is a daunting prospect. The challenge of catering to specific market niches is illustrated by the experience of Hour Glass, a retail jewelry chain in Singapore. The company's Managing Director recounts how her company lost some $2 million from establishing and then abandoning software offerings from two large software vendors. She finds that the consultants did not know the jewelry business and were unable to articulate the benefits of E-commerce applications for her particular industry.[44]

Due to the economic downturn, small businesses are even more cost conscious than they have been in the past decade. Many are scaling back spending plans, postponing upgrades, and instead are focusing on making use of the technology they have already purchased. Many companies complained that they had overspent on technology that they didn't really need and on consultants who didn't understand their business.

CTM's Telecom Outlook survey findings are in tune to these sentiments, and show that affordable high-speed Internet is a first step in helping SMEs find the best uses of the Web for essential business needs. Rather than focusing on multi-featured systems that small businesses are not equipped to make full use of, providers should focus on basic services and access. Although a broadband infrastructure exists in Hong Kong, Singapore, and South Korea to support small firms' Internet access, the United States is still grappling with cost and demand issues that have hindered build out.

7. Conclusions

The business efficiencies of IP-based applications, stemming from improved internal coordination and supply chain management, will continue to be a compelling force driving adoption by large corporations. Research and surveys suggest that many of these applications, particularly web-based customer support and supply-chain management will be adopted by a majority of companies within the next 3 to 5 years.

Contrary to many industry predictions, however, the small and medium-size enterprise (SME) market has been relatively slow to adopt these applications. Although many industry analysts attribute this lag to a lack of awareness of e-commerce applications, this paper argues that the lack of capital and skilled personnel, the significant and often under-stated cost of such e-commerce applications and solutions, and the core structure of SMEs remain challenging impediments to the adoption of e-commerce applications by SMEs, in the United States, Singapore, Hong Kong and South Korea. Furthermore, this paper argues that internal coordination is not a problem confronting SMEs, and only a re-engineering of core business processes may allow SMEs to achieve the business efficiencies of e-commerce applications.

Since SMEs participate in some eighty percent of all supply chains, and given that corporations are likely to benefit greatly from improved supply chain management, large enterprises should consider offering incentive and subsidy programs to encourage SMEs to adopt E-commerce solutions. Alternatively, the national benefits accruing to e-commerce, such as smaller government bureaucracies, increased national competitiveness, and higher economic growth, justifies the creation of appropriate tax and subsidy programs by national governments to encourage adoption of IP-based applications by SMEs.

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back to index

Abstract

This paper examines some of the economic, social and cultural factors that explain the adoption rate of IP-based applications by SMEs in several countries, including the United States, Hong Kong, South Korea, and Singapore. Specifically, this paper, focuses on three fundamental issues facing SMEs. First, the capital requirements (considered by most accounts, as the greatest impediment), are discussed. Next, the need for re-engineering of core business processes and the role of government are considered.

back to index

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back to index

E-Commerce via Satellite in Japan

Keng-Jin Lian
Hughes Network Systems
USA

View Abstract

Introduction

On most street corners of Japanese cities, there is a convenience store. For Japan's population of 120 million people, there is about one convenience store for every 3,300 Japanese residents. These combinis have become such an integral part of Japanese lifestyles that its popularity is closely eclipsing that of Shrines, Sushi and the Shinkansen bullet trains.

There are numerous convenience store franchises throughout Japan; most notably are the three larger ones, Seven-Eleven, Lawson and Family Mart. As competition intensifies among the different convenience stores, storeowners are constantly trying to stay ahead of the competition by offering more products and services while maintaining a low cost. For a convenience store located in the heart of Tokyo, it needs at least $5000 per day to breakeven, in remote areas, the number is usually closer to $3000 per day.

Convenience Store e-commerce

For anyone who has been to this island nation, they would know that space is a premium in Japan. This factor has also greatly influenced the buying culture of the population. Unlike the US, the amount of goods purchased by the Japanese population at one time is small in quantity and size, due partly to limited storage space. Consequently, one can expect to visit these stores several time a week in order to purchase sufficient groceries to last through the week. The average size of the combinis is about 9,000 square feet with 3,000 square feet for back storage room. By having more than 50,000 convenience stores nationwide, these stores serve as a great location for collecting and distributing merchandize.

Today, all Seven-Eleven and Lawson convenience stores in Japan has a satellite dish to provide e-commerce solutions to their customers as well as providing connectivity to suppliers, stores, and Banks in order to speed up the transmission of orders. In addition to cost savings by using satellite technology, the stores also provide an added layer of security since Japan is prone to earthquakes. In order to provide consistent service throughout the country, in certain rural areas, satellite is the only way to provide a high-speed communication link between the stores.

This technology has brought about numerous advantages. Most notably is the ability to monitor customer needs, which allow the convenience stores to react more quickly to changes in the market place and respond to market demands. In addition, stores can better predict daily trends to reduce product cycles, especially for short-term products such as bento lunch boxes, rice balls and sandwiches. Furthermore, the collected sales data can also help management to improve quality control and pricing.

Hidden amid the bento boxes, instant noodles and snacks, customers will find a computer terminal that uses touch screen technology. These terminals allow customers to sign on for free, and browse through the online catalogue and place an order.

Once a customer selects a product, they receive a paper receipt. This is taken to the cash register and payment is made either in cash or by a special card from Lawson. Items that are not in stock are delivered to the store and the customer can pick them up at these combinis at a later time (Figure 1). Large perishable items such as computers or perishable goods are usually delivered directly to the customer's home. If a customer wants to arrange a trip, the process is somewhat different. After inputting information about dates and destination, a Japan Travel Bureau agent instantly calls the telephone attached to the terminal. The travel agent confirms the travel details with the customer who then pays for the trip at the cash register. A few days later, the travel package is delivered to the customer's home.

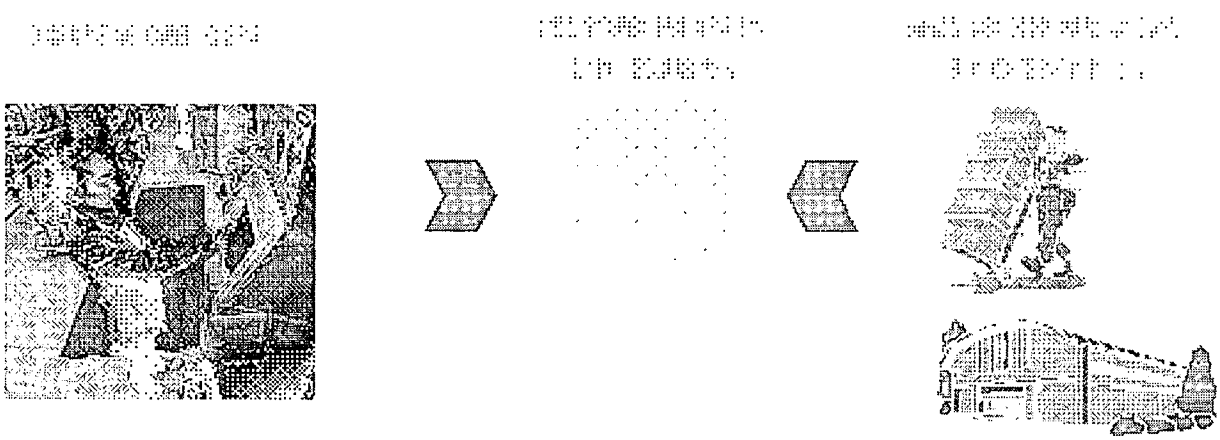

FIGURE 1. E-COMMERCE BUSINESS CYCLE

According to a recent article on SiamFutre.com and Nikkei Business, about 90% Japanese consumers seem to prefer picking up their online book purchases at local convenience store outlets instead of delivering them to their homes.

In addition, computer game machine maker Nintendo Co. Ltd. has also introduced the "Nintendo Power" that let customers re-use game cassettes, overwrite old games with new software. Customers can bring these cassettes to these combinis to provide a self-serve "multimedia service station" where they can download new software for a small fee.

The introduction of e-kiosks in some of these convenience stores has resulted in increased of sales by 6%.

When a new computer game goes on sale, the orders are received at a rate of 3,000 orders a minute. In some cases, more than 100,000 online tickets have been sold for sporting events and concert tickets in a day. In a country where less than one third of the population has access to the Internet, bringing online shopping into the marketplace has been a big hit for customers. According the International Market News, the combined online kiosk sale is expected to hit US 5.8 billion by 2003.

Gulliver: Used Car e-Kiosk

Another relatively similar e-commerce application via satellite involves a used car network in Japan. Gulliver, one of Japan's largest providers of used car has also adopted a similar e-kiosk concept. Gulliver's Dolphinet, the information network powered by HNS has also revolutionized the used-car market in Japan and has allowed end users to sell or acquire used car online.

Dolphinet is a "virtual showroom" that is located in Gulliver dealership all around the country. It allows customers to browse the nationwide selection of used cars as well as make purchases online. The difference between Gulliver and other dealership is that it does not keep cars in stock. This not only allows Gulliver to maintain a low cost but also offer a better price compared to other dealerships. Information on transactions is updated frequently and can be multicast over the network effectively. Customers will always get the most up-to-date information. In addition to allowing customers to buy and sell cars online, Gulliver also allows customers to obtain car loans as well.

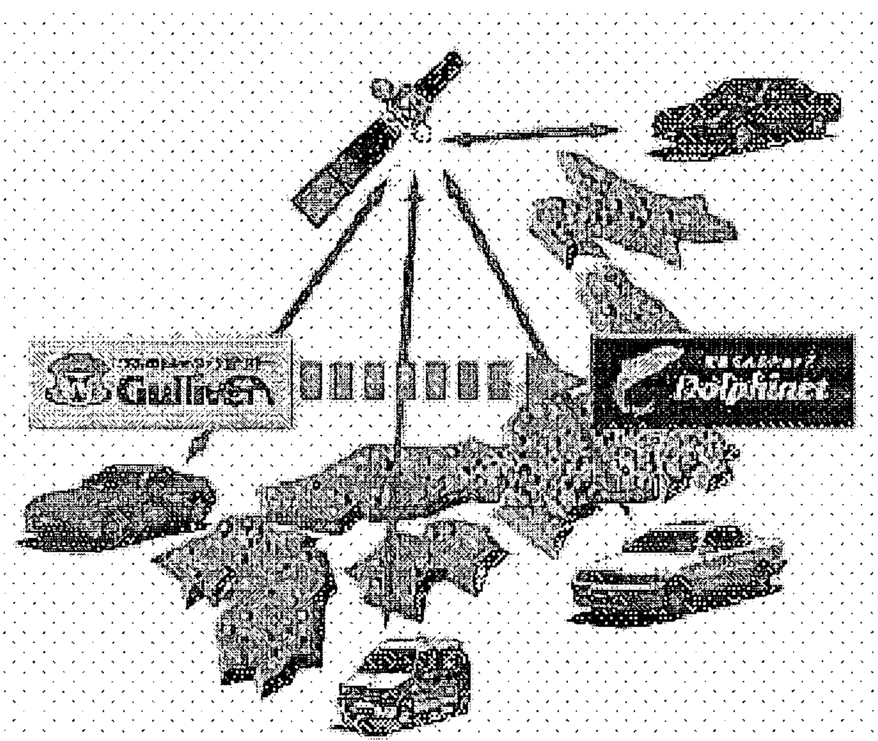

FIGURE 2. GULLIVER: DOLPHINET E-KIOSK

While e-commerce in Japan would one day have the same market share it has in the United States, Japan's less-developed information technology infrastructure and its still significant regulatory hurdles would mean a much slower rollout. Nevertheless, these convenience store chains and used car dealership have leaped frog these hurdles by offering a new virtual services and connections via satellite.

Value-Added Services

Using satellite technology to provide economic access to online stores is one of the ways retailers are revolutionizing the way business is done. It also reflects the changing nature of the VSAT industry and its many uses in today's changing market environment.

As the satellite industry moves into the e-commerce era, service providers are constantly asking what additional revenue can they derive from their customers. End users are constantly questioning what additional benefit satellite solution provides other than cost savings.

HNS recently launched the new Direcway Broadband solution that brings together a family of products to allow us to provide our customers with a variety of solutions, from consumers, SOHOs to large enterprises.

Direcway's high-speed VSAT network powered global businesses, enables companies to send out any kind of information. From live webcast from a CEOs, annual reports, or multimedia marketing material, multicast simultaneously to countless offices around the world. Direcway offer enterprise solution to satisfy virtually any requirement, Internet and Intranet access, e-learning, video conferencing and streaming media and all of the content delivery and management systems backed by HNS.

With advances in caching and spoofing technology, VSAT is increasingly being seen as a better and more economical solution compared to terrestrial solutions. For instance, many of our gas station customers can now install view screen at the pump to deliver stock reports, weather, and traffic updates, along with advertising. This help brings more people in to the gas station stores. It gives advertisers a more cost-effective way to reach consumers. This satellite solution help distribute high quality content to all gas station view screens, simultaneously.

Moreover, Direcway also provides music and messaging services that allows service providers and enterprises to have music playback functionality. The Direcway solution allows enterprises to effectively market to the customer by creating the right atmosphere to extend the customer's stay, shape buying decisions, encourage repeat visits and increase sales opportunities. This has significant influence in today's emotion base marketing, which is widely adopted by many enterprises such as Starbucks, GAP, and Barnes and Nobles.

All in all, the e-commerce revolution is just one of the many venues in which VSAT has impacted, especially in Japan. Instead of providing simple connectivity, HNS has continued to strive to provide more value add to the end user by maintaining the VSAT at a competitive price.

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back to index

Abstract

On most street corners of Japanese cities, there is a convenience store. For Japan's population of 120 million people, there is about one convenience store for every 3,300 Japanese residents. Now, thanks to an e-business solution from IBM and Hughes, Japanese consumers can buy more than beverages and instant noodles at these shops. They can order vacation package to Kyoto, family passes to Tokyo Disneyland, and even get their daily horoscope for a mere 500 Yen.

These conbinis are almost as famous as the Shrines, Sushi, and the Shinkansen bullet train, anyone who has ever been to Japan will talk about the amazing Japanese convenience stores. Tucked amid the instant noodles, canned drinks and bento boxes at the local Lawson Convenience Store, customers will find a computer terminal that gives them access to an increased variety of products that otherwise could not fit into the these tiny retail space. Using touch screen technology, customers can order concert tickets, make train and plane reservations and pay at the cash register on the way out.

While a study by Andersen Consulting concluded that while e-commerce in Japan would one day have the same market share it has in the United States, Japan's less-developed information technology infrastructure and its still significant regulatory hurdles would mean a much slower rollout. Nevertheless, these convenience store chains have leaped frog these hurdles by offering a new virtual services and connections, leaving analysts puzzled and trying to understand the popularity of this service that have swept Japan by storm.

Each of Lawson's new e-kisoks in Japan is equipped with Hughes Network Systems' (HNS) Broadband IP Multimedia Relay that enables high speed IP connectivity to the Internet and other application services. These satellite-based kiosks use state-of-the art satellite technology to deliver content to stores nationwide and provide a secure access for customers.

In addition, HNS' Multimedia Relay is also equipped with a disk drive to store up to multi-Gigabytes of data, converting this multimedia relay box into a video and music jukebox of some sort. Through HNS' alliance with different organizations, HNS is able to provide customized multimedia content such as video and music content to retail customers in Japan and other parts of the world. The content are multicast over the satellite and enables retail customers to offer different genres of music based on their preferences and also allow messaging and advertisement insertions to be inserted in between these content. This new technology will hopefully bring more applications to light as in the case of this e-kiosk.

back to index

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back to index

Emerging Wireless Data Services Markets- An Asian Perspective

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View Abstract

The authors present a comprehensive research design focusing on market segments for these services, and identify subscriber preferences for a wide range of services. Analysis of user demographics and preference patterns reveals groupings that facilitate market segmentation, and provide a rationale for marketing activities that exploit the knowledge of segment members to accelerate adoption. The analysis concludes with recommendations for service providers and regulators.

Introduction

Forecasting the marketability of IT-based innovations is difficult, and mobile data services display a strikingly inconsistent track record. In Europe, despite the huge popularity of text messaging, take up of WAP-based data services is sluggish. In North America, where legacy infrastructure and multi-bearer interoperability issues represent additional barriers to adoption, the mobile data services outlook is even more uncertain (Raisinghani, 2001). Yet in Japan, DoCoMo's i-Mode service is a huge success, signing up ten million users in less than one year, then doubling that within the next (Kuchinskas, 2000).

In Singapore, WAP services have yet to attract the necessary critical mass, despite heavily promoted launches by local mobile operators Singtel, MobileOne, and StarHub (Gilbert, 2000). This stimulated our examination of mobile subscriber perceptions to identify the emerging structure of this mobile data services market.

Framework for Analysis: Diffusion of Innovations across Segments

Technological innovation occurs whenever a tool or practice is used for the first time in a specific context. Prior research explains how new technologies are adopted (Rogers 1995, Urban and Hauser, 1980), which market segments are likely to adopt these new technologies, and why (Agarwal and Prasad 1999). The Rogers (1995) model of innovation diffusion examines relationships among communications and adoption behavior, focusing on the flow of messages that influence the adoption of technology flow to individuals through channels ranging from mass media to friends, family, and colleagues in the workplace. Urban and Hauser (1980) suggest that new product failures may be due to market related causes, such as small market scale, a poor fit between product features and demand, the lack of value from the buyer perspective, poor positioning, channel problems, and forecasting errors.

Rogers' (1995) innovation-decision process provides one theoretical foundation for the survey, which was designed to identify barriers to WAP adoption. The study of innovation diffusion focuses on the flow of messages that influence new behavior. Diffusion is the process through which (1) an innovation (2) is communicated through specific channels (3) over time (4) among the members of a social system.

An innovation is an "idea, practice, or object perceived as new by an individual or other unit of adoption." (Rogers, 1995, p. 11).

Communication is the process by which participants create and share information with one another. Messages that influence the adoption of technology flow to individuals through channels ranging from mass media to friends, family, and colleagues in the workplace.

The social system describes the domain in which an innovation diffuses. The units of a social system include individuals, informal groups, and/or organizations. Social systems create various types of rules; not only laws, but also norms and standards that influence adoption and use (Spar 1999). Members may act as enablers or barriers to adoption.

The time span of the adoption process varies by innovation type. Extensions of existing products -e.g., backlit phone displays- are "continuous" innovations, versus "dynamically continuous" innovations; those perceived as new -e.g., digital cellular networks- that do not represent major technological advances. A third type, the "discontinuous innovation," -the home computer is a relevant example- is a source of new value, that also requires new behavior for its sale, ownership and use (Anderson & Ortinau, 1988).

Mobile data services are a form of technology-enabled discontinuous innovation that can succeed only if adopted by a critical mass of subscribers, in a given social context, and over time. While this will create new value, the adoption process will require new behaviors.

The figure below portrays the stage theory of innovation (Rogers 1995). This work focuses on Stages I through III, during which adopters acquire knowledge about the innovation, and take decisions to adopt or reject innovations, based on the perceived characteristics of these innovations (PCI).

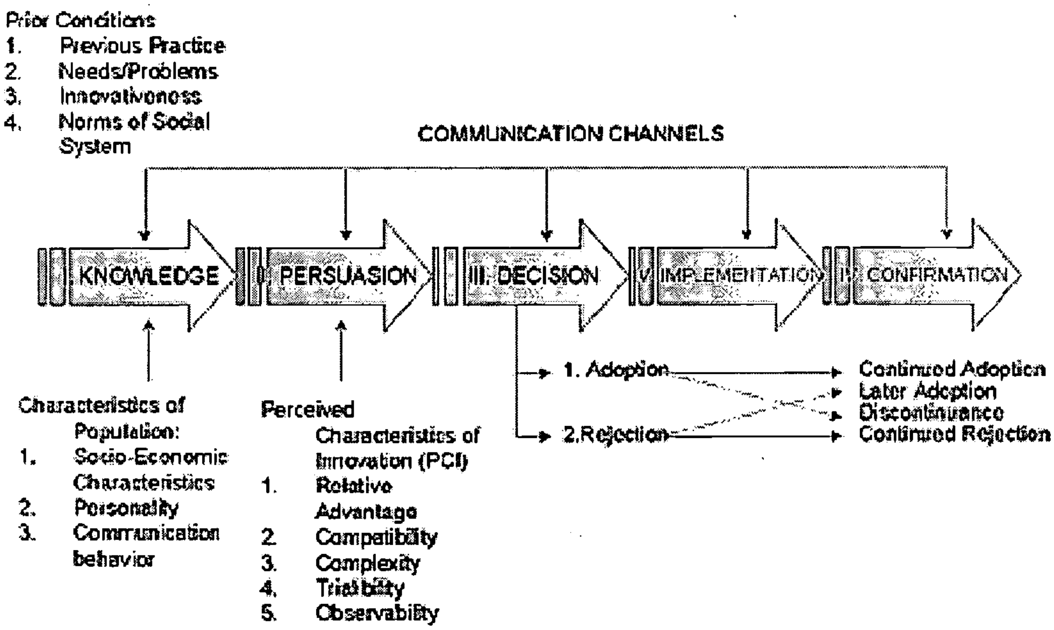

FIGURE 1: DETAILED INNOVATION DIFFUSION MODEL (ROGERS 1995)

Adapted from Rogers, 1995

During the Persuasion stage of the Rogers (1995) diffusion model, five PCI variables influence the decision to adopt:

Relative advantage is the degree to which an innovation is perceived as advantageous, or better than current tools or practices. While value may be perceived in economic terms, convenience, social prestige, and satisfaction also influence many adoption decisions.

Compatibility describes the extent to which a given innovation is seen as consistent with existing values, past experiences, and needs of potential adopters. Tornatsky and Klein (1982) identify two distinct compatibility levels: one at the operational level of technical standards and work practices, another at the cognitive or normative level of belief systems in a social context. Those innovations that require extensive behavioral change, alterations to technical infrastructure, and new work practices tend to be less likely to be adopted.

Complexity describes the degree to which an innovation is perceived as difficult to use, and to understand. Certain innovations, such as radios, are readily understood by most members of a social system; while others, such as DOS-based personal computers and WAP phones, require more skill or knowledge and thus would be adopted more slowly.

Observability describes the extent to which individuals are able to see or verify the results of an innovation. For example, in considering a new cellphone model with a color LCD display, a potential adopter would want to see an actual picture under lighting conditions similar to those on the street. If display quality is not fully observable - as in a mail-order or Web catalog - a degree of uncertainty is present, which would deter adoption. Also, the presence of information asymmetries in the diffusion process may inhibit adoption and lead to failures of new services to find the critical mass needed to survive in the market.

Trialability describes the degree to which a potential adopter can experiment with an innovation, without a long-term commitment. The trial experience potentially reduces perceived uncertainty about other characteristics of the innovation - relative advantage, compatibility, and complexity - and offsets uncertainty associated with low observability.

Market segmentation techniques were developed to help corporations understand and respond to customer needs. Market segmentation knowledge enables responsive, effective, and cost efficient promotional strategies, and facilitates the design of products differentiated according to the needs of clusters of customers (Weinstein 1994). Market risks increase for new products and services derived from information technology, which enables a wide range of configurations, yet demands a large initial investment. In this paper we suggest that managers can reduce potential failures by identifying market segments and their needs prior to designing and introducing new products (such as WAP), then match promotional activities to the characteristics of segment members to accelerate the adoption process across segments.

Segmentation groups subjects into clusters according to geographic, socio-economic, psychographic and behavioral attributes (Urban and Hauser 1980, Weinstein 1994). In today's information intensive environment, the impact of mass marketing related demographics and economic basis for segmentation has declined. New psychographic clusters based on perceived usage and benefits, known as lifestyle and need-based segmentation, have gained credence for explaining how adopters of new technologies behave (Michman 1991). Segment membership can be global and behaviorally homogeneous, yet their socio-economic basis may be heterogeneous. Figure 2 portrays the interactions among these constructs:

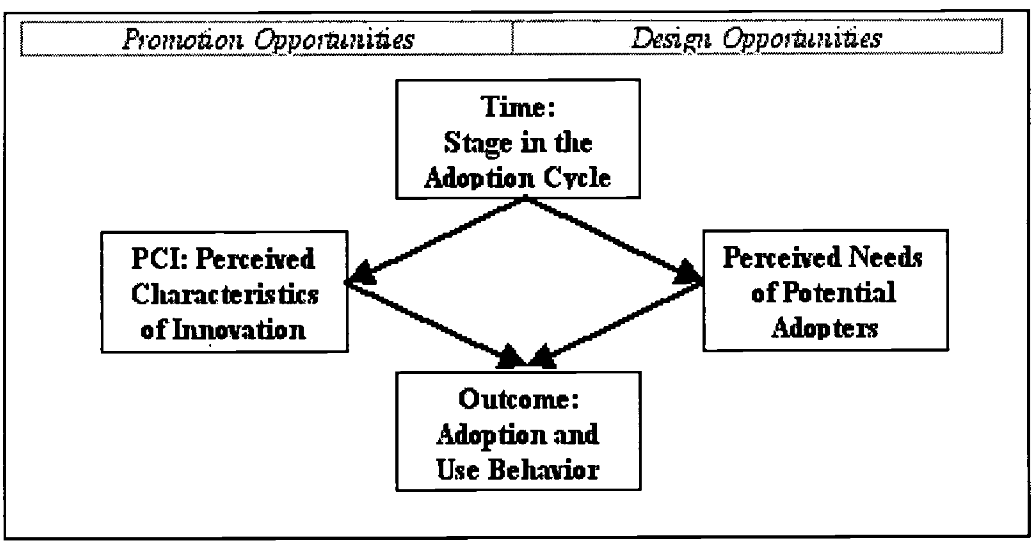

FIGURE 2: A DYNAMIC FRAMEWORK FOR INNOVATION-BASED MARKET RESEARCH

This work integrates two perspectives on market segmentation. Diffusion research categorizes adopters according to their adoption behaviour, creating time-based segments. Needs-based segmentation emerges from information intensive environments, where marketing and communication strategies are shifting from the mass media orientation to a personalized approach (Hoffman and Novak 1996). This trend builds on interactive IT platforms to help us cope with the exponential growth of demands on our attention (Simon 1971, Goldhaber 1997). However, effective segmentation strategies require major corporate commitments and shift in marketing strategies, actions that may incur higher initial costs.

Approach to the Research

The researchers selected innovation theory as the primary lens through which to view the mobile data services phenomenon, focusing on WAP services as the mostly widely available example in use at the time (Raisinghani, 2001). The second stage involved a focus group composed of 20 SMS users who were non-users of WAP. The focus groups helped clarify research issues and refine the questionnaire design. The final stage involved distributing survey forms to a convenience sample of 300 undergraduate and postgraduate students, data analysis and interpretation, and development of recommendations[1].

During the analysis stage, we drew on market segmentation theory to develop an understanding of the needs of potential users. The PCI model is widely applied to market research and has been validated in many different contexts, ranging from agriculture to family planning, and is extensively used in the study of the diffusion of personal computing. The elements of the PCI model are adapted to the WAP context in Table 1, below:

Variable	Definition
Relative Advantage	Benefits accruing to subscriber from adopting MDS services
Compatibility	How well MDS devices and services fit their daily lifestyle
Complexity	Difficulties perceived by subscribers in using MDS services
Trialability	Ability to experiment without commitments to long-term service contracts or purchasing devices (such as Blackberry) that cannot be adapted to non-MDS services
Observability	The extent to which MDS benefits can be observed without trial

TABLE 1: PERCEIVED CHARACTERISTICS OF INNOVATIONS (PCI) VARIABLES, ADAPTED TO WAP

For this paper, the unit of analysis is the decision by an individual to adopt WAP services, rather than the device itself. Factor analysis identifies segments within the markets for each service, indirectly deriving a sample of services demanded by each segment. Analysis by segment reveals the characteristics of subscribers who intend to adopt WAP within the next year, and maps demand for a wide range of potential services to segments.

Analysis of the field data from the innovation perspective

The researchers applied the Rogers PCI framework to a 30-question survey form, focused on current and planned mobile phone ownership and use, attitudes toward mobile data services, and personal data including technological know-how, Internet use patterns, and subscriber demographics. Of the 300 forms that were distributed, 198 were returned, for a 65% return rate (seven forms were later rejected due to incomplete responses). The survey population was evenly divided along gender lines. Slightly more than half (55%) were working adults, with the remainder full time undergraduate and postgraduate students. Most were between 18 and 35 years of age, with about twenty percent of the panel above or below this range. More than 85% owned and used cell phones. While one in nine owned a phone capable of accessing mobile data (WAP) services, only half of these subscribed to the service.

WAP subscribers in our survey panel were likely to be male, to perceive themselves as technologically savvy persons to whom others would turn for guidance. They were also more likely to use SMS and personal organiser functions on their cell phones. These findings (significant at $p<.05$ despite the small sample) are consistent with Rogers' (1995) roles of early adopter and opinion leader, as well as with the Consumer Innovativeness Model (Goldsmith, et al 1991), which posits a linkage between technological know-how and early adoption.

Subscribers and non-subscribers varied in ways that are relevant to marketing mobile data services. Subscribers were far more likely to use cable and wireless modems to connect their personal computers to the Internet. For access to information about technology and technology-based services, WAP subscribers were significantly more dependent on mass media channels, and less dependent on advice from family, friends, and colleagues, compared to non-subscribers. These findings confirm the need to match not only the product, but the communications channel, to the intended target (Rogers, ibid.), over time.

A Dual Logic of Market Segmentation

This work integrates divergent approaches to market segmentation. The Rogers (1995) model posits five segments, based on the timing of their adoption behavior: (1) Innovators, (2) Early Adopters, (3) Early Majority, (4) Late Majority and (5) Laggards. As each segment perceives innovations differently, knowledge of their needs and behaviors can focus the use of resources to help prevent a newly introduced innovation from failing Miller (1993). By cross-referencing these time-based segments to the factor analysis of their demographics and psychographics, telecommunication service providers (TSOs) can devise a viable marketing plan [Weinstein, 1994, pp.205-223]. The TSO can also use this knowledge to develop a positioning strategy to guide other tactical strategies [Kotler, 1999, pp. 46]. In each segment, a new product such as WAP can then be positioned based on price, its ability to add specific types of value, and its image. Figure 3 portrays these relationships:

FIGURE 3: A SEGMENTATION MODEL FOR MOBILE DATA SERVICES MARKETS

Analysis of field data from a needs-based segmentation perspective

Factor analysis [3] was applied to study relationships among the intention to use WAP services within one year, specific service requirements, and demographic variables, resulting in the identification of five needs-based segments that are most likely to be early adopters:

Early Adopters and Opinion Leaders

Mobile Professionals: these services fill needs related to work life, including calendaring, and access to mobile email and intranet/extranet services.
Sophisticates: filling needs for status, in terms of material style.
Socialites: filling needs to keep in touch with family and friends while on the go.
TechnoToy: filling needs for hands-on knowledge about technological developments.

Follower Segments

Lifestyle: these segment members, whose adoption behavior lags the four categories above, will use mobile data services fill needs related to mobile lifestyles, such as delivering information or directions to people who are in an unfamiliar location, and helping people fill "dead time" with time-critical tasks. Examples of such tasks include bill paying while waiting in line or on public transport, or facilitating meetings among friends who are on the move.

Two follower segments, containing those who were unlikely to adopt, emerged:

Misers: members of this segment were unwilling to pay for WAP services.

Laggards: were the last to know about and adopt new technologies.

A series of separate factor analyses by service maps demand for specific services back to each of the revealed segments, as portrayed in Table 2 below:

SEGMENTS	Categories Demanded	Specific Services
Mobile professionals	Financial, location-based, personal information, news, entertainment Intranet/Extranet	Banking, music, ring tones, tickets, world news, maps, greetings, email, interest and exchange rates
Sophisticates	Financial, news, personal, location-based, entertainment, Intranet/Extranet	Multi-player games, photos, ICQ, music, tickets, locating friends, banking, world news, maps, greetings, timetables, ringing tones, email, interest and exchange rates
Socialites	Personal, entertainment	ICQ, multi-player games, music, photos, locate friends, maps, greetings, ring tones, email
TechnoToy	No significant (P<.05) service preferences	
Lifestylers	No significant preferences	World news, greeting cards
Misers	Financial, news, personal, Intranet/Extranet	Music, banking, maps, timetables, email, interest and exchange rates
Laggards	location-based, financial, Intranet/Extranet	ICQ, multi-player games, ring tones, email, music, photos, greetings, timetables, email

TABLE 2: SERVICES DEMANDED BY REVEALED SEGMENTS

Respondents identified lack of observability as a current barrier to WAP adoption, and further analysis suggests relative advantage will be a critical success factor for its future acceptance. Over the long run, the most attractive segments are the Mobile Professionals and Sophisticates, who are older and earn more. However, as different services are required, and meeting the service quality expectations of Mobile Professionals may be more complex, the Sophisticates might be a more realistic medium-term target. Also, as many specific services required by Socialites are also required by Sophisticates, these two segments might be launched simultaneously.

An interesting tactical problem arises: as both Sophisticates and Socialites are more likely to seek out family, friends, and colleagues than mass media for the information that will guide them toward a decision to adopt, and few of their associates will have a positive perception of the service, how should operator promote it?

One answer to this question may be found by examining current users of WAP services, who match the Opinion Leaders profile identified by Rogers, then finding ways to pass information to early adopters in the target market through this segment. Another approach requires providing a suite of "Light" mobile data service applications that run on existing GSM networks and cellphones, based on SMS technology. These will provide potential adopters with a "window" on potential benefits from WAP adoption. By combining the PCI model with the revealed segments, and populate each cell with segment-specific marketing activities that are likely to reduce uncertainty and thus accelerate adoption, the following table emerges:

Perceptions SEGMENTS	**Relative Advantage**	**Compatibility**	**Complexity**	**Trialability**	**Observability**
Mobile Professionals	Work-based applications Time savers Context-based applications	Corporate M-portals, Applications suites to meet common needs	Simple design and interface Interoperability w/ corporate applications	Online demos Corporate evaluation trials	Compelling content. Use internal TechnoToys as promoters
Sophisticates	High-status early adopters Fashionable design values	M-portals, Applications suites to meet common needs	Simple design and interface (possibly voice)	Individual evaluation "loaners"	Compelling content. "Starting Up" setup tools
Socialites	Entertainment, ICQ, gaming	Ad-hoc group applications	Simple design and interface	Parties, social marketing. etc	Compelling content
TechnoToys	Magazines, technical journals, FAQs	Demo sites Published standards	Development kits to help build content	Online demos and simulators	Individual evaluation "loaners"

Lifestylers	Time-sensitive applications	Applications suites to meet common needs	Simple design and interface	Free trial services and downloads	Compelling content
Misers	Case studies to reveal value Free trial services				
Laggards	No segment-specific recommendations				

TABLE 3: NEEDS-BASED MARKETING APPLIED TO DIFFERENT SEGMENTS

Although the activities in the cells in Table 3 are far from complete, the pattern of these activities demonstrates the need to design different approaches to marketing for each segment. Because the motivation for use, discretionary income, and preferred source of information vary widely among the segments, the sources of uncertainty are different. Thus, the activity required to court members of the TechnoToy segment, who could play Opinion Leader roles, is very different than that needed to encourage Mobile Professionals to adopt mobile data services. Members of each segment acquire information from different channels, are influenced in different ways, and view the adoption decision through a different value set.

Limitations

This preliminary study has many limitations -a small sample size, narrow geographic scope, and the convenience sample - that suggest that its results be treated with care. Despite these gaps, the authors hope others find our approach to the research promising, and these results useful, if not definitive. Followon research is underway to bridge many of these gaps.

Conclusions

Content that compels attention, highlighted in the right column of Table 3, is a success factor across the segments. The real theme of the DoCoMo success is not the I-mode technology platform, but their needs-focused business model. Instead of selling technology to consumers, DoCoMo delivers lifestyle and content, and harnesses the creativity of hundreds of semi-independent design teams to acquire content. When an independent studio presents an idea that DoCoMo feels will meet the needs of its operators; they receive business advice and technical support. In exchange for providing infrastructure, DoCoMo takes a share of the revenue. Their subscribers, few of whom realise they are on the Internet, receive access to a constantly changing constellation of mobile data services. This model captures the energy needed for a virtuous spiral of innovation, one that reaches a higher level with each cycle.

Recommendations: business models

Voice and EDI subscribers normally provide their own content, so telecoms operators rarely develop core competence in content creation or management. In fact, many sell content (subscriber directory data) to firms who are more able to exploit its value. Yet, successful mobile data services will demand compelling content. In the entertainment and games industries, where rewards are geared to sales, semi-independent studios are the dominant sources of content. As demonstrated by the i-mode case, operators must build business models to attract a stream of ever-changing content from beyond traditional telecoms industry boundaries, then match this compelling content to subscriber needs, which shift over time.

Recommendations: marketing

Much of our thinking about the emerging mobile data services phenomenon is shaped by the immediacy of our experience with the Internet. However, a mobile phone inhabits a far more intimate space in our daily lives than television sets or personal computers. Its mobility, scaled-down connection to Internet contents and services, convenience and timeliness of access are important advantages. Thus, few of the marketing lessons from mass media or electronic commerce are likely to apply to mobile commerce. Many users of cell phones, who carry them wherever they go, pay careful attention to the incoming stream of calls and text messages. For operators who learn to manage this attention, the new channel represents an opportunity to be close to customers. This can take many forms, including differentiation through versioning of services and pricing across different segments; and customized bundling of cell phones and services to meet different needs and perceived values of these segments. Differentiation may also be needed for product design (size, color, degree of technical sophistication, and accessibility features) and their subsequent positioning. The communication strategy should be targeted directly at the target segment lifestyle and be congruent with the desired product positioning. It could be targeted at opinion leaders such as TechnoToys, who may not use the services, but who can transmit viral marketing messages about the benefits of mobile data services.

Recommendations: regulation

Regulators that hope to encourage local innovation in the mobile data services market may want to examine the impact of current policies on behaviors that lead to adoption. While such policy is beyond the scope of the current research, it is evident that operator arrangements that raise switching costs (such as SIM-locked phones and fixed contract periods) deter experimentation with new services, while weak interconnect agreements for data-related services leads to poor interoperability among services that are accesses through multiple sources, or that require interactions among subscribers from different operators. Such policies are not only anti-competitive, but also anti-innovative.

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Endnotes

1. Although there are limitations of the use of student population as data units, our choice was guided by the common belief that WAP technology is more likely to be adopted by younger and upward mobile

subscribers

2. SPSS extraction performed via Principal Component Analysis, followed by rotation via Varimax with Kaiser Normalization. Rotations converged in 6-9 iterations.

back to index

Abstract

The authors present a comprehensive research design focusing on market segments for these services, and identify subscriber preferences for a wide range of services. Analysis of user demographics and preference patterns reveals groupings that facilitate market segmentation, and provide a rationale for marketing activities that exploit the knowledge of segment members to accelerate adoption. The analysis concludes with recommendations for service providers and regulators.

back to index

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Lee Gilbert began his international career as a consultant for SRI International, and later served the Institute of Systems Science as Deputy Director, Harvard Business School as Future Information Systems faculty Fellow, the United Nations Secretariat as Regional Adviser for Technology Transfer and Development, and Nanyang Business School as Director of its MBA (Management of I.T.) programme. As an IT practitioner, he assisted varied private and public sector clients throughout the world to acquire and implement effective computing and telecommunications solutions to business problems.

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back to index

Social/Cultural

Tuesday, 15 January 2002
1430–1600
South Pacific I - II

T.2.1 IT Services

Chair:
PAULA HELFRICH, Executive Director, Hawaii Island Economic Development Board, *USA*

T.2.1.1 A Case Study of IT Outsourcing in a Large Telco: Power-Political Impacts (View Abstract)

G. MICHAEL MCGRATH, Deputy Director, CSIRO-Macquarie University Joint Research Centre for Advanced Systems Engineering (JRCASE) and ELIZABETH MORE, Professor of Management & Director, Graduate School of Management, Marquarie University & Director, MGSM Pty Ltd, *Australia*

T.2.1.2 The Use of Government Electronic Service Delivery: The Australian Experience (Academic peer reviewed) (View Abstract)

SUPRIYA SINGH, Senior Research Fellow and TERRY LAIDLER, Director, Centre for International Research on Communication and Information Technologies (CIRCIT) at RMIT, *Australia*

back to sessions

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*Agriculture Based Remediation Program, Consultant (1998 - Present)
*Rural Economic Transition Assistance - Hawaii Program Coordinator (1993/Pres.)
*China Clipper Lodge & Coffee Farm (1994-Present)
-Kama'aina Come Home (recruiting, repatriation - 1999/Present)
-Kamehameha Statue Committee & Wailoa Cultural Center (1997)
-Paniolo Heritage Program - Hawaii Horse Owners (1996-Present)
-Plantation Heritage Trail - Islandwide (1996-Present)
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Pan American World Airways, Inc.
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*Commissioner, State Foundation on Culture & Arts (1995 - Present)
*Workforce Development Program, State of Hawaii (1998 - Present)
*Aloha Festivals sponsor and volunteer (1990 - Present)
*Kamehameha Schools Alumnae Asscn - Statue Committee 1997 (assoc. member)
*Member, Pan American Historical Society (Dinner Key, FL) (1992 - Present)
*Secretary, Hawaii Horse Owners Association (1992-Present)
*Chair, Ewa Neighborhood Board, Honolulu (1984-90)
*Chair, Gang Violence in the Schools Task Force, Ewa (1989)
*Founding Board member, Pacific Islands Assc., (1988 - Present)
*Honorary member, Dooley Foundation (Vietnam, Laos, Nepal - 1970-1980)

back to index

A Case Study of IT Outsourcing in a Large Telco: Power-Political Impacts

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View Abstract

1. INTRODUCTION

This paper outlines how, in the rush to align with others, management often unthinkingly destroys the very basis of competitive advantage residing in previous organization designs and work practices. We report on a recently completed study of an IT outsourcing venture, in which the particular needs of one of the outsourcing company's most strategically important and highly successful Divisions were neglected during both the establishment of the venture and in the detailed interface planning phase. The impact on the Division's IT operations - a major source of its success - was devastating. Moreover, our study graphically illustrates the effect that dysfunctional political activity can have on the crucial issue of the retention and cultivation of the intellectual capital residing in expert personnel.

Over the last decade there has been a rising interest in the dimensions of power and politics to explain some of the richer and often intangible aspects of organisation processes and behavior. This is hardly surprising given increasing organisation problems related to distribution and inequities of power, competition for resources, the link between power, authority, and leadership, and especially the challenge of the ongoing dynamics of organisational change that threaten traditional power bases. As Buchanan and Badham (1999; 1) put it: "There is clearly enhanced scope for political manoeuvring in a less well-ordered and less disciplined organizational world. There is also clearly a greater need for a critical understanding of the shaping role of political behaviour in such a context."

We have also moved from a romantic view of power as personal attributes, through a modernist approach that associates power with structure and position, to a postmodern view that understands power being about relationships. There is also the acceptance of the ways in which current change management is inextricably linked with power and politics in increasingly complex, uncertain and ambiguous organizational environments. As Mintzberg (1983) emphasised some time ago, being an effective change agent implies a willingness and capability to engage in the political process of organization change. On the other hand, it is equally important to recognise the interdependency of the cast of characters in change and the power and politics enmeshed in their actions and interactions.

While these changes in theoretical and practical developments have occurred they have largely focussed on micro-individual and team relationships within organizations. What hasn't been widely discussed is the nature of such power and politics from both a strategic and tactical perspective across organizations in partnering and collaborative relationships. This includes both the more positive and negative faces of power and politics.

Our paper is organized as follows: Sections 2 and 3 contain our case study narrative and a system dynamics view of some crucial aspects of the outsourcing operation respectively. We then present an extended model, developed to highlight power/political impacts. Finally, our conclusions are presented in Section 5.

2. CASE STUDY: AN IT OUTSOURCING VENTURE

Gigante is a large Australian company involved in the development and provision of IT products and services. In 1992, recognizing the need for a much greater presence in the international arena, it took over a much smaller player, Cowboys Inc., who were already operating very successfully in what was, essentially, the same business. The marriage was, in effect, a hostile takeover. One immediate impact of this was that many of Cowboys best and most experienced technical and managerial staff walked out the door in the first 12 months following the merger.

Despite this, Cowboys (now rebadged as Gigante's International Division) continued to operate very successfully. Rapid response to new circumstances was the key to their success. Mainstream Gigante was much more slow-moving, operating within a mechanistic, highly bureaucratic organizational structure. In contrast, International displayed many of the characteristics of the smaller, organic structural paradigm. In particular, communications lines were flexible and uncluttered and scant regard was paid to formal policies and procedures. International was able to operate within this preferred mode largely because of its General Manager who, apart from being highly respected and well-liked by his team, was regarded as an astute politician, intolerant of any outside interference in his Division's operations. Thus he was able to act as an effective buffer between International and the mainstream organization.

Nowhere was this style of working more evident than in International's IT operations. Rapid changes to production lines, the customer base and specific customer demands meant that billing, orders and customer management systems had to be updated frequently and quickly. Typically, a salesman working offshore would place an urgent call to the IT Manager and: 1) request information required to finalize a quote; and 2) advise of system changes required to support his prospective customer's particular product demands. Unless the quote information was provided overnight and the necessary system changes made within a month (at the outside), it was highly likely that the deal would fall through. These sales support requests were given top priority by the IT Department, activities were carried out "on-the-fly" and, despite (or because of) its small size (12 people), the Department had compiled an excellent and admirable record in meeting its deadlines. As such, it was considered to be a major source of competitive advantage for International and was generally held in high regard by colleagues.

This came to an abrupt end in 1997 when Gigante entered into an outsourcing deal with Worldwide Information Technology (WIT). A major player in IT outsourcing, WIT had a hierarchical organization structure, a predominately bureaucratic mode of working and a culture similar in many respects to that of Gigante. In this environment, the very features that were the essence of International's strengths and successes now were jeopardized. In particular, to have any systems maintenance or enhancement work undertaken, work orders had to be prepared, and estimates and program specifications had to be developed. All these were then passed upwards through three layers of interface management on the Gigante side, then downwards through a similar number of layers on the WIT side and, finally, each work order had to be vetted by WIT's Legal Department. Control, hierarchy and formal communication dampened the highly innovative culture - the previous emphasis on flexibility and freedom, the horizontal and informal.

Unconsulted prior to the establishment of the outsourcing arrangement or during the preparation of detailed operating procedures (which were far from complete in a number of important respects), International found itself in a very difficult position. With the procedures as they stood, there was no way that its sales force or other operations management and staff could continue to receive the level of IT service they had become accustomed to and required: its staff lacked both the skills and the will to prepare the necessary documentation and to negotiate their way through the system; unacceptable delays were intrinsic in the procedures themselves; and the final blow came when their champion (the General Manager) was promoted to an offshore position. Their problems were exacerbated when the General Manager's replacement displayed little understanding of the problems that outsourcing had generated and less inclination to tackle them (or even discuss them!). Moreover, he failed to comprehend the destruction of 'the rose among the thorns' of the organization.

Those in the IT Department have displayed considerable vigour in trying to obtain a better deal for the Department, its systems and its Division. Essentially, they have simply refused to relinquish control over their systems to WIT and the various parties involved in interface management, and have continued to enhance and maintain their systems themselves. The IT Manager, however, recognises that his resistance will inevitably have to end and is devoting most of his energies to securing a better deal for his Division, plus improved interface procedures. Moreover, while this state of affairs persists, International are not only wearing the cost of their own internal staff performing actual work on their systems, but are also paying WIT for that portion of their staff performing nominal work on International's systems!

Perhaps the most depressing aspect of the whole case study, however, is the impact that the outsourcing venture has had on the International IT Department's morale. Effectively, a vibrant (if unconventional) IT group, providing their customers with timely and excellent service, has been shattered - in our view, probably beyond repair. Some staff have already resigned (rather than take up the offer of moving across to WIT) and most others are actively seeking alternative employment.

3. A SYSTEM DYNAMICS VIEW

In arguing their case, International's IT Department felt that they needed some quantitative support. Intuitively, they were certain that outsourcing would have a major negative impact on their bottom line but needed some means of demonstrating this. We were consulted and suggested they develop a system dynamics model. Once the basic rationale and approach (and, especially, the simulation capabilities of the ithink software employed) were outlined, the IT Manager readily agreed to our suggestion and the model presented in Figure 1 was developed. Note that, for the purposes of this paper, the model presented is somewhat simplified.

International, as its name implies, operated in a global marketplace. It was one of only eight companies marketing a very limited range of high-tech communications products - mostly to medium-to-large, distributed organizations. Each product was designed for (essentially) the same communications function and, at any given point in time, one product tended to dominate the market (while other products were towards the beginning or end of their life-cycles). The model presented in Figure 1 could be applied to any member of the product range but was parameterised using the dominant product and, of course, International's operations relative to this particular product only.

FIGURE 1: STOCK AND FLOW IMPACT OF DELAYS ON MARKET SHARE AND REVENUE.

At the time development of our model commenced, International had a 20% market share of the dominant product. Among the eight players, this placed it equal second overall but it was rapidly increasing its share - mostly at the expense of its two major rivals. Our clients were convinced that, within three months, they would be the clear leader - and, indeed, the trend seemed to suggest that this was a reasonable assumption. No other player had more that 12% of the market. For the most part, International's excellent performance was due to the superb IT support its sales staff received (discussed in the previous section).

FIGURE 2: DELAY IMPACT ON TRAFFIC SHARE.

During modelling, a number of critical success factors were identified. Of these, there was almost universal agreement that the two most vital were: i) the delay in getting into a new (product) market; and ii) delays in responding to customer requirements after release of a new product. These are included in Figure 1 as the converters, init delay rel to comps (initial delay relative to competitors) and avge post imp delay rel to comps (average post-implementation delay relative to competitors). These determine both the initial and current market share (init pct share and current pct share) and, together, these are used to calculate International's market share for any quarter, quarterly share). Using this and freely-available data on product traffic and lifecycle patterns, quarterly and cumulative traffic (market share) and revenue can easily be calculated (for both International and its competitors). The model was built up using data from obsolete products and those nearing the end of their life-cycle. It was validated (to the extent possible) against the performance of the (current) dominant product to the latest point in its life-cycle for which figures were available. Key simulation outputs (revenue and market share figures) were shown to closely match actual product performance. Having developed the model, we were then able to run various forms of sensitivity analysis. For example, Figure 2 illustrates the impact of variations in initial delays relative to competitors on market share (with graphs 1-5 corresponding to 4 weeks faster, 2 weeks faster, no difference, 2 weeks slower and 4 weeks slower respectively). A number of other graphs were produced as a result of our analyses and, collectively, these dramatically demonstrate the impact of both types of delay on International's market share and revenue: i.e. the modelling exercise produced precisely the type of "ammunition" the IT Department was seeking.

As noted, however, the IT Department's attempts to utilise these results have met with little success. In retrospect, there was always a fair chance this would eventuate, given that key decision-makers were not included in the model building process (Vennix, 1996). Vennix's advice is sound and, in an ideal world, key stakeholders would always be involved in the development of important decision support models. The reality, though, is that, in many modelling situations, this is simply not possible. For example, in the case under review here, the size of the organization, stakeholders' other responsibilities, stakeholders' geographical dispersion and severe internal and external pressures on Gigante at the time of the study, all mitigated against our attempts to get "buy in" and active participation from the more influential decision makers. Moreover, even if we had managed to realize our desired levels of participation, we doubt it would have made a great deal of difference to the eventual outcome: i.e. other factors - notably power/political considerations were always going to make life very difficult for both International and, particularly, its IT Department. We turn our attention to these factors in the following section.

4. INTERNATIONAL'S INFLUENCE ATTEMPT: A WIDER VIEW

Gigante's International Division (and, particularly, its IT Department) could clearly see the devastation the outsourcing decision would wreak on their business. In their attempts to alleviate the impact of this decision, they employed rational arguments. As we have seen, however, much decision making in organizations is not rational. In this instance, International's concerns were dwarfed by a much bigger "game" and, here, their lack of any real political "clout" counted very much against them. In the causal-loop diagram presented in Figure 3, we have attempted to represent some of the major influences we detected as part of this wider game.

Organizations enter into IT outsourcing agreements for many reasons. During this study, we heard considerable conjecture as to the "real" reasons behind the Gigante/WIT deal, but press reports at the time consistently nominated major cost savings as Gigante's principal motive for entering into the contract (one of the largest IT contracts ever signed by an Australian company).

A special Program Management team (abbreviated as pm in Figure 3) was formed to manage Gigante's side of the alliance. From Figure 3, it can be seen that their performance had a major effect on the success of the outsourcing venture. Furthermore, since most of Gigante's products require substantial IT support, outsourcing operations had a significant impact on product performance and this, in turn, directly influenced Gigante's bottom line. In addition, the direct link from outsourcing perf to Gigante profit indicates that outsourcing, in itself, was expected to contribute to profit through greatly decreased IT costs. Thus, this portion of the diagram effectively mirrors Gigante's official outsourcing policy and views.

FIGURE 3: IMPACT OF ALLOWING OUTSOURCING EXCEPTIONS.

However, other important factors were also at work. In particular, Gigante's executive, the Project Management team and the outsourcing agent (WIT) all stood to gain (and lose) much from the outsourcing venture and links from Project Management team and agent performance to rewards/profit are clearly identified in Figure 3. In this context, it is easy to see that exceptions (exemptions from the outsourcing arrangement) could clearly not be tolerated. That is, apart from reducing the agent's profit, every exception allowed was likely to have a damaging impact on general perceptions of Project Management team performance. Thus, Project Management implemented a policy to the effect that exceptions would not be allowed under any circumstance - no matter what benefits specific cases might have for individual products (and the systems and personnel that supported these). To complete the picture, outsourcing can be a very risky business (Aubert et al., 2001) and there were many (inside and outside Gigante) who doubted the wisdom of this particular venture. Consequently, perceptions of the performance of Gigante's executive were closely linked to both the outsourcing operations themselves and the Project Management team.

Looked at in a (seemingly) rational light, the decision not to exempt International and their systems from the outsourcing deal seems bizarre - ensuring as it did the eventual destruction of International's leadership in their particular product market, plus the additional loss of a number of committed, scarce and valued IT specialists. If we view the situation from a power/political perspective, though, the events that transpired begin to make sense.

Clearly, all parties stood to lose substantially. The Project Management team and the agent would have lost (shared) control over the provision of important resources (International's systems and IT personnel) to the organization at large and, in addition, the agent would have received less funds for its services. Furthermore, without control over these systems and specialist personnel, the two parties' total level of expert knowledge (a vital source of power in organizations) would have suffered. Gigante's executive, however, would have been largely unaffected (in a direct sense) with respect to these power sources.

Perhaps, most interesting of all are the power sources of consensus, reputation and prestige and the fact that all parties would have suffered here. As Pfeffer (1981; 54-57) has argued, reputations are built upon perceptions and, as noted previously, allowing exceptions would have had a major negative impact on perceptions of Project Team performance. Actual performance also has an effect on perceived pm perf and both these factors are clearly identified in our causal-loop diagram. The link between perceptions of Project team and Gigante's executive performance is also identified. However, in Pfeffer's scheme, there is also a clear link from perceptions (of both power and performance) to prestige and extending our model to specify this additional relationship is a relatively simple exercise. Finally, where an organization unit or group has a strong, united, common view on issues, they derive power from consensus (Pfeffer, 1981; 122-124). Pfeffer emphasises that this is a particularly formidable power source but one that can easily be dissipated by significant change. Allowing exceptions would certainly fit into this category.

5. CONCLUSION

While collaboration strategy is not the answer to all organizational ills, it can be an effective tool, although its success relates to a number of key variables touched on in this paper, the critical one being that of managing organizational power plays and political activity effectively.

What we find in this case study is considerable self-interest and a consequent disregard for the vital role played by individuals in collaboration processes. The results are that in accentuating rules and efficiency, strategies for innovation and organizational learning were forgotten. This rigidity, coupled with highly-dysfunctional political activity, simply prevented realisation of new possibilities available in multilateral organizational collaboration (Lutz, 1997). Certainly the case demonstrates many of the pitfalls and costs of inter-organizational collaboration, especially so far as stakeholders in Cowboys/International were concerned.

Finally, organization change increases the turf warfare of change management - and part of this includes the more macro dimensions of organization prestige and reputation. In the realm of any organization's corporate communication, the most critical function is that of the organization's image and identity, important within the organization but perhaps even more vital to the external community and many of its key stakeholders. Diverse stakeholders may have varying images of an organization but reputation and identity should be consistent, a hallmark that distinguishes it instantly in a globally competitive environment where attracting the right customers, investors and employees is crucial. Image, identity, prestige and reputation are today hallmarks of the qualitative intangibles based in perceptions and hard fought for. They are part of an organization's intellectual capital in the broad sense and can be irrevocably damaged even by one instance of poor management. Put simply, the organization is the message and poor communication (arising, for example, from the politically-motivated turf warfare referred to above) can destroy it instantly!

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back to index

Abstract

While cost savings and other benefits forecast in the early days of the outsourcing boom have not always eventuated, the approach has retained much of its popularity. It is becoming increasingly apparent, however, that we still have some way to go in understanding how outsourcing arrangements actually work in practice. Here, we report on an IT outsourcing venture, where interface management's failure to take into account the needs of one of its most successful Divisions destroyed a major source of that Division's competitive advantage - its information systems support function. We describe how that Division developed and attempted to employ a system dynamics model to protect its operations and functions. We then use a further model based on the same paradigm to illustrate how power/political considerations meant that its efforts were always likely to fail.

back to index

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back to index

The Use of Government Electronic Service Delivery: The Australian Experience

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View Abstract

1. Introduction

Governments aim to deliver their services online. The impetus comes from two different frameworks. The first is the desire to be part of the Information Economy, enabling the Government to increase access to its services and at the same time increase efficiency, cut red tape and reduce costs. The second driving force is to move towards more participatory, responsive policy making and service delivery. In the United States, United Kingdom and Australia, government documents detailing ESD strategy emphasise the first stream. There is an assumption that ESD is linked in some ways to greater electronic governance. The commentary on ESD in developing countries like India is that it is leading to more accessible and transparent government[2].

The emphasis on the provision of Government ESD is not matched by a study of the use and effectiveness of these services. In Australia, for instance, in September 2000, 90 per cent of Commonwealth Government agencies provided appropriate services online[3]. However in the 12 months to November 2000, nine per cent of all Australian adults used the Internet to access government services.

In this paper we argue that the gap between the supply and use of Government Electronic Services is partly due to the fact that the very concept of "government services" is not well elaborated in the public mind, and the structure of government is often inaccessible to citizens. People usually interact with government only twice or three times a year. The services that immediately come to mind are paying municipal taxes, vehicle registration, and dealing with social security benefits. Internet access has been growing, but significant groups of people remain unconnected. In November 2000, half the adult Australian population had not used the Internet sometime during the year[4]. It is recognised that as more and more people get connected to the Internet the exclusion of the disconnected gets more severe.

The gap between the supply and use of services is also related to the fact that the models behind government Electronic Service Delivery (ESD) relate more to the market, to issues of efficiency, lower costs, than the language of equity, participation and citizenship. Often the emphasis is on delivering information and services rather than helping the user conduct his or her activities with greater ease.

In this paper we draw on available published data on Government ESD. The main focus is on Australian State and Commonwealth agencies. Reference is also made to studies from the United Kingdom, the United States and Canada. We also draw on a qualitative study of the use of ESD in Australia, conducted between July 1999 and February 2000. It was based on open-ended interviews with 25 middle-income, Anglo-Celtic men and women. The interviews aimed at giving us a richer understanding of the issues involved in the effective delivery of government services, rather than serving as a basis for predicting future demand or generalising across the Australian population.

2. Current Approaches to ESD in Australia

Some Australian state and territory governments, began to introduce ESD as early as 1993. All levels of governments in Australia have embraced electronic service delivery, although to a lesser extent at the local level. The services are targeted at business, community organisation, government, students, youth and families. Provision of services to regional Australia is a strategic priority.

The services provided are of three basic types:

- Information access or receipt — common examples are finding transportation timetables or conditions of a licence;
- Information submission or provision such as filling out your tax return;
- Financial transaction such as paying fines or paying your tax online.

The pervasive philosophy is to provide "single window/whole of government" interfaces, 24 hours a day seven days a week, for a wide range of government services. It is also usual for governments to espouse the principle of using all possible delivery channels, though online channels are preferred because of lower costs. There is a recognition that services need to be organised according to users and their activities rather than government departments.

These aims have been difficult to achieve. Going to a whole of Government approach and tailoring information and services to users' activities requires a difficult and time-consuming re-organisation of the way Government works. The presumed cost savings of ESD have also been diluted by the need to keep and integrate parallel channels of delivery.

3. Use of ESD

Consumers/citizens interact infrequently with government for a limited range of activities. This interaction, though infrequent, can often be crucial. The contact is often triggered by the need for some paper work or the payment of a bill or fine. However once a person, or someone they are caring for, becomes frail, old, sick and/or unemployed, the interaction with government becomes more complicated and intense. Then interaction with government ranges widely across the areas of work, health, transport, education and financial well being.

The Commonwealth Information Centre May 1998 survey of 1210 consumers and 804 small business operators showed that[5]:

- More than a fifth (21 per cent) had had no contact with a government agency in the past year;
- 40 per cent had one to three contacts;
- 8 per cent had had more than 10 contacts.

A Canadian representative random survey of 2,900 Canadians in 1998 also substantiated this pattern of infrequent dealings with government[6].

As most people infrequently initiate contact with government, the typical citizen seeking information is faced with a new or hazily remembered process on each occasion. The 1998 Canadian survey found that 25 per cent did not know where to get information about the service. The 1998 Commonwealth Information Centre Survey found that when consumers did not know the government agency responsible, they searched for information by using the phone book (47 per cent), asking someone else (24 per cent), asking another government agency (18 per cent) or directory assistance (17 per cent). Only two per cent of previous searches were made using the Internet. Phone queries showed a slightly higher chance of success.

At present, the traditional ways of interacting with the government — face-to-face, mail, telephone, fax — are still dominant. The Commonwealth Information Centre survey (May 1998) gave some indication of how consumers and small businesses would use the CIC information referral service.

TABLE 1: USE OF COMMUNICATION CHANNELS FOR INFORMATION SEARCH AND REFERRAL

Preferred Communication Channel	Consumers % (n=1092)	Small Businesses % (n=660)
Telephone	89	93
Internet	4	6
Fax	2	27
Postal mail	2	5
E-mail	2	7

Note: This data applies to use of the 'basic' CIC service without reference to any particular activity. Refer to Chant Link & Associates Pty Ltd (1998, May) *Research on the Commonwealth Information centre (CIC)*

Project Number 1364. Prepared for National Manager Innovations Team, Centrelink, Canberra. Note that multiple responses are included in the column for Small Businesses.

Issues of access, use and trust limit the present use of the Internet for seeking or providing information and for financial transactions. The Internet, however, is fast becoming a valuable tool in the mix of communication channels. Strong indications exist of a willingness to use the Internet for government services in the future. It is within this wider context of access and use of the different communication channels that we place our consideration of present patterns of government interaction.

3.1 Changes in citizens' expectations of government services

The greater use of the telephone and the Internet to deliver government services is leading citizens to expect a higher standard of responsiveness. Users also expect government to be trusted and effective providers of electronic services.

The Canadian Survey 'Citizens First', October 1998 found that 'timely service' was the single strongest determinant of service quality across all services and levels of government. The telephone and e-mail had vastly increased consumer expectations of what was seen as 'timely' service. Instead of the two weeks that consumers found acceptable for mail responses, four hours was now the standard for the telephone and e-mail[7].

The potential of the Web and the electronic kiosk to deliver services focused on the activity rather than the department and level of government has also increased citizen expectations in this regard. There is little acceptance of having to deal with more than two people for a specific query or problem, whether it is by telephone or over-the-counter.

3.2 A focus on activities

In this part of the section we draw on the qualitative data to show how citizens interact with government to seek or provide information and conduct financial transactions.

3.2.1 Seeking information

Our interviews show that a face-to-face service is preferred when people have a problem and are not sure how to look for information that would help them. If it is a simple query like a time table or information about events in the city, then the Web is often the channel of choice for an expert user who knows where to look.

Face-to-face interaction is valued more highly in the social context and the government office is located conveniently. Gerard[8], 25-39, the coordinator of an Online Access Centre says, In Tassie, people like people. People like personal service. They like to have personal contact just so they can talk." He says this is a characteristic of country living throughout Australia, adding, "I'm from New South Wales and it's certainly the same there.

The telephone, which is a familiar and comforting channel of personal communication, often fails to be interactive when used as a tool for searching for information. When face-to-face interaction is not convenient, telephone waiting times are long, or it is difficult to get the right person to deal with your problem, the Web and e-mail become attractive options for getting information and for communicating with a department. However the Web is an unfamiliar place that often requires expert knowledge.

Bertram, 25-39, a teacher in Victoria says, "I really hate being on hold with government departments...They're always doing that electronically to me where they're not providing me with information." Gerard from Tasmania describes similar experiences. He says, Interactive voice response is not necessarily better. At times you have "to listen to the whole menu before you could press a button".

The Web is The channel of choice, when there is a need to research documentary data. Titania in her early 50s, used the Web to get supporting evidence for her mother's successful claim for compensation. Titania's mother served in the Australian army between 1942 and 1945. She now has mesothelioma, which is linked to asbestos exposure. Titania says,

All the initial research was done from my study on the Internet ... Then I was able to go to the War Memorial and just put in my requests and just put in my numbers and they'd bring things out of the archives.

The key evidence was found in war diaries.

They were written up on a daily basis by the commanding officer... One day I just came across a simple instruction that was passed on and that was ... that all people in the gun sections had to wear their gas mask for half an hour a day no matter what they were doing... I started to find out what the gas mask was comprised of."

She followed this trail through the Internet from one linked site to another till she got to the precursor of the CSIRO. That information led her to the evidence she needed.

3.2.2 Providing information

At present postal mail is an important channel for providing information to the government across a range of small business activities. The provision of information online increased greatly with the online registration of businesses in 1999 before the implementation of the Goods and Services Tax. The possibilities of the Web are recognised, providing that the forms are well designed and the electronic record of having submitted the information is accepted as evidence.

3.2.3 Financial transactions

It is important to reiterate that the latest ABS data (May 2001) show that 50 per cent paid their bills or transferred funds via the telephone (compared to 39 per cent in May 1999), and nine per cent used the Internet (compared to two per cent in May 1999). So the Internet is very much an emerging payments medium, in a context where there is an increasing shift from physical to online modes of payment.

The greatest concern in making payments for goods and services for the first time through the Internet is the security of the payment. Among the 25 people we interviewed, only six had used the Internet to pay accounts — for utilities, car registration and, in one instance, university fees. Sylvia, was typical of the majority who had not yet made any payments over the Internet. She felt uneasy, saying, "You just worry about finding that you've got this huge bill on your credit card when it comes in and not be able to get out of it." Like most of our respondents, Sylvia, 40-54, a bureaucrat in Canberra, was concerned about the secure transmission of data and how it is processed and used.

The concern about security diminishes once there is a history of successful Internet payments. There is then a greater sense of comfort with Internet payments. The increase in the legislative underpinnings to electronic payments will also increase the level of comfort. But as yet, Internet payments are not totally trusted. There is however likely to be greater trust when dealing with a government site, for it is seen as a trusted site.

4. Designing ESD for the Victorian State Government

These conclusions about what citizens value in online government services lead to design principles that maximise the effective use of services. We found that:

- Services need to be focused on activities;
- Services need to be easy to use;
- Services need to be secure and trusted;
- Services need to be responsive; and
- Users expect a choice of channels.

We used these design principles as a starting point to consult with those involved in Victorian State Government service delivery to canvass how they could alter their practice to increase the likelihood that citizens would deal with government online.

We identified four areas of public sector activity where stakeholders could implement the principles:

- "traditional public servants" who have to maintain existing forms of interaction with citizens by phone, post, fax and email while new online services develop;
- those involved in the development of e-government services;

- "gatekeepers" and "quality assurance" staff responsible for the content and performance of service staff in both old and new systems; and
- those responsible for service integration, to allow citizens to migrate easily across channels.

The consultation the action research initiated identified four major strategies targeting new users, high frequency users, likely repeat users and public servants themselves. We followed some of the design principles to suggest the government focus on activities by "channelling" services around users activities by providing a Children's Channel, a whole of government Bookstore, and a Jobs Channel. We also suggested that the state government "flood" a particular transaction, namely bill payment and implement a high profile cross promotion and marketing campaign.

As services need to be easy to use, the main online portal should be redesigned to make it overwhelmingly user friendly. We suggested the development of a government online directory both for training staff in user service migration and for online use by citizens. A whole of government, intelligent, open grammar search engine should be purchased. Moreover, there should be scope for user personalisation of the portal.

As online services need to offer a choice of channels and be responsive, we proposed that e-mail become a third routine channel of communication with government alongside post and telephony.

The majority of the strategic proposals were funded in the 2001-2002 Victorian State Budget, indicating the success of the action research process in generating innovative ideas for further improving the quality of government online services.

Conclusion

There is little difference in the intent of Government ESD and what users say they want. The gap in provision and use lies in governments being able to operate with the users' perspective in mind. This move from a supply to demand perspective, from the provision of services to the use of services requires a shift in mind set, language and culture. These are slow processes requiring a constant examination of the way governments classify information and provide services. It also requires a bridge between the market and technology languages spoken by the government and the citizenship and activity languages expected by users. Performance measures required by government bureaucracies also need to expand from the monitoring of provision and efficiency to the use/non-use of Government ESD and their effectiveness. Once these cultural shifts are in place, and governments are seen as increasingly responsive, Government ESD will be the first step to electronic governance.

Endnotes

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[6] Rein Research Inc. (1998, October) Citizens First. Prepared for the Citizen-Centred Service Network and the Canadian Centre for Management Development, Canada.

[7] Rein Research Inc. (1998, October).

[8] All names of respondents in CIRCIT's qualitative sample are pseudonyms to preserve confidentiality.

back to index

Abstract

The revolution in government electronic service delivery (ESD) is not yet matched by a similar change in the way citizens access government services. This paper will focus on Australian initiatives within the context of international developments. Commonwealth and state governments and agencies in Australia are increasingly delivering government services online. Australian data show that only nine percent of citizens used government services online at least once during 2000. Data presently collected do not allow conclusions to be drawn about the frequency or reasons of repeat or non-repeat usage and reasons.

We draw on an Australian study of the use of Government electronic service delivery from the perspectives of Australian citizens to point to some of the factors that encourage and inhibit use. This study drew on available government reports and surveys in Australia, United Kingdom and Canada. It also included a qualitative study of Australian consumers. The study found that well designed government ESD needs to be focused on activities. The services need to be easy to use, secure and trusted and responsive. Moreover users expect a choice of channels. These design principles were used to develop strategies for increasing the use of government online services in the Australian state of Victoria.

Singh, S., Ryan, A., Kelso, R., Laidler, T., Burke J. and Tegart, A. (2001). *The User Perspective* on *Government Electronic Service Delivery*. Research Report No. 29. Melbourne: CIRCIT at RMIT. We gratefully acknowledge the funding support by the Department of Communications, Information Technology and the Arts, Nortel Australia and Multimedia Victoria.

back to index

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Associate Professor Supriya Singh is a Senior Research Fellow at the Centre for International Research on Communication and Information Technologies. Her research interests focus on the use and design of new information and communication technologies, with an emphasis on smart personal agents. Her particular interest is in the changing nature of money and commerce because of the new technologies. Her latest book is "Marriage Money" (Allen & Unwin, 1997).

Supriya is currently the Vice-Chair of the PTC Conference Committee and heads the socio-cultural track. She is also President elect of the Association for Qualitative Research and President of the Sikh Welfare Council of Victoria (Australia).

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back to index

Business & Applications

Tuesday, 15 January 2002
1100–1230
South Pacific III - IV

T.1.2 Existing & Emerging Networks

Chair:
JIM HEBERLE, President, HeBe Associates, *USA*

T.1.2.1 From Internet to Supranet with Mobile Commerce (View Abstract)

GEOFF JOHNSON, Research Area Director, Asia Pacific, Gartner, *Australia*

T.1.2.2 Peer-to-Peer Computing—Business Implications of Emerging Distributed Technologies (View Abstract)

THOMAS AGOSTON, Manager, Asia-Pacific, IBM Global Services, *USA*

T.1.2.3 Privacy Security and Universal Service: Three Issues May Control the Future of ENUM (View Abstract)

ROBERT JACKSON, Counsel, Communications Group, Reed Smith LLP and JODI COOPER, Partner, Capital Telecom Law, *USA*

Presenter:
JODI COOPER, Partner, Capital Telecom Law, *USA*

From Internet to Supranet with Mobile Commerce

Geoff Johnson
Research Area Director, Asia Pacific
Gartner
Brisbane, Australia

View Abstract

1. 'Mobile Access to the Internet Creates Wireless Web Services'

It might be stating the obvious, but the reason that Wireless Web or Mobile Internet is so "hot" is because both cellular wireless services and Internet services have been so incredibly successful. This leads enterprises and individuals to expect new business opportunities when they combine the two. Wireless Web capabilities are now critical for all types of users and IT vendors from network operators, to database, server, applications development and web integration vendors in order to complete the coverage of their products and services to users 'anytime, anywhere'.

The power of these mobile services derives from their ability to connect to virtually any economically-active individual in the world and to facilitate that interaction with the logic, content, search engines and entertainment available from the Web.

Wireless Web access is not a matter of taking the browser from a PC and shrinking it onto a phone. Wireless devices with data capabilities have great potential to extend the use of the Internet. However, this will not be realized by taking the concepts of the wired Web and simply reducing them to fit the limitations of small-format devices, with limited or no keyboard, and limited bandwidth. Transferring PC-oriented Web content directly to a phone will not work, while automatically converting Web content is also unsatisfactory. These approaches are like a TV channel showing a newspaper. The challenge of creating useful applications is much more fundamental.

When most first-time users try mobile phone access to the connectivity and logic of the Internet the experience is slow, clunky and requires an investment in learning how to use it. The limitations of mobile devices, circuit-switched (rather than packet) networks and immature applications is reminiscent of the Internet circa 1994. However, with over 1 billion wireless web capable devices in circulation by 2003, their ubiquitous use in every-day life has a high probability.

2. Mobile Business Drivers

Three major drivers are reinforcing each other:

1. Business needs new types of mobile application to reduce costs, to satisfy the need for "anywhere/anytime" customer service and to bridge supply chain gaps.
2. Technological developments and the falling price of mobile technology are making new types of application technically and economically feasible. Mobile phone chip sets are expected to reach a price of $35 in the next five years. Technologies such as precise location sensing will enable new types of application, including shopping support portals that find alternative sources for products and services near the consumer's location.
3. Mobile phone ownership will approach 100 percent penetration of economically active consumers. This opens up the possibility of Internet-like transactions and commerce to a huge new consumer base.

Mobile business is a phenomenon, which will be enabled by four factors that act to support each other:

1. **Economics**. The falling price of mobile airtime and key mobile technologies is making new applications economically feasible enabling any electronic device to be networked.
2. **Social trends**. Mobile phones have become a mandatory lifestyle accessory in many societies and social groups, especially young people inclined to take on new devices and applications.
3. **Technology**. Core technologies such as WAP and iMode enabled a first generation of applications and precise location sensing.
4. **Business Need**. Organisations need new types of mobile application to reduce costs, to satisfy the need for "anywhere/anytime" customer service and to bridge supply chain gaps.

This means that nearly all web servers delivering applications today must eventually accommodate a mobile access to those applications.

Consider the following strategic framework showing four distinct phases expected in e-Business adoption.

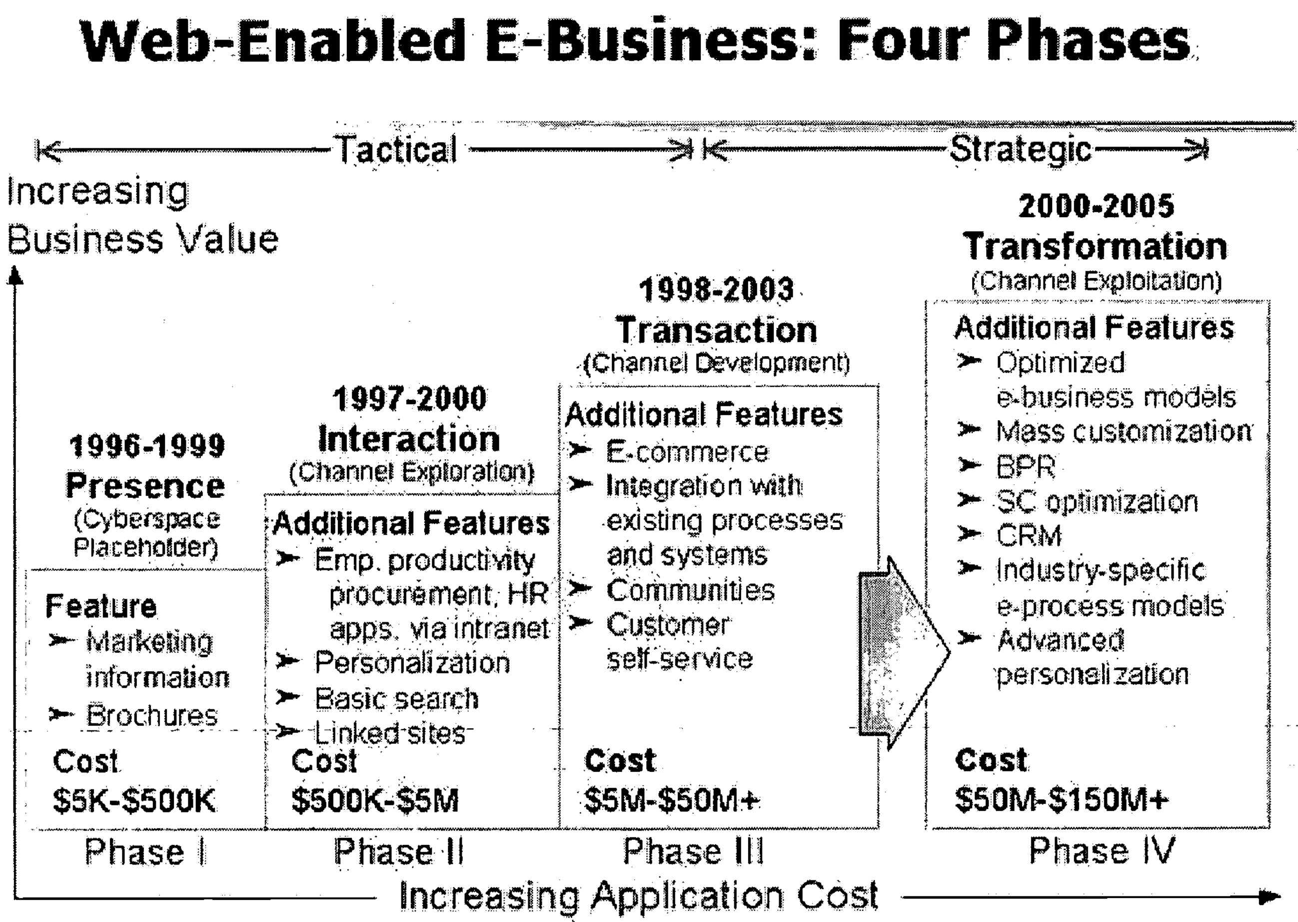

FIGURE 1. WEB-ENABLED E-BUSINESS: FOUR PHASES

3. Ultimate Destination: The Supranet

We define the 'Supranet' as the merger of the physical world (the "P world") and the electronic world (the "E world"). Mobile technologies and pervasive computing provide the glue that makes the Supranet real. The Supranet allows us to deliver coherent, multipart interactions with end users involving many objects, including traditional computers and new "intelligent" devices. The Supranet implies a very high level of transparent integration between both devices and business processes from multiple sources.

Wireless will catalyze a new phase of evolution of the Internet, driven by the need for user experiences that span these many environments and devices. Wireless offers huge benefits in flexibility and convenience, but, by itself, it is almost useless. We define the Supranet as the next phase of the Internet, which will result from this pressure and need.

The Supranet is the emerging ubiquitous network infrastructure that links the "e-World" of electronic devices (e.g., computers, phones, televisions) and the "p-World" (the physical world of paper, houses, people, vehicles).
It is enabled by four key phenomena:

1. embedded computers in many everyday objects;
2. next-generation wireless networking;
3. interfacing technologies (e.g., bar code scanning, speech recognition and electronic identification); and
4. design of applications that satisfies user needs in a natural way with combinations of media and devices.

4. Mobile Phone Generations

The coverage and capability of the mobile phone network will be a key element of the mobile commerce environment. Mobile networks will evolve through several generations:

1st generation (1G) networks were analogue and data was transmitted (slowly, below 9600 bps) using modems.

2G (the current generation) mobile networks typically use digital circuit-switched connections for both voice and data and provide only low speed data (typically around 9.6Kb) over GSM and CDMA.

2.5G networks will use technologies such as General Packet Radio System (GPRS) or possibly EDGE- Enhanced Data for GSM Environment) to support packet switched medium speed data (theoretical maximum rates are over 100Kb but 20 to 56Kb will be a more realistic expectation). Packet switched data is desirable because it provides cost-effective "always on" connections which create a more positive user experience.

3G networks will start to be deployed commercially in 2002 but not broadly until 2003/4 and offer higher data rates (theoretically over 1Mbps, but realistically around 128Kb in most cases), which are sufficient for more data intensive, and multimedia applications. The core of a 3G network is likely to be IP based.

4G is still an ill-defined concept however it is likely to involve efficiency improvements and ubiquitous use of IP for both vice and data.

Action item: Design applications on the assumption that theoretical maximum data rates will seldom be achievable and that several generations of technology will co-exist in many territories.

5. Ubiquitous Mobile Computing, Ubiquitous Mobile Connectivity

Pervasive devices will include phones, PDAs, digital cameras, set top boxes, music players and other consumer electronics. New devices (e.g., combining several of these functions) can also be expected. Wireless networking is also becoming pervasive, with technologies offering connection ranges stretching from a few metres (Bluetooth), through to anywhere on the planet (mobile phones). The gaps have been filled. Broadly speaking, it will be (at least theoretically) possible to connect any computing device with any other computing device.

Mobile devices will interact with a wide range of static "base stations," including cash registers, kiosk devices such as ATMs, large consumer appliances (e.g., washing machines) and more conventional computers. The ubiquity of computing and networking will offer the potential for many new applications, such as payment systems or "anytime/anywhere" consumer applications.

Action Item: Enterprises must examine the potential threats and opportunities posed by new devices and become prepared to be device agnostic as they handle an exploding range of new types of mobile networked devices.

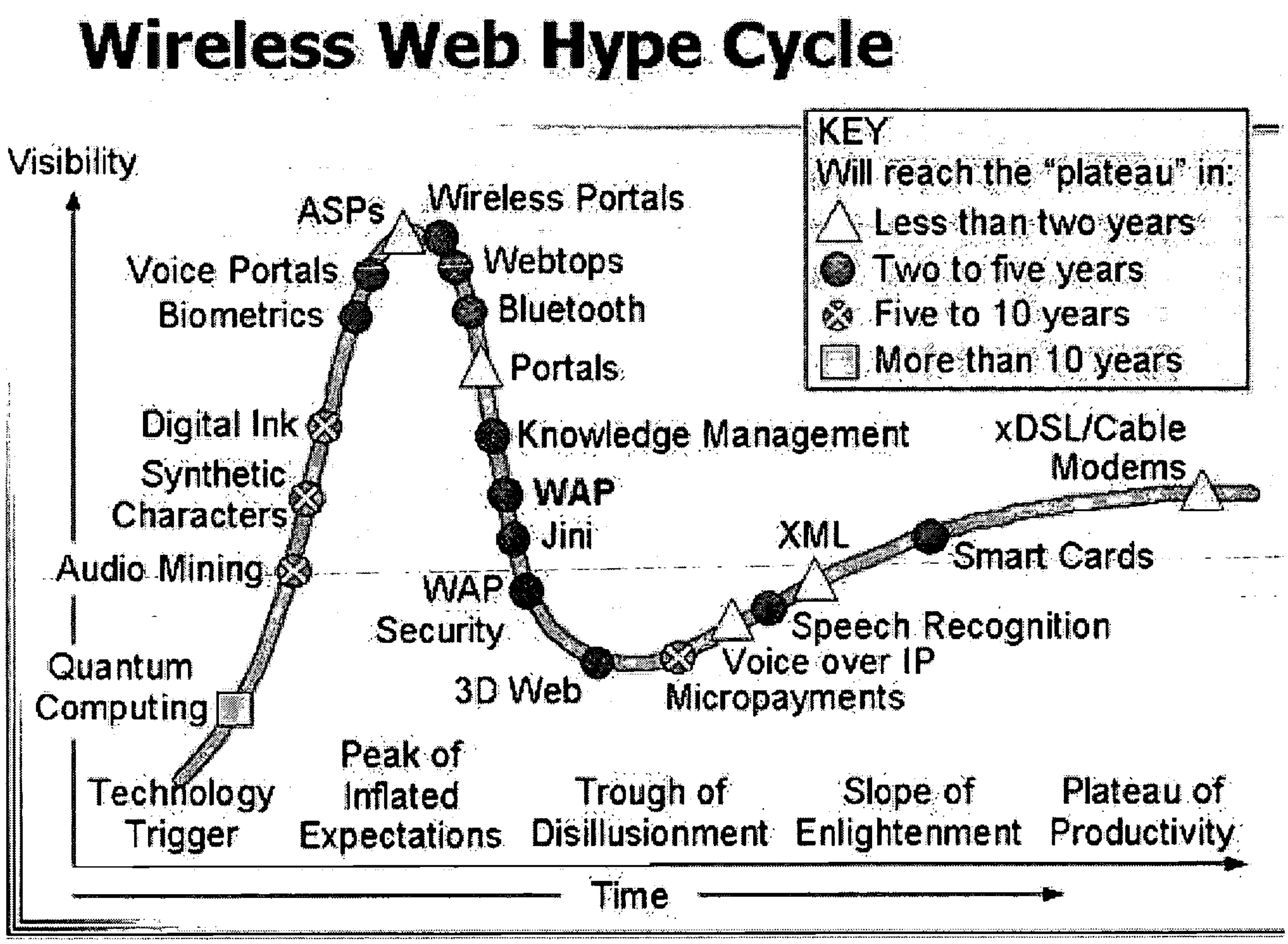

FIGURE 2. EXPECTATIONS OF WIRELESS WEB SERVICES ARE OFTEN INFLATED

Determining when to adopt an emerging technology is a critical decision. If an enterprise launches its efforts too soon, it will suffer unnecessarily through the painful and expensive lessons associated with deploying an immature technology. If it delays action for too long, it runs the even-greater risk of being left behind by competitors that have succeeded in making the technology work to their advantage.

This decision can be eased by using Gartner's Hype Cycle Model of emerging technologies. The hype cycle chart characterizes the typical progression of a technology from over-enthusiasm through a period of disillusionment (due to the inevitable failures that arise from its inappropriate application), to an eventual understanding of the technology's relevance and role.

Action Item: Technology planners should assess the relative impact of a technology and act early for high-impact technologies, no matter what their normal level of technology aggression, while waiting for others to move first on technologies that are less relevant to the core of their business.

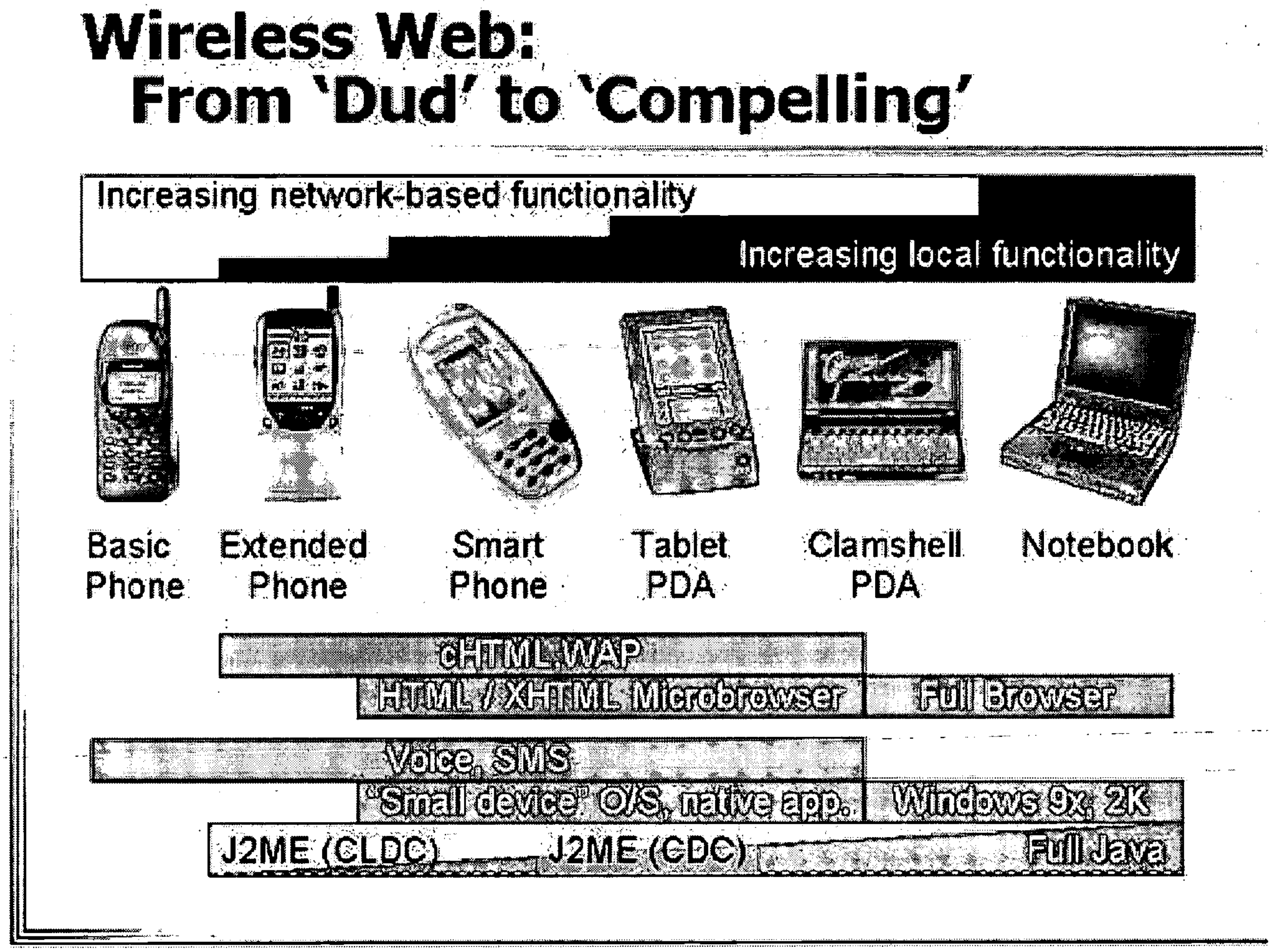

FIGURE 3. WIRELESS WEB SERVICES MUST MOVE FROM 'DUD' TO 'COMPELLING' IN ORDER FOR PERVASIVE ADOPTION TO OCCUR

There will be significant diversity in application characteristics and user needs (e.g., depending on if the user is a consumer or an employee). This will be further complicated by a very wide range of client device capabilities, extending from a basic voice phone through to a wireless connected PC. The diversity of requirements and client capabilities will result in a wide range of client-side architectures including (but not limited to):

Ultra-thin client. If the client device capabilities are unknown or very limited, interactions may be restricted to "lowest-common-denominator" functions, such as voice response, SMS and tone signaling.

WAP or other microbrowsers. WAP will define a base level of client functionality, but more-conventional HTML may be preferred in cases when the device and network are more capable.

Thicker clients. If the client is running an operating system that supports client-side program installation (or has the ability to execute Java), more-capable client applications can be used to enhance usability and compensate for device and network limitations. The technical diversity of mobile devices will make Java (particularly J2ME) a preferred client-side technology.

Action Item: Monitor deployment of devices and capabilities in your target market and add new mobile channels to exploit the capability of new devices.

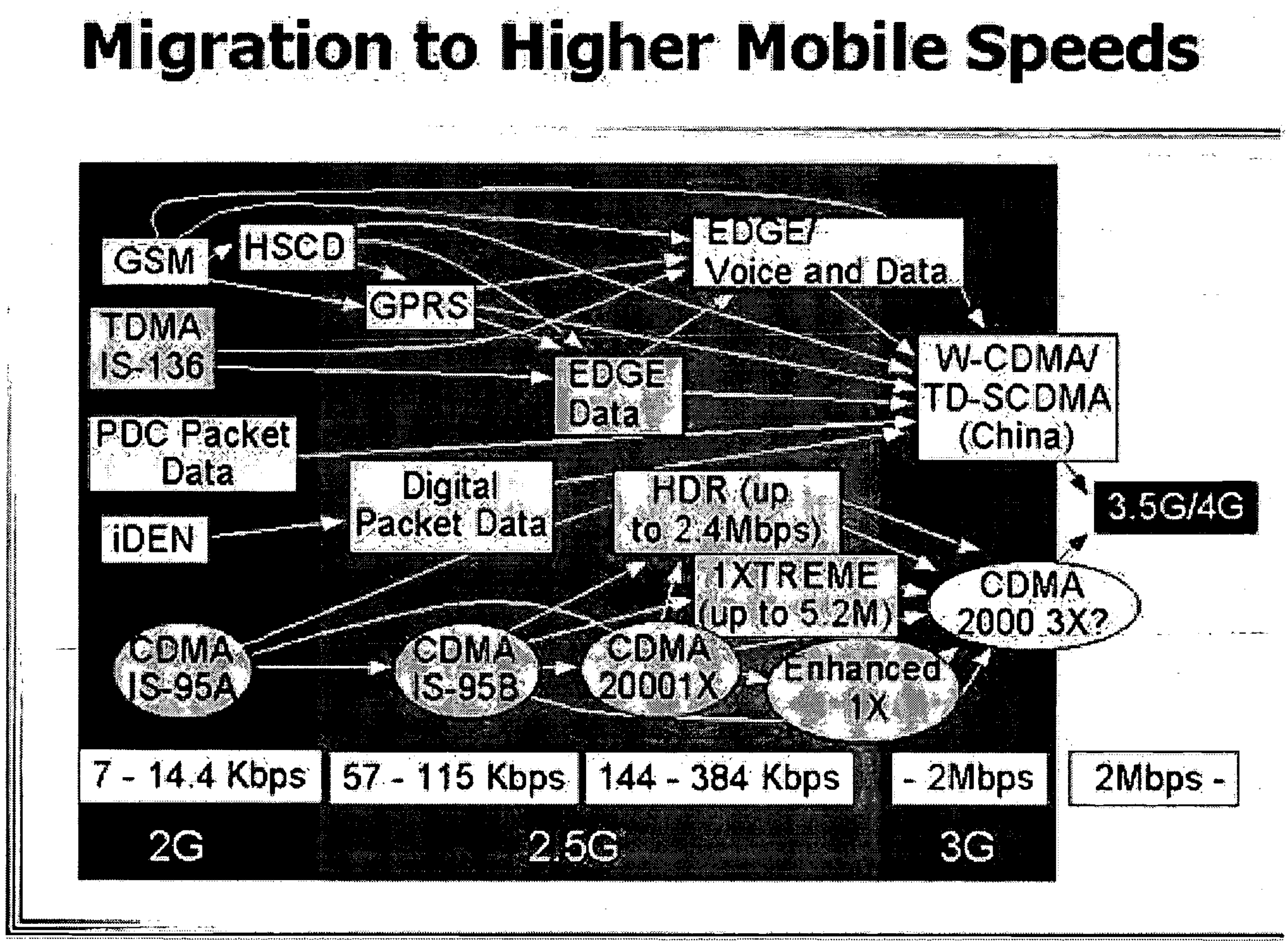

FIGURE 4. MIGRATION TO HIGHER MOBILE SPEEDS

Mobile operators, their suppliers and downstream customers are introducing the most significant change to hit the mobile communications market since its beginning: the shift to packetized data. The introduction of packet data that has already commenced in most of the world's leading markets opens the prospect of radically new services based on a connectionless or "always-on" model. This will require new methods of billing and new business processes to support them.

Other technological developments, and the falling price of mobile handsets, will make new types of application technically and economically feasible. Technologies such as precise location sensing will enable new types of applications, such as shopping support portals, that find alternative sources for products and services near the consumer's location.
Business needs new types of mobile applications to reduce costs, to satisfy the need for "anywhere/any time" customer service and to bridge supply chain gaps.

Action Item: Enterprises should develop a mobile e-business strategy. Furthermore, enterprises should be aware of the timetable for the introduction of new technologies and services and be wary of inflated claims by vendors and operators. The profusion of mobile data technologies for 2.5G and 3G will lead to vendor, operator and market inertia which will be sufficient to inhibit widespread service adoption through until 2004.

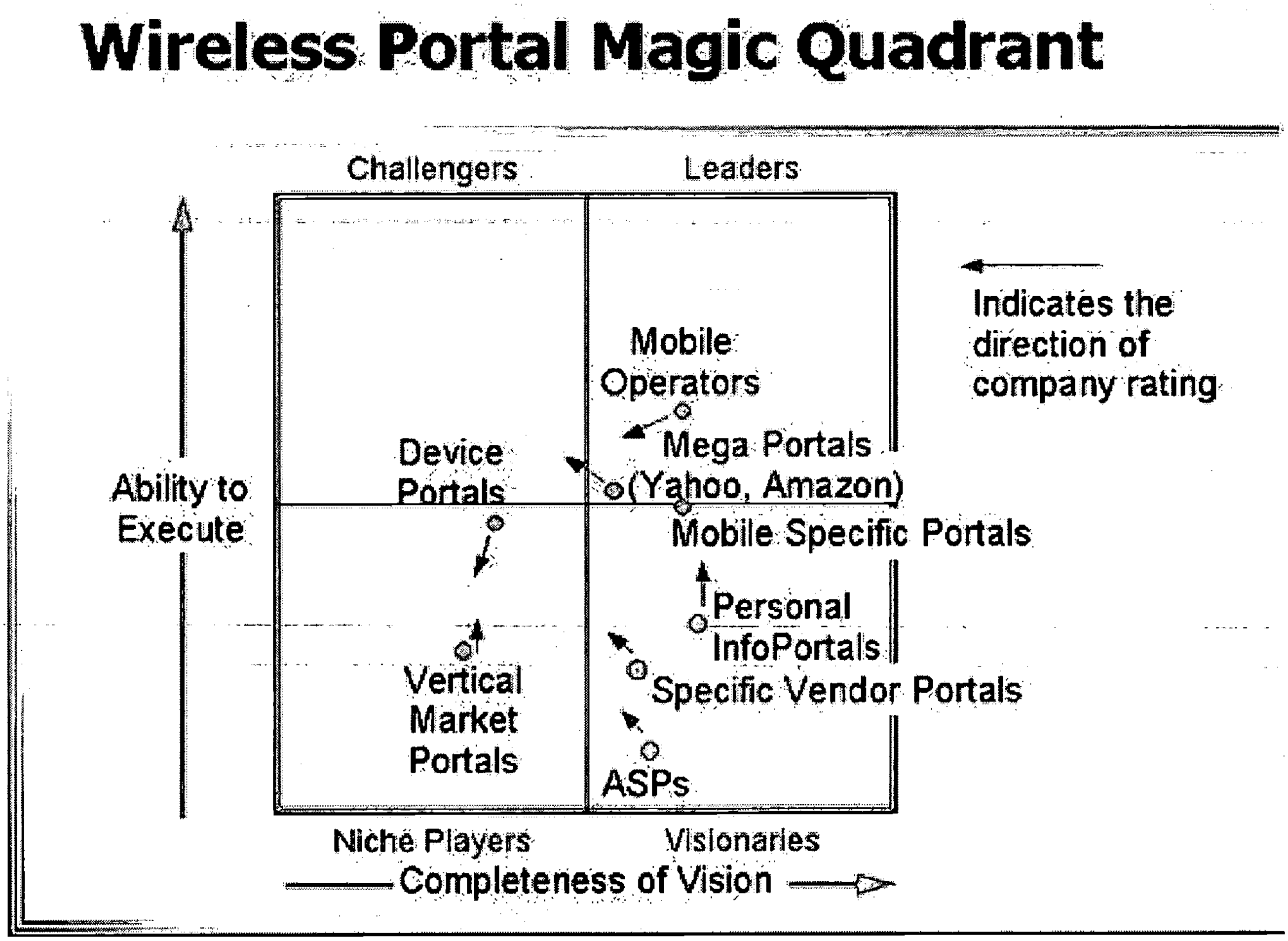

FIGURE 5. WIRELESS PORTAL MARKET EVALUATION QUADRANT

Aspiring mobile portals come from several different backgrounds and have different strengths and weaknesses. Contenders include:

1. Network operators that own some key information (such as location) and the customer relationship.
2. Existing mega-portals, such as Yahoo, AOL etc that are attempting to move into the mobile domain.
3. New portals specializing in mobile applications.
4. Financial services organizations such as banks providing "free" WAP phones and attempting to leverage existing customer relationships.
5. Niche content specialists such as sports portals.

Overall, we believe that network operators alone do not have the skills or relationships to be successful portals and will be forced to partner with other content and service providers. Mega portals are large-scale, dominant or popular Web sites that business or consumer users of mobiles habituate. Mobile-specific portals are those custom built for the medium such as WAP sites. Specific vendor portals use and promote application mobility such as airlines, banks. Personal Info Portals focus on personalization and "Me" profiles delivering heavily tailored and customized solutions often in a "push" mode. Device portals are those that focus on the abilities of the device, e.g., PDAs streaming video, smartphones pushing alerts, or location-aware advisory messages. Vertical market mobile portals are "anywhere, anytime" extensions of linked sites for IT procurement and monitoring or entertainment linking.

Action Item: Enterprises seeking a mobile portal presence should evaluate partnerships with existing powerful portals rather than mobile operators.

6. Wireless Security: No Walls and Many Ears

Wireless web architecture suffers all the vulnerabilities of Internet architectures and introduces several new risks. In particular, wireless access requires multiple stages of network transport, provisioned by different suppliers, making it impossible today to supply guaranteed end-to-end security.

Intermediate machines (notably WAP servers) offer new points of attack for hacking. Wireless communications can be intercepted. Shared encryption keys defined by phone manufacturers are at risk. Some mobile devices do not have sufficient computing power to perform long-key encryption. Users may be lazy or confused, and may not operate Bluetooth-enabled devices in the most secure manner. Bandwidth and device restrictions encourage security shortcuts. Short-messaging service (SMS) provisioning messages offer a new opportunity for hacker attack. And, of course, portable devices are physically insecure and easily stolen.

Despite these challenges, mobile security is likely to be good enough for a wide range of activities in the short term, although improvements should be adopted as they become available. Some publicized security risks (such as wireless viruses) are hype at this time.

7. Breaking Usability Barriers

Mobile devices will quickly evolve from pay phones in the pocket to personal links to the "e-world." Wireless networks will not be able to provide the speeds available from fixed networks, but they will provide for the daily needs of the vast majority of people. Emerging technologies like E-Ink, light-emitting polymers (LEPs), organic light-emitting diodes (OLEDs) and virtual retinal displays promise daylight-readable displays with far-better qualities and lower power consumption than today's backlit liquid crystal displays (LCDs). Personal area networks (PANs) that permit the selection of the most-appropriate ways of interacting with what will become a personal communications gateway are emerging.

The first example is Bluetooth; however, its 1-Mbps throughput is too limited to drive multimedia displays. Second-generation Bluetooth specifications are being worked on, and emerging technologies, such as ultra-wideband radio, promise low-power PANs with speeds of tens of megabits per second.

Interactions with devices will become natural using gesture and voice dialogue. Textile manufacturers can already weave circuits into clothing; as mobile communications become ubiquitous, basic communications and interaction will be built into clothes. Biometric capabilities, such as voice and fingerprint security, will become basic elements of devices to improve security. Daily objects like watches, rings and clothing will become intelligent elements of the personal network, able to monitor health and vital signs.

8. Recommendations: Action Points

- Make a list of Projects that will benefit from Mobility.
- Position your enterprise's investment so that early mobile disappointments are converted into popular business-enabling applications in the medium term as wide-scale, technological, discontinuity impacts.
- Educate your users. Tune their perceptions to the "Supranet" migration, where 'anytime, anywhere' lifestyles and commerce become an adjunct to all applications.
- Source and manage mobile devices as network appliances using service providers, firewalls, security and network management. Define data access and back-up policies to control Total Cost of Ownership. Enterprises should own mobile devices in order to control their use under a management policy and expense them annually.

back to index

Abstract

In this paper we address the following Key Issues:

- How will the demands of e-business transformation affect networking?
- What key emerging technology developments will reshape the marketplace?
- How will enterprises and vendors develop effective strategies in a rapidly changing environment?

The Conclusions that we reach are that:

- The intersection of two of the fastest growing network services - cellular wireless and the Internet will drive ubiquitous adoption of highly personalized 'anytime, anywhere' services.
- Mobile technology, commercial need and network availability will combine to drive the evolution of mobile e-commerce and the emerging 'Supranet'.
- Early disappointments in network infrastructure, applications and usability will be overcome in different economies at different speeds.
- Mobile device usability barriers will fall. Think about networking literally anything that can provide entertainment or a personal service.

We make these Recommendations:

- Make a list of Projects that will benefit from Mobility.
- Position your enterprise's investment so that early mobile disappointments are converted into popular business-enabling applications in the medium term as wide-scale, technological, discontinuity impacts.
- Educate your users. Tune their perceptions to the "Supranet" migration, where anytime, anywhere becomes an adjunct to all applications.
- Source and manage mobile devices as network appliances using service providers, firewalls, security and network management. Define data access and back-up policies to control TCO. Expense devices annually.

back to index

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back to index

Peer-to-Peer Computing -- Business Implications of Emerging Distributed Technologies

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USA

View Abstract

1. Introduction

The terms "Peer to Peer" or "P2P" infer many different things, including:

1. Architectures: client-server, hybrid/brokered and "pure" P2P computing;
2. Applications: community and content-driven File Sharing (e.g. Napster, Gnutella, Freenet); Distributed Computing for extreme processing and storage (simulations and numerical modeling including the Search for Extraterrestrial Intelligence (e.g. SETI@home), climate modeling, AIDS and Cancer Research projects); Collaborative Knowledge: professional service firms creating knowledge supply chains; Instant Messaging (e.g. Chat, ICQ); Messaging Frameworks (e.g. Jabber); Multiplayer Gaming (e.g. Sony Playstation 3) ; Servers, Devices and Agents (e.g. Bluetooth); as well as a
3. Sociological and Economic Phenomenon: to some P2P means "Person to Person" and implies interpersonal communication, with sociological, cultural and linguistic components.

   Note: Please refer to the Glossary for definitions and explanations.

2. Background: A Quick History of the Internet and Computer Architectures

The original Internet was a Peer-to-Peer architecture. Internet "hosts" (computers connected via a TCP/IP backbone network) communicated via IP addresses (e.g. from host A: 129.42.17.99 to host B: 64.58.76.222). The introduction of the Domain Name System (DNS) allowed users to replace numerical IP addresses with romanized names, i.e. www.ibm.com for 129.42.17.99, and "www.yahoo.com" for 64.58.76.222. A network diagram of the early Internet (i.e. ARPANet) depicts a large cloud with host computers interconnected as peers.

Connectivity: When personal computers (PCs) first arrived, they were mostly stand-alone, unconnected machines. Later, direct connections, Local Area Networks (LANs) and other devices provided connectivity between small groups of computers, usually located in the same vicinity. The advent of the "World Wide Web" drove the Internet to look more like a "client-server" model — with "hosts" serving HTML data to "clients," usually browsers such as Netscape's Navigator. Network diagrams of the Internet at this stage showed more and more computers outside the Internet backbone connected (or connecting via dial lines) to hosts within the cloud.

Peer-to-peer computing is the result of the confluence of several trends:

1) decentralizing trends in software engineering intersecting with available technology. From an engineering perspective, the trend over the last decade, driven by forces such as enterprise application integration, has been away from monolithic systems and toward distributed systems. This trend was inhibited somewhat by the ease of managing centralized applications, but the Internet's growth, followed by the rise in importance of B2B (business-to-business) transactions, made full-scale distributed computing a business necessity. Intersecting this trend were the increased availability of:

2) powerful networked computers,

3) inexpensive bandwidth, and

4) numerous, interconnected peers.

Non-technical social issues were also important. Most of what's driven recent interest in P2P arose as a result of the popularity of products like Napster and Gnutella (discussed below.) They provided the "killer apps" that put a subset of P2P technology in the hands of millions of end-users, and raised awareness of the power of the P2P paradigm. However, the first P2P applications appeared nearly two decades ago, and many are still in existence.

Basic P2P technology has been around at least as long as USENET and FidoNet -- two very successful, completely decentralized networks of peers. USENET, started in 1979, is the distributed application that provides most of the world with online newsgroups. Files were exchanged in batch over phone lines, often at night when long distance rates were lowest. Consequently, there was no effective way to centralize the function of the USENET. The natural result was an extremely decentralized, distributed application -- a structure it retains to this day. Another early P2P success is FidoNet, which like USENET, is a decentralized, distributed application for exchanging messages. Both USENET and FidoNet years ago faced and overcame many of the problems that modern P2P applications face today, primarily scalability and security.

Comparing Computer Architectures

Perhaps the primary reason why P2P has received so much attention is that it represents a breakaway from the heretofore dominant "client-server" model.

Pure Client-Server Model: a central server serves data to outlying clients.

Pure Peer-to-Peer Model: numerous interconnected peer computers share resources, tasks and data.

Hybrid/Brokered Peer Model: interconnected peers rely on a server for supplemental functions, e.g. to store information changes for later access by offline peers.

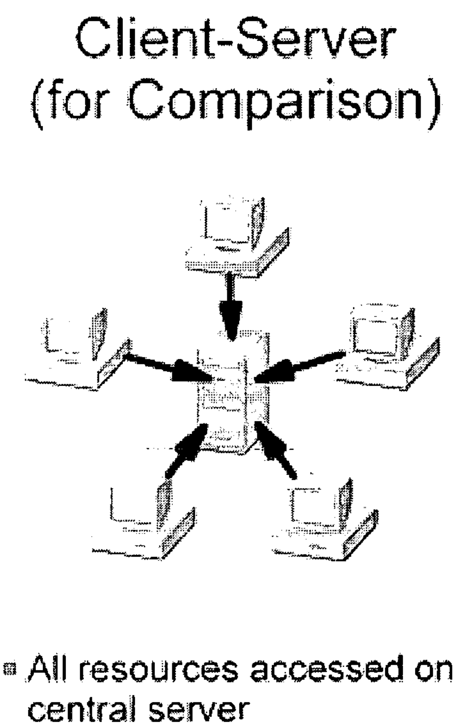

FIGURE 1. CLIENT-SERVER (FOR COMPARISON)

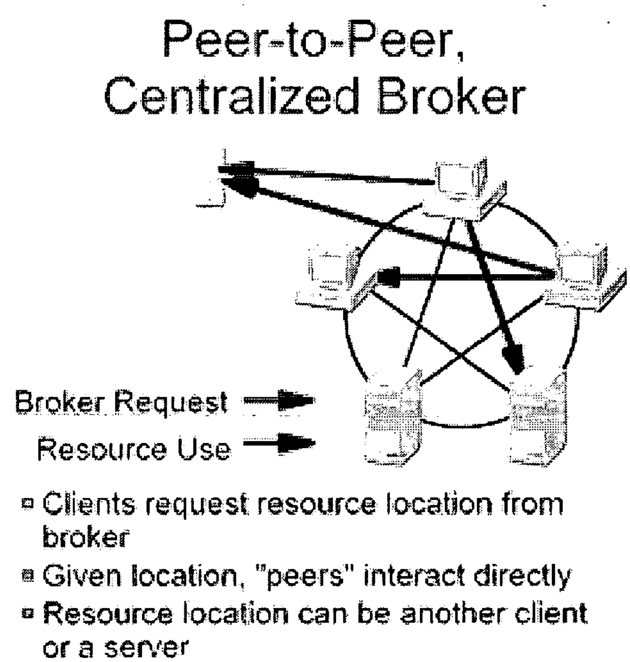

FIGURE 2. PEER-TO-PEER, CENTRALIZED BROKER

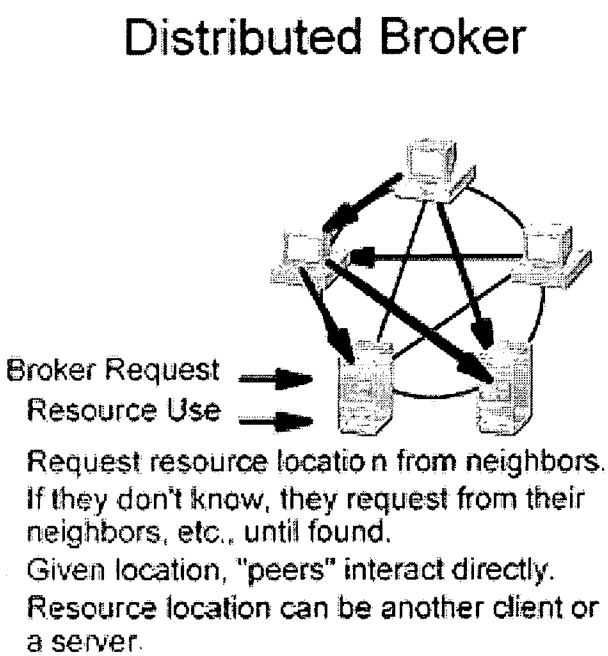

FIGURE 3. DISTRIBUTED BROKER

3. Technical Definitions: What is P2P?

P2P is a new way of thinking about how Internet applications function and communicate, especially with the increased availability of ubiquitous networking and pervasive computing. In simple terms, a hive of bees will almost always be smarter than any single bee. With P2P, generally speaking, clients are like worker bees that handle the bulk of an application's processing and data transfer, while centralized servers simply coordinate the hive's activity. In more technical terms, P2P distributes computing resources through a network, instead of centralizing them on a server (as in client-server). P2P often uses a brokerage function to locate resources. This brokerage function can be distributed or centralized; centralization is more common. After the resource has been located using a broker, the distributed nodes interact directly. Examples of distributing various resources (all use a central broker except as noted) include:

Computation: Information Power Grid (NASA), Datagrid (CERN), SETI@Home, LoadLeveller, Entropia.

Data/File Sharing: Napster, Gnutella (distributed broker), Limewire (distributed broker)

Collaboration: AOL Instant Messenger, Lotus SameTime, Microsoft NetMeeting, Groove Networks, Consilent

The Technological Landscape

Another definition holds that P2P is a subset of distributed computing (but not all distributed computing is P2P.) The name "peer-to-peer" suggests an egalitarian relationship between peers and, more importantly, suggests direct interactions between peers. In this view, P2P applications consist of a number of peers, each performing a specific role in the P2P network, in communication with each other. Typically, the number of peers is large and the number of different roles is small. These two factors explain why most P2P applications are characterized by massive parallelization in function. One of the most popular examples is the Gnutella network (a follow-on to Napster, mostly used for sharing music files), which consists of a large number of essentially identical peers. P2P networks are made up of collaborating machines in which one or more of the following characteristics are prominent:

- The network relies on the active collaboration of edge-of-the-net devices (end-user PCs, cell-phones, PDAs, game boxes, etc.). That is, the peers benefit directly from the participation of other peers rather than just from the server.
- Participating machines in the network act in some sense as both clients and servers.
- Users of a P2P application are aware of each other. That is, the P2P network creates a sense of a community — the system is greater than the sum of its parts.

P2P can be seen as a class of applications that takes advantage of resources -- storage, cycles, content, human presence -- available at the edges of the Internet. Such outlying P2P resources are increasingly cut off from the DNS system because they have no fixed IP address, creating a need for resource-centric addressing for unstable environments. Because accessing these decentralized resources means operating in an environment of unstable connectivity and unpredictable IP addresses, P2P nodes must operate outside the DNS system and have significant or total autonomy from central servers.

In P2P applications, the technical challenges lie in the interaction between the peers and, to a lesser extent, in the peers themselves. (P2P is not to be confused with another issue in the telecom industry; namely "Internet peering" services between ISPs, which improves performance and reliability. Peering in this context refers to the way that ISPs exchange traffic with each other.)

There are many different definitions and opinions as to what characterizes P2P.

The uncertainty about defining P2P extends to categorizing P2P applications. Perhaps "P2P applications can be grouped into four general categories: Exchanges (value in the goods and services stored or transferred), Collaboration (value in the communications and information-sharing between nodes), Information discovery (value in the intelligence the group effort delivers to the individual user), Distributed computing (value in the aggregate product). The categories could also be labeled as shared storage, shared spaces, shared information and shared processing."

Let us try to categorize P2P by looking at some applications:

1. Popular Applications - Categorization and Classification:

A. File Sharing and Content Distribution:

Community- and Content-driven sharing of data; File sharing, distribution and search

The purpose of these systems is to make files that are distributed over many machines accessible and searchable to all users. Some systems also aid in distributing files to clients needing them, e.g., MyCIO, which distributes virus-checker update files within a corporation. Today, this category offers the largest variety of novel P2P applications. Here are a few examples.

Napster

Napster was perhaps the most well known file-sharing service because of its mass adoption for sharing music files, until ordered by a court in 2001 to cease its operations which infringed copyrights. According to Nielsen//NetRatings, traffic to Napster at-home declined significantly in mid-2001, while other file-sharing sites, i.e. KaZaA, BearShare, Audiogalaxy and iMesh, were gaining traffic, suggesting that Web surfers were still keenly interested in file sharing, and seeking alternatives to Napster. While Napster continued with limited operations, it still was the most popular file-sharing site, in spite of the traffic decline. File sharing sites attracted a large audience of teens aged 12 to 17; teens spent more time and accessed more pages than any other demographic group.

Gnutella and FastTrack are similar file sharing systems, but with the directory distributed among users, hence complicating regulatory efforts (in contrast, Napster's directory was on a centralized, easily-identified server). In a decentralised network (which removes the centralized server and places the burden of computing resources on the computers sharing the network), there is no central authority to control, monitor or filter any of the files being traded.

This type of File Sharing succeeds according to "network effects" — the bigger the network, the more valuable it is.

A Napster for Law Firms

International law firm Baker & McKenzie uses a P2P system developed by NextPage Inc., to share legal briefs and other documents among their 61 offices in 35 countries and to search the firm's P2P network, e.g. for a document containing a certain word or name. This system is a commercial example of using P2P for a distributed application that ordinarily would use a centralized database.

Distributed search

InfraSearch, founded by a Gnutella developer and later acquired by Sun Microsystems, is developing search software based upon the Gnutella "friend-of-a-friend" forwarding mechanism. Generalized search queries are forwarded through a net of participating machines that send back results to the originator of the search, rather than searching a centralized index. OpenCOLA and Thinkstream are start-ups with different technologies but similar goals.

Content Distribution

Kontiki, managed and funded by former Netscape executives, is testing a network designed to harness millions of PCs to distribute music, videos, software and other digital content. The company envisions attractive, unique content, such as customized news digests that arrive overnight to employees from management. P2P should provide lower operating costs than current client-server content distribution methods.

B. Distributed Computing

For extreme processing and storage (simulations and numerical modeling):

CPU sharing and "grid" computing

This P2P category covers capturing unused CPU power. It includes both a loose style of CPU sharing exemplified by the Search for Extraterrestrial Intelligence (SETI @ home is a project managed by UC Berkeley which uses 2 million volunteer home PCs to analyze radio telescope data looking for signatures of possible deliberate radio transmissions) and the more tightly coupled approaches found in scientific grid computing systems.

Loosely coupled networks combine the power of many computers to solve CPU-intensive tasks, such as simulations (e.g. climate) and numerical modeling. The edge-of-the-net machines act as computation servers usually coordinated by a central "task server." Not all computation tasks are suited for loosely coupled CPU sharing. The ideal task requires little coordination between peers and a relatively small data and bandwidth usage for a relatively large amount of computation. Tasks such as scanning radio telescope data or factoring large integers are a good match. Tasks that require very large data sets (with heavy bandwidth requirements for downloading) and/or extensive coordination between computational elements are not so suitable. Problems to be solved in distributed computing include coordinating and monitoring the activities of independent nodes and ensuring robust, reliable communication between them. Perhaps the biggest challenge for Internet-wide CPU sharing is sociological, namely how to motivate a large number of PC users to participate. Direct payment is a poor motivation because even the full power of a 1GHz Pentium IV processor isn't worth enough money in practical terms. Successful CPU sharing networks, such as SETI @ home, attract participants on the basis of psychological rewards such as appeals to altruism or competitiveness. Another example is Scripps Research Institute; the molecular graphics laboratory uses a process of mathematical computations called "molecular docking" to test how AIDS drugs interact with virus proteins.

Within an intranet (inside a network's firewall), corporate CPU sharing has already proven to save on costs of compute-intensive tasks. Intel claims to have saved $500 million over the last 10 years by sharing unused CPU cycles and storage for compute-intensive tasks.

Distributed applications like SETI@home and the various distributed.net projects do not have much peer-to-peer interaction, and perhaps should be called peer-oriented.

Grid Computing: Computing grids allow geographically distributed virtual organizations to share applications, data and computing resources. Grids are clusters of servers joined together over a network (usually the Internet), using open protocols such as Linux, which are designed to provide resource aggregation, database sharing and collaboration. Grid drivers include the need for incremental compute resources, efficient utilization of existing resources, and sharing resources. The advantage isn't merely scavenging otherwise unused resources; rather it is setting up resources that many independent organizations can use, making it easy to change and/or manage the patterns of use. IBM is using Grid projects as a testing ground for deploying e-Sourcing, which involves the delivery of computing resources including bandwidth, applications and storage as a utility service over the Internet. Grid applications include collaboration for design, business, gaming, communication (e.g. intracompany for automobile or aircraft manufacturers), sharing data (BioGrid), and aggregating resources (NASA Information Power Grid). Challenges to Grid Computing include heterogeneity, latency, scale, autonomy, dynamic nature, privacy and security.

C. Collaboration

These systems are intended to foster collaboration and communication between groups of people within or between organizations. Workgroup collaboration is primary (combining e-mail, shared databases, white boards, multimedia conference facilities, virtual conference rooms, and similar tools) supplemented by Instant Messaging, multi-user games, and P2P financial trading and auctions.

An example is Microsoft's Windows Messenger, to be included in upcoming Windows XP operating system. An interesting player is Groove Networks, a startup founded in 1997 by Ray Ozzie, the developer of Lotus Notes. Groove offers a collaborative work system that is not based on the client-server model; it does not require a centralized server. Groove uses P2P networking to initiate and maintain shared workspaces in real time. Users collaborate with messaging, shared applications, voice and video. A P2P attribute is that data is distributed and stored on each user's hard drive, although there are some centralized tools (e.g. deploying and managing the software and licenses.) Groove's attraction is significantly lower operating costs than client-server collaboration applications. However, the scalability of Groove and similar P2P collaboration tools is unclear. The fact that data is stored on PCs without a central server back-up raises reliability issues. This distributed approach reduces the control of system administrators, who are used to more centralized management.

Professional Services firms such as consultants KPMG are creating collaborative knowledge supply chains using P2P technologies, in order to allow the organization's widely-dispersed knowledge to be effectively shared and utilized.

Collaboration also includes distributed markets and transactions. Several startup companies provide P2P equivalents of online auctioneer eBay and of commodity and financial exchanges.

D. Communication: Instant Messaging

The popularity of Instant Messaging (IM) or "Chat" in the consumer market is gradually being replicated in businesses, where its potential as a communications tool is beginning to be recognized. IM not only enables exchanging real-time text messages with friend and colleagues; programmers are creating IM "bots" that respond to queries about news, stock quotes, weather, definitions and more.

IM is an example where innovations are incorporated from the Internet into business. IDC estimates that 23.6% of large corporations will deploy internal instant messaging by mid-2002. PricewaterhouseCoopers has begun installing an instant messaging system (Omniprise from Ikimbo). If it performs well enough, IM will extend throughout PWC's 160,000 consultants worldwide. IBM continues to deploy and upgrade internal IM tools globally, currently using Lotus Sametime.

Jupiter Media Metrix reports that IM applications grew 29% in usage reach and 35% in usage intensity during 2000 due to aggressive cross-network promotions by Yahoo! and MSN. According to IDC, the WW Corporate IM applications market by users will experience a 114.7% CAGR from 2000-2005, and by revenue will see a 92.0% CAGR during the same time frame. Corporate IM applications include standalone IM applications, team collaborative applications, and IM-enabled ICE applications (integrated collaborative applications such as MS Exchange or Lotus Notes). Gartner Dataquest predicts that by 2004, 60% of real-time Internet-enabled communication between users via any means, including voice, text or call-and-response, will be driven through instant-messaging technology. They have placed Enterprise IM at the peak of inflated expectations on their "2001 Hype Cycle of Emerging Technologies and Tends."

The current challenge is trying to identify a business model for IM that will generate revenue and profit. Today, consumer IM services tend to be free. Interoperability is one IM inhibitor as AOL and Microsoft rivalry continues.

E-mail is already more established in the enterprise, but one advantage of IM is real-time communication capability. There is potential for enhanced services that rely on a user's presence information (knowing whether a person is on-line, available, and via which device. In the enterprise, Gartner Dataquest identified a couple of niche uses:

- Remote workers — simulating office-based human interactions.
- Presence information - knowing when and where someone is available; enabling messages and phone calls to be forwarded to the appropriate device.
- Support desk applications.

User identity is a hot issue, with the need for identity portability becoming evident. As IM adoption in business continues, the need for global identity management increases in importance, generating a need for interoperability between established directory products, authentication systems, and emerging IM screen names and identities. Future requirements may expand global identities to applications or machines. Microsoft's Passport service was designed for identity purposes, and if combined with the MSN IM client could create a more substantial identity vehicle.

Companies like AOL / ICQ, Microsoft, and Yahoo! are looking for enhancements to create "stickiness" (keep users on their web sites) and increase their IM subscribers. Features include voice, video, and wireless. Mobile IM could change the way meetings are conducted. In addition to the main meeting, parallel, secondary meetings could be conducted by different people exchanging their thoughts and opinions. There is an initiative underway by Ericsson, Motorola, and Nokia called Mobile Data Village, which hopes to do for IM and presence services what the WAP Forum did for mobile markup schemes.

Messaging Frameworks: Jabber is an IM system aimed at being able to message across multiple platforms (Windows, Linux, Mac...) and services (AOL IM, ICQ, MSN, IRC...) It is open-source, free, cross-platform, extensible (XML-based) and modularized. Jabber and ICQ are considered P2P because they: a) devolve connection management to individual nodes after they resolve addresses, and b) violate the machine-centric worldview encoded in the DNS system (IM addresses are not related to DNS); IM addresses can "travel" from machine to machine.

E. Multiplayer Gaming

Multi-user P2P games such as Activision's Battlezone have attracted large audiences of "gamers," many of whom represent the next generation of Web programmers. More recently, Electronic Arts' Majestic presents an interactive story using multiple forms of communication to draw players into the game. E-mail messages, faxes, phone calls, Web pages, video clips and more are all employed to draw in users.

The phenomenon will grow further when Sony's next generation Playstation 3 (PS3) game machines ship. By early 2002, precursor PS2 machines will be ready to tap Internet content using standards like Sun's Java, Macromedia's Flash, and RealNetworks' Media Player. Following in a few years, PS3s will be Internet-enabled, contain a "supercomputer on a chip," and will likely connect to a P2P infrastructure. The chip will function both as a network server and a game processor. The infrastructure may depend upon centralized Sony game servers, but will also support applications beyond games. In May, Sony Computer Entertainment set a flurry of alliances with AOL, Cisco, Sun Microsystems and IBM to promote open standards for video and games over the high-speed networks. This alliance hopes to prevent the broadband industry from winding up with customers segregated into mutually incompatible platforms. Games should be playable on multiple pieces of hardware.

Meanwhile, Microsoft has hyped its XBox game console as the vehicle for delivering not just lone gaming but, eventually, multiplayer games over Microsoft-owned servers. This meshes neatly with Microsoft's broader .NET strategy of using its new XP operating system to funnel video, music, chat and other Web-based communications through its proprietary systems as well. According to The Economist, "Microsoft expects to lose money on its XBox hardware, but make it back with services such as online multiplayer game networks." In other words, they are working on a viable P2P business model.

F. Tools, standards, frameworks and enabling technologies

There are many efforts to help those who want to build P2P systems. For example, Sash is a programming language for Web and Application Developers to build simple weblications. (Think of the analogy to a "sash," the moveable parts of a window.) A dynamically configurable development system, Sash blends Web technology (JavaScript, Dynamic HTML, XML) and desktop systems to create network-based applications integrated into common desktop environments. Sash enables building P2P and non-P2P web applications ("weblications") which are web-aware but don't require a browser, and can be run online or cached to run standalone on a desktop. A weblication using Javascript looks like an actual application (e.g. TurboTax), not the browser GUI. It offers promise that P2P frameworks will be built using SOAP and UDDI, so that P2P applications can easily leverage new Web Services.

G. Servers, Devices and Agents

This category deals with various forms of P2P where the peers are specialized in some fashion, e.g., as "intelligent" agents, pervasive devices, or B2B servers. Bluetooth devices and Web Services, which involve servers peering with other servers, fall into this category. A brief comparison of Web Services, P2P and Grid follows:

	Web Services	P2P	Grid
Namespace	DNS	non-DNS directory	DNS+LDAP
IP addressing	Static	static or dynamic	static or dynamic
Network connection	always connected	Intermittent connection	always (currently)
Representation	service is a proxy for an organization	peer is a proxy for an individual person	service is a proxy for a cluster resource
Function	different kinds of service work together	Interchangeable peers work together	compute/storage resource management
Key issue to be solved	describing and finding services (UDDI, WSDL)	finding & addressing peers in real time ("presence" registry)	describing and finding resources (current LDAP)
Protocols & APIs	Open	Open or proprietary	Open
Virtual Organizations	Yes	Some do, some don't	Yes

It's the Applications!

It is important not to be distracted by the hype and copyright sideshows surrounding P2P, but rather to focus on applications. When evaluating P2P as computing models, consider what infrastructure characteristics are lost, compared to using client-server.

With P2P, the infrastructure loses such basics as:

- security

- fast communication
- low-overhead data sharing
- reliability of both communication and computing nodes
- knowledgeable scheduling
- accounting & charge-back
- resource discovery (or recruiting)

Innovation is the discovery of useful applications that work in spite of these missing elements.

With Napster, reliability is pretty bad. But if one source stopped working, users just try another. Napster effectively addresses resource discovery; users can find what they want, then go get it.

The characteristics of SETI @Home allow it to work despite many of the above problems, with a little extra work. SETI administrators solved the discovery problem by recruiting volunteers (as does Napster), but had a significant security problem because some participant pranksters sent back doctored data hoping to fabricate signals from extraterrestrial life. The solution: heavily redundant computation -- sending out the same sub-problem to many people -- and not believing anything until multiple participants produce the same result.

Groove attempts to address these problems within the confines of real-time off-line collaboration applications. However, in most cases, Groove has soft deadline goals, and system participants tend to work around problems flexibly. Human and social factors are essential to successful collaboration.

Some other areas of P2P have been long-sought dreams for parallel processing that have yet to be realized, or have been realized, but with unexpected results. Generally, parallel processing best suits applications that can be divided effectively into many small, independent pieces (like SETI). Unfortunately, it is not easy coercing applications into this distributed form. In practice, parallel processing is very difficult. Databases generally are not well suited to it (especially for updating and OLTP). Another dream of system administrators is using supposed "free" cycles on client desktops, which are seen as additional I/T resource. However, in many cases, the available combined compute power is insufficient for practical purposes.

Therefore, it is critical to create not just infrastructure, but also matched applications. Infrastructure is easier, but application structure and characteristics are crucial. Until practical application issues are addressed, P2P (and in particular Grid Computing) may not become widely adopted. One approach is to find applications that work once the simplest problems are fixed, perhaps in specific contexts (e.g. security is easier in a department or on an Intranet) and next concentrate on the required infrastructure.

With the coming of Web Services (the delivery of software applications over the Internet in the form of services, and software modules that communicate using standard Web protocols such as XML and HTTP), application issues and challenges take on increased importance, particularly as P2P affects business as well as consumer applications.

Post this on the wall: It's the applications!

Conclusions

Business users are looking for solutions, not just more technology. The days of IT departments embracing web technology just for technology's sake are over, hence there is some hesitation in evaluating P2P. But there is no doubt that P2P developments are presenting new opportunities and offering solutions to business problems. Whereas the Web was primarily dumb clients (browsers) talking to smart servers (web sites), the trend is towards smart clients talking to smart servers, smart servers talking to smart servers, and smart clients talking to smart clients — on a more equal footing.

P2P is neither a discrete technology, nor a single application. P2P, in and of itself, is not an industry, but a category of technologies (architectures and applications), and economic and sociological trends that take advantage of resources -- storage, cycles, content, human presence -- available at the edges of the Internet. These portend continued change and growth: For network operators, symmetric rather than asymmetric use of bandwidth will increase. P2P provides reasons for more consumers to participate in network computing. New hardware (mostly Pervasive devices) and new software (infrastructure) will emerge because of P2P. Identifying profitable business models are the next challenge.

Glossary

AIM — AOL Instant Messenger. AOL's widely-used instant messaging system, which popularized "buddy lists" and is based on a centralized server architecture.

Aimster — A file sharing network that uses the AIM protocol. File sharing occurs between identifiable "buddies" rather than between anonymous individuals. This distinction has both legal and technical ramifications.

Bluetooth — a low power, short range (approximately 10 meters) wireless interconnection protocol for devices such as notebook PCs, PDAs, digital cameras, and others. Bluetooth is a computing and telecommunications industry specification that describes how mobile phones, computers, and personal digital assistants (PDAs) can easily interconnect with each other and with home and business phones and computers using a short-range wireless connection. Using this technology, users of cellular phones, pagers, and personal digital assistants such as the PalmPilot will be able to buy a three-in-one phone that can double as a portable phone at home or in the office, get quickly synchronized with information in a desktop or notebook computer, initiate the sending or receiving of a fax, initiate a print-out, and, in general, have all mobile and fixed computer devices be totally coordinated. The technology requires that a low-cost transceiver chip be included in each device. How It Works: Each device is equipped with a microchip transceiver that transmits and receives in a previously unused frequency band of 2.45 GHz that is available globally (with some variation of bandwidth in different countries). In addition to data, up to three voice channels are available. Each device has a unique 48-bit address from the IEEE 802 standard. Connections can be point-to-point or multipoint. The maximum range is 10 meters. Data can be exchanged at a rate of 1 megabit per second (up to 2 Mbps in the second generation of the technology). A frequency hop scheme allows devices to communicate even in areas with a great deal of electromagnetic interference. Built-in encryption and verification is provided.

Bots — Shortened term for "Robots" or applications that perform a prescribed, automated, ongoing function without active human administration. Examples are Shopping bots, programs that repeatedly log on to Web sites to help users search for prices or products, but which have overloaded and crashed e-Commerce Web sites. Another can be viewed by users of AOL Instant Messenger who add the screen name "SmarterChild" to their buddy list. SmarterChild, a bot created by ActiveBuddy, won't tell parents how to raise their kids, but can give users weather or play a trivia game.

DNS — Domain Name System, a hierarchically organized network of name servers that translate Internet domain names such as ibm.com, into IP addresses, e.g., 63.37.255.60. The name servers act as both clients and servers. A domain name is a meaningful and easy-to-remember "handle" for an Internet address.

Firewall — a security gateway between the Internet and an Intranet, whether corporate or home, that filters packets. Packets that do not fit the owner's firewall policies do not pass through the firewall. A firewall is a set of related programs, located at a network gateway server, that protects the resources of a private network from users from other networks. (The term also implies the security policy that is used with the programs.) An enterprise with an intranet that allows its workers access to the wider Internet installs a firewall to prevent outsiders from accessing its own private data resources and for controlling what outside resources its own users have access to. Basically, a firewall, working closely with a router program, examines each network packet to determine whether to forward it toward its destination. A firewall also includes or works with a proxy server that makes network requests on behalf of workstation users. A firewall is often installed in a specially designated computer separate from the rest of the network so that no incoming request can get directly at private network resources. There are a number of firewall screening methods. A simple one is to screen requests to make sure they come from acceptable (previously identified) domain name and Internet Protocol addresses. For mobile users, firewalls allow remote access in to the private network by the use of secure logon procedures and authentication certificates.

Freenet — A fully decentralized P2P file sharing network with the goal of preventing censorship, providing anonymity for users, removing any central point of failure or control, and providing plausible deniability for node operators.

Friend-of-a-friend forwarding — a network in which each node may forward messages it receives to one or more other nodes of which it is aware. Messages that are requests for a service are typically forwarded only if the receiving node cannot itself satisfy the request. A Gnutella node, forwards to all nodes to which it is connected. This promiscuous forwarding generates a combinatoric explosion of messages. Other forwarding schemes are more selective. Each Freenet node, for example, forwards to the single node it estimates to be most likely to be able to satisfy any given request. Simulation experiments suggest that Freenet's scheme is quite efficient, typically finding the right node within five hops (see chapter 14 of Peer-to-peer: Harnessing the Power of Disruptive Technologies, Andy Oram ed., O'Reilly & Associates, 2001).

Gnutella — An open source, fully decentralized message-forwarding network. Its primary use currently is as a file-sharing network, however it has more general applications. InfraSearch, a startup recently acquired by Sun, uses Gnutella for distributed file search. Like Napster and similar Web sites, Gnutella is often used as a way to download music files from or share them with other Internet users and has been an object of great concern for the music publishing industry. Unlike Napster, Gnutella is not a Web site, but an arrangement in which users can see the files of a small number of other Gnutella users at a time, and they in turn can see the files of others, in a kind of daisy-chain effect. Gnutella also allows users to download any file type, whereas Napster is limited to MP3 music files. After installing and launching Gnutella, a user's computer (node) becomes both a client and a server in the network (which is called GnutellaNet) and is able to share files that other Gnutella users have set up to make available. Gnutella, whose name pays homage to both the hazelnut/chocolate spread "Nutella" and the GNU project of the Free Software Foundation, was originally developed by Nullsoft (creators of MP3 and WinAMP). It was never publicly released because Nullsoft's parent corporation (AOL) declared the work an "unauthorized publication". However, the beta version that was made available for preview was an open source program, which resulted in any number of clone variations becoming available that AOL does not own.

GPS — Geographical Positioning System. Small GPS devices receive signals from a system of satellites that allows the device to determine its position (latitude, longitude, and altitude) to within a few meters' accuracy.

GUI - graphical user interface. A computer monitor's "look and feel" which uses easily-understood icons and graphic representations to replace the arcane alphanumeric commands and terms used by DOS and other prehistoric languages. Think Windows vs. MS-DOS. Or think Mac vs. anything.

HTML — HyperText Markup Language. The document format used on the World Wide Web. Web pages are built with HTML tags, or codes, embedded in the text. HTML defines the page layout, fonts and graphic elements as well as the hypertext links to other documents on the Web. Specific HTML tags are in the form "html <tag>".

HTTP — HyperText Transfer Protocol is the set of rules for exchanging files (text, graphic images, sound, video, and other multimedia files) on the World Wide Web. Relative to the TCP/IP suite of protocols (which are the basis for information exchange on the Internet), HTTP is an application protocol. Essential concepts that are part of HTTP include (as its name implies) the idea that files can contain references to other files whose selection will elicit additional transfer requests. Any Web server machine contains, in addition to the HTML and other files it can serve, an HTTP daemon, a program that is designed to wait for HTTP requests and handle them when they arrive. A Web browser is an HTTP client, sending requests to server machines. When a browser user enters file requests by either "opening" a Web file (typing in a Uniform Resource Locator) or clicking on a hypertext link, the browser builds an HTTP request and sends it to the Internet Protocol address indicated by the URL. The HTTP daemon in the destination server machine receives the request and, after any necessary processing, the requested file is returned.

ICQ — The first PC-based chat system, started in 1996, which is now owned by AOL. It uses direct P2P communication when possible and a centralized server when P2P communication isn't available.

IM — Instant Messaging, also known as "Chat." The online, real-time exchange of text messages.

IP — Internet Protocol. The Internet Protocol (IP) is the method or protocol by which data is sent from one computer to another on the Internet. Each computer (known as a host) on the Internet has at least one IP address that uniquely identifies it from all other computers on the Internet. When you send or receive data (for example, an e-mail note or a Web page), the message gets divided into little chunks called packets. Each of these packets contains both the sender's Internet address and the receiver's address. Any packet is sent first to a gateway computer that understands a small part of the Internet. The gateway computer reads the destination address and forwards the packet to an adjacent gateway that in turn reads the destination address and so forth across the Internet until one gateway recognizes the packet as belonging to a computer within its immediate neighborhood or domain. That gateway then forwards the packet directly to the computer whose address is specified. Because a message is divided into a number of packets, each packet can, if necessary, be sent by a different route across the Internet. Packets can arrive in a different order than the order they were sent in. The Internet Protocol just delivers them. It's up to another protocol, the Transmission Control Protocol (TCP) to put them back in the right order. IP is a connectionless protocol, which means that there is no continuing connection between the end points that are communicating. Each packet that travels through the Internet is treated as an independent unit of data without any relation to any other unit of data. (The reason the packets do get put in the right order is because of TCP, the connection-oriented protocol that keeps track of the packet sequence in a message.) In the Open Systems Interconnection (OSI) communication model, IP is in layer 3, the Networking Layer. The most widely used version of IP today is Internet Protocol Version 4 (IPv4). However, IP Version 6 (IPv6) is also beginning to be supported. IPv6 provides for much longer addresses and therefore for the possibility of many more Internet users. IPv6 includes the capabilities of IPv4 and any server that can support IPv6 packets can also support IPv4 packets.

IPv6 — Internet Protocol, version 6, an upgrade of the IP system to support 128 bit addresses.

IRC — Internet Relay Chat, a P2P protocol that supports real-time group discussions.

ISP — Internet Service Provider, examples are AOL, Earthlink, MSN and most telephone companies.

Jabber — An open source framework for instant messaging, based on XML.

LDAP — Lightweight Directory Access Protocol (RFC 1823), a protocol to access directory services on a network. LDAP is a software protocol for enabling anyone to locate organizations, individuals, and other resources such as files and devices in a network, whether on the public Internet or on a corporate intranet. LDAP is a "lightweight" (smaller amount of code) version of Directory Access Protocol (DAP), which is part of X.500, a standard for directory services in a network. LDAP is lighter because in its initial version it did not include security features. LDAP originated at the University of Michigan and is supported by many companies, including Netscape, Microsoft, Novell and Cisco. In a network, a directory tells you where in the network something is located. An LDAP directory is organized in a simple "tree" hierarchy consisting of the following levels: the root" directory; which branches out to Countries, each of which branches out to

Organizations, Organizational units, and ultimately Individuals (which includes people, files, and shared resources such as printers). An LDAP directory can be distributed among many servers. Each server can have a replicated version of the total directory that is synchronized periodically. An LDAP server is called a Directory System Agent (DSA). An LDAP server that receives a request from a user takes responsibility for the request, passing it to other DSAs as necessary, but ensuring a single coordinated response for the user.

Metadata — a loosely defined term that refers to data about data. In P2P, it generally refers to data about files to be found by a search or about descriptions of Web services users might want to find. In the case of Napster, the metadata about a music file is the song name and artist. In the UDDI registry, the metadata is XML descriptions of businesses and services. Distributed search networks must evaluate or, in some cases, create metadata in order to produce a result. Simple stereotyped file sharing networks such as Napster can use simple metadata. The more complex or heterogeneous the purpose of the network, the more it relies on accurate and expressive metadata.

Microsoft Passport — the company's end user identity and notification service, i.e., a key piece of their registry effort. Microsoft is going to great lengths to sign up users for Passport. For example all Hotmail and MSN users are automatically signed up. Microsoft Passport enables any Passport site to share information about the user.

MSN — Microsoft Network, Microsoft's dial-up network offering ISP and content services. A competitor to AOL.

NAT — Network Address Translation, a technique for translating IP addresses on the fly. The address visible to the external Internet need have no relationship to the address used on the internal network.

NNTP — Network News Transfer Protocol.

NFS — Network File System, the distributed file system pioneered by BSD Unix machines from Sun.

OLTP — on-line transaction processing

SETI — Search for Extraterrestrial Intelligence, a long-term astronomy program that looks at data, such as radio telescope data from the Arecibo dish, attempting to find signs of intelligent life.

SETI @ home — a network, managed by the SETI project at University of California, Berkeley, that uses millions of home PCs to analyze radio telescope data looking for signatures of possible deliberate radio transmissions. Each home user downloads the software from the Berkeley server. The software runs as a screen saver. So, whenever the machine is not in use, it analyses a set of data sent from the Berkeley server. When it has finished the task, it sends the results to the Berkeley server and requests the next task. Slow PCs may take as long as 20 hours to analyze one data set. Fast ones may complete a set in 10-20 minutes. SETI @ home runs on Windows PCs, Macintoshes, Linux machines and popular Unix machines.

SMTP — Simple Mail Transfer Protocol, an established protocol first defined in 1982 that is used for efficiently and reliably transferring mail between machines.

SOAP — Simple Object Access Protocol, an XML-based protocol for communication between machines. SOAP is a way for a program running on one kind of operating system to communicate with a program on the same or another kind of an operating system by using HTTP and its Extensible Markup Language (XML) as the mechanisms for information exchange. Since Web protocols are installed and available for use by all major operating system platforms, HTTP and XML provide an already at-hand solution to the problem of how programs running under different operating systems in a network can communicate with each other. S OAP specifies exactly how to encode an HTTP header and an XML file so that a program in one computer can call a program in another computer and pass it information. It also specifies how the called program can return a response. SOAP was developed by Microsoft, IBM, DevelopMentor, and Userland Software and has been proposed as a standard interface to the Internet Engineering Task Force (IETF) and W3C. An advantage of SOAP is that program calls are much more likely to get through firewall servers that screen out requests other than those for known applications (through the designated port mechanism). Since HTTP requests are usually allowed through firewalls, programs using SOAP to communicate can be sure that they can communicate with programs anywhere.

Stickiness — the much-touted practice during the dot.com heyday of measuring the appeal of a web site by how likely web surfers were to come and stay viewing the site, rather than linking off to a different one. Like "eyeballs" and "hits," stickiness is one of many metrics used to measure the performance of Web companies when there is no chance in hell of profit.

TCP/IP — see IP definition above.

UDDI — Universal Description, Discovery, and Integration) is an XML-based registry for businesses worldwide to list themselves on the Internet. Its ultimate goal is to streamline online transactions by enabling companies to find one another on the Web and make their systems interoperable for e-commerce. UDDI is often compared to a telephone book's white, yellow, and green pages. The project allows businesses to list themselves by name, product, location, or the Web services they offer. Ariba, IBM, and Microsoft spearheaded UDDI. See uddi.org While the group does not refer to itself as a standards body, it does offer a framework for Web services integration. The UDDI specification utilizes World Wide Web Consortium (W3C) and Internet Engineering Task Force (IETF) standards such as XML, HTTP, and Domain Name System (DNS) protocols. It has also adopted early versions of the proposed Simple Object Access Protocol (SOAP) messaging guidelines for cross platform programming.

Usenet — a distributed system of "newsgroups" for bulletin-board style discussions on a variety of topics. Usenet is a collection of user-submitted notes or messages on various subjects that are posted to servers on a worldwide network. Each subject collection of posted notes is known as a newsgroup. There are many thousands of newsgroups.. Usenet's original protocol was UNIX-to-UNIX Copy (UUCP), but today the Network News Transfer Protocol (NNTP) is used. Most browsers provide Usenet support and access to any newsgroups.

UUCP — Unix-to-Unix copy protocol, the original P2P file exchange system.

WebDAV — Web Distributed Authoring and Versioning.

Web Services -- the delivery of software applications over the Internet in the form of services, and software modules that communicate using standard Web protocols such as XML and HTTP.

According to Mark Colan (IBM), Web Services are "Internet-based modular applications that perform a specific business task and conform to a specific technical format." So, if certain processes from a user's applications can be invoked over the Internet, within a method and with a standard format, then the user is already a server of Web Services. Similarly, if one calls on certain processes external to the applications via Internet, then one is already a client of Web Services. SOAP and WDSL are the standards at the heart of Web Services. Web Services highlight the following objectives: implementing personalized information exchange between B2B partners, and offering and publishing modular applications in a ready-to-use format.

WSDL — Web Service Description Language, an XML-based language used for describing Web Services -- the services a business offers and to provide a way for individuals and other businesses to access those services electronically. WSDL is the cornerstone of the Universal Description, Discovery, and Integration (UDDI) initiative spearheaded by Microsoft, IBM, and Ariba. UDDI is an XML-based registry for businesses worldwide, which enables businesses to list themselves and their services on the Internet. WSDL is the language used to do this. WSDL is derived from Microsoft's Simple Object Access Protocol (SOAP) and IBM's Network Accessible Service Specification Language (NASSL). WSDL replaces both NASSL and SOAP as the means of expressing business services in the UDDI registry.

XML - (EXtensible Markup Language) A document format for the Web that is more flexible than the standard HTML format. While HTML uses only predefined tags to describe elements within the page, XML allows tags to be defined by the developer of the page. Thus, tags for virtually any data items such as product, sales rep and amount due, can be used for specific applications, allowing Web pages to function like database records. For example, instead of an imbedded tag on a web page referring to a simple graphic, XML can enable it to refer to an entire spreadsheet.

Addendum

Meta is a prefix that in most information technology usages means "an underlying definition or description." Thus, metadata is a definition or description of data and metalanguage is a definition or description of language. Meta derives from Greek, meaning "among, with, after, change." Whereas in some English words the prefix indicates "change" (for example, metamorphosis), in others, including those related to data and information, the prefix carries the meaning of "more comprehensive or fundamental." The Standard Generalized Markup Language (SGML) defines rules for how a document can be described in terms of its logical structure (headings, paragraphs or idea units, and so forth).

SGML is often referred to as a metalanguage because it provides a "language for how to describe a language." A specific use of SGML is called a document type definition (DTD). A document type definition spells out exactly what the allowable language is. A DTD is thus a metalanguage for a certain type of document. (In fact, the Hypertext Markup Language (HTML) is an example of a document type definition. HTML defines the set of HTML tags that any Web page can contain.)

The Extensible Markup Language (XML), which is comparable to SGML and modelled on it, describes how to describe a collection of data. It's sometimes referred to as metadata. A specific XML definition, such as Microsoft's Channel Definition Format (CDF), defines a set of tags for describing a Web channel. XML could be considered the metadata for the more restrictive metadata of CDF (and other future data definitions based on XML).

In the case of SGML and XML, "meta" connotes "underlying definition" or set of rules. In other usages, "meta" seems to connote "description" rather than "definition." For example, the HTML tag is used to enclose descriptive language about an HTML page.

One could describe any computer programming or user interface as a metalanguage for conversing with a computer. And an English grammar and dictionary together could be said to define (and describe) the metalanguage for spoken and written English.

back to index

Abstract

Napster, the wildly popular file-sharing system for trading MP3 music files, may have given "Peer to Peer" (P2P) computing a questionable reputation, but P2P is rapidly becoming attractive to consumers, businesses and even governments. The term "P2P" infers many different things, including 1) **Architectures**: client-server, hybrid/brokered and "pure" P2P computing; 2) **Applications:** community and content-driven File Sharing (Napster, Gnutella, Freenet); Distributed Computing for extreme processing and storage (simulations and numerical modeling including SETI@home, Climate, AIDS and Cancer Research projects); Collaborative Knowledge: professional service firms creating knowledge supply chains; Instant Messaging (Chat, ICQ); Messaging Frameworks (Jabber); Multiplayer Gaming (Sony Playstation 3) ; Servers, Devices and Agents (Bluetooth); as well as a 3) **Sociological and Economic Phenomeno**n: to some P2P means "Person to Person!"

This paper examines the market environments, emerging technologies and scenarios for platforms and applications enabled by Peer-to-Peer Computing -- what does it mean to have zillions of pervasive devices interacting as peers? It also addresses the implications on business processes and practices -- i.e. opportunities of using distributed computation for derivatives and other financial calculations. P2P creates new challenges as well, including managing dynamic directories, synchronizing data, and managing presence and awareness services in an increasing decentralized environment.

Recent developments have called to mind the "Tragedy of the Commons" -- the tendency of property in public hands, where no individual holds direct responsibility, to be mismanaged due to insufficient incentives for conservation and maintenance. The Internet is currently under many stresses, some of which are exacerbated by "Peer to Peer" (P2P) applications, perhaps putting the Internet at risk of suffering the fate of a mismanaged public Commons.

This paper examines these issues and developments to date.

back to index

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back to index

Privacy, Security and Universal Service: Three Issues May Control the Future of ENUM

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View Abstract

The introduction of the Worldwide Web (WWW) standard in the 1990s revolutionized the telecommunications industry as it opened the Internet to non-technical users and launched countless businesses throughout the globe. Today, the appearance of the ENUM standard[1], which maps ordinary telephone numbers to Internet addresses, will likely be the WWW-like event of the first decade of the new millennium. ENUM is the universal solution to communicating with family, friends and business associates through the use of a single phone number. Most people have multiple phone numbers and multiple E-mail addresses, making it virtually impossible to keep pace with organization and tracking of these multiple addresses. Not only does ENUM technology allow contact with individuals through the use of one phone number, depending on associated Uniform Resource Identifiers (URIs), it might allow a user of the service to contact another user in many different ways. That is, one user might allow another user access to only one E-mail address but allow a different user of the service access to several phone numbers and E-mail addresses.

However, ENUM technology might be hindered by the failure of its developers and advocates to address, contemporaneously, the serious public policy issues raised by ENUM technology. The availability of ENUM services, while offering the potential for revolutionary changes in telecommunications, also presents threats to future ENUM services users and non-users alike in areas of important concern to them - including privacy, security, and universal service (the widespread availability of access to telecommunications services at affordable prices). Unless the telecommunications and Internet industries address these concerns to the satisfaction of the public, the world's governments, in response to these public concerns, are likely to adopt heavy-handed laws and rules regulating ENUM technology that will likely severely retard its growth. Thus, the question before us is: Can we anticipate and address public concerns about ENUM technology before it is widely deployed?[2]

ENUM: The Technology

In September 2000, a standards advisory body, the Internet Engineering Task Force (IETF), gave its unofficial approval for a new telecommunications standard, known as ENUM. According to NeuStar, Inc. (NeuStar), which helped develop this new standard, ENUM "is the convergence of the Public Switched Telephone Network (PSTN) and Internet Protocol (IP) Networks."[3] ENUM technology maps a standard international telephone number (e.g., 1+202-414-9200) to an Internet Domain name. This matching of a telephone number to an Internet address (URL) would permit what would otherwise be circuit-switched traffic to be carried on a packet-switched network-the Internet. NeuStar has indicated[4] that once a telephone number has been translated into an Internet address, one of two results would occur. If an authoritative name server is found, the ENUM call would access the appropriate Naming Authority Pointer (NAPTR) records and then proceed through the Internet according to the ENUM subscriber's registered services for that number. The call will be completed completely within the Internet. If, on the other hand, an authoritative name server cannot be found, the network would return a "404 Error Not Found Message," open a connection to the PSTN, and route the call conventionally. In either event, the entire process would be transparent to users.

The use of ENUM technology would allow more flexibility in the provision of telecommunications services. According to NeuStar, a single telephone number could be used to reach a subscriber's e-mail, voice mail, fax, instant messenger, and telephones, including mobile phones[5]. Thus, ENUM technology would permit subscribers to use a single number on their business cards, while allowing other ENUM subscribers to reach them through a variety of media, depending on the routing instructions that were previously created on a controlling Internet web site.

ENUM technology greatly increases the viability of Voice over IP, which could threaten the economic and regulatory status quo. According to the Federal Communications Commission (FCC), total U.S. carriers' revenues for 1999 were $286.51 billion dollars, of which approximately $215.8 billion came from end user customers[6]. Moreover, the overwhelming bulk of those revenues were derived from circuit-based services. Accordingly, the potential migration of many of these revenues to packet-based services, such as Voice over IP, creates an enormous financial risk for traditional carriers, as well as opportunities for both these carriers and other network providers to capture Voice over IP traffic and revenues.

ENUM technology clearly has the potential to revolutionize telecommunications services internationally. Consumers could be given many more choices over their communications services and carriers and other service providers may gain new sources of revenues as they offer ENUM-based services in the market.

However, the availability of ENUM technology in the marketplace will create other side effects that are likely to disturb consumers, non-ENUM users, and governmental bodies. ENUM technology is likely to affect individuals' perceptions of privacy and security, as well as threaten carriers' revenues, which will, in turn, create problems for the maintenance and expansion of universal service, i.e., the ability of all persons to have access to telecommunications services at affordable prices.

We submit that, unless these concerns are both considered and addressed during the deployment of

ENUM technology and services, the likely result will be consumer discontent and the imposition of burdensome laws and regulation. Accordingly, we recommend that the public policy issues associated with ENUM technology, especially privacy, security, and universal service, be addressed by the telecommunications and Internet industries before they bring ENUM technology to the market. We are generally not suggesting what specific solutions should be taken, as that step would be clearly premature at this point in time.

Privacy and Security Considerations

Consumer privacy of individual data records and network security considerations are material to the implementation of ENUM technology. Regardless of whether ENUM technology is directly regulated by governmental agencies, the majority of regulatory and legal issues with respect to ENUM will relate to policies associated with the services provided over the ENUM protocol rather than the implementation of the technology itself. Even though not all countries have the same rules and regulations, all countries will need to address the same issues because all consumers are concerned with these issues.

To many, personal privacy is the foundation of personal freedom. Consumers should be cognizant of privacy implications, particularly with ENUM services and trials in place in many countries. When a consumer, business or other entity becomes an ENUM subscriber, the information provided becomes a record, or file. This record then becomes part of a database of the corresponding ENUM carrier or service provider. The subscriber, through the use of a single number, can then access each record.

The open nature of these ENUM records raises considerable privacy and security issues[7]. Information contained in a resource record is publicly accessible (e.g., E-mail addresses, and directory contact information)[8]. While unlisted numbers in the PSTN environment are not displayed in public telephone directories, a subscriber with an unlisted number who chooses to purchase an ENUM service will likely have his or her published information displayed in ENUM resource records to anyone who can query the Domain Names System (DNS). This result would likely defeat the subscriber's privacy expectations.

Also, "number hijacking" may occur when an ENUM registrant's resource records are created, modified, or deleted without obtaining and verifying the proper authentication and authorization of the ENUM registrant. "Spoofing" or the misrepresentation of the identity of the originator of the information could allow unauthorized updates to the ENUM registrant's resource record. Invalid data could, in turn, cause malicious redirection of communications.[9]

Another type of privacy invasion that could occur is when a marketing department is able to find users registered with competing Service Initiation Protocol (SIP) services and call those users to try to persuade them to change carrier affiliation. Are consumers ready for even more telephone or Internet-based solicitations? Potentially more disturbing is the idea that a registrant could be slammed, that is, the resource record of the registrant is amended so that the owner of the telephone number is made an unwilling and unknowing customer of some unchosen service provider. Moreover, an ENUM database could be an opportunity for spamming, i.e., a registrant receiving and being charged for unsolicited materials or services.

Another privacy issue might arise if in the event that a smaller telecommunications provider of ENUM services were to utilize the operational support systems (OSS) of a larger, more established telecommunications operator. In order for a smaller provider to access the OSS, it must have a very deep linkage into the larger operator's server. In such event, if a smaller carrier has this level of access to provide ENUM services to its customers, it could also negatively affect the privacy (and security) rights of the larger carrier's customers-a generally unacceptable result for all concerned.

In sum, a registrant's ENUM resource record could potentially be altered, amended, destroyed, transferred to another ENUM provider or be set up to receive unsolicited information and materials. This invasion of privacy issues and security issues that could potentially result from the use of ENUM services could raise serious regulatory and legal issues that, even if initially unregulated by a country, might eventually result in governmental bodies imposing regulatory safeguards, conditions and/or fines on individuals and organizations that participate in these illegal activities.[10]

Therefore, ENUM registrants and agents acting on their behalf should be required to demonstrate their identity, or authenticate themselves, to the ENUM Registrar and/or ENUM Tier-2 Provider in order to create or modify a resource record[11]. Authentication is simply the step of making sure users are truly who they say they are, so that any ENUM record transaction is valid. Once a user has been authenticated, it becomes necessary to ensure that ENUM registrants and their agents acting on behalf of ENUM registrants have the appropriate permission to create, modify, or delete a user's resource record. There are many possible means of authenticating and authorizing a subscriber or agent, as noted below in the security discussion.

The accuracy of ENUM resource records impacts on whether a subscriber's E.164 number can be associated with the desired URLs. A combination of techniques including initial administrative processes, on-going verification, and redress procedures may be used by ENUM service providers in order to protect consumers from being exposed to fraudulent or negligent activities. Consumers do have certain methods of recourse in place to prevent information from being disclosed to anonymous resolution queries. In order to make use of the designated zone ENUM services described herein, the consumer must "opt-in" to the system. Opt-In is a framework whereby a subscriber must affirmatively choose whether to use this ENUM implementation. Absent an affirmative choice by the consumer, for example, a service provider for a registrant's E-mail service may not populate the ENUM record for such subscriber. To the extent that a consumer does not want to disclose this information, the consumer would not "opt-in" to this service. The use of Automatic Number Identification (ANI) would allow an ENUM subscriber to call the registration node from that number, or vice versa. Similarly, independent third party validation might be another potential safeguard as well as pre-authorization of subscriber ENUM phone numbers through the use of passwords or other methods.

Universal Service

According to 1999 data compiled by the International Telecommunications Union (ITU)[12], there were 69 nations that had fewer than five main telephone lines per 100 residents. These range from Mongolia, with 4.970 main lines per 100 residents, on the high side, to the Democratic Republic of the Congo, with a mere .0039 main lines per 100 residents, on the low side. These nations, with a combined population of 2,548,220,000, also run the gamut in population, from Kiribati (80,000) to India (1,012,400,000). The average and median number of main lines per 100 residents for this entire group of nations is 1.596 and 1.014 respectively. These figures contrast to worldwide average of 16.272, a figure that, itself, poorly trails telecommunications development in most developed nations. For example, Japan has 65.33 telephone main lines per every 100 residents.

If one were to assume that the average cost to add a new telephone access line were $2300, these 69 nations would be required to invest more than $715.6 billion simply to bring telephone penetration levels up to the worldwide average of 16.272 per 100 residents. Reaching the telephone penetration levels to those found in the U.S., Canada, Japan, and Western Europe would require additional investments of hundreds, if not thousands, of billions of dollars. Of course, the actual costs would be less expensive for those nations that have high-density population clusters and more expensive for those that are sparsely settled. Additionally, many countries may be able to provide telecommunications services on a less costly basis through the use of radio-based technologies, including satellite technology.

Many telephone administrations have used the international market for revenues to build their domestic telecommunications infrastructures. This has been done through the establishment and maintenance of high accounting rates, making calls to and from a country more expensive. This approach produces economically efficient prices according to well-accepted economic theory: Ramsey Pricing - wherein a multi-output monopolist recovers overhead costs from in inverse proportion to the elasticity of demand for the outputs.[13]

In the event that a telephone administration can maintain a monopoly for the termination of calls to its country, the maintenance of high accounting rates can produce domestic benefits. For example, using August 2001 Accounting Rates as compiled by the FCC, Cambodia has an accounting rate with the U.S. of $1.76. For the same period, the Philippines' typical accounting rate was $0.57 for the interchange of traffic with the U.S. If Ramsey Pricing principles ring true, Cambodia should be able to build out its domestic network and expand service to more citizens more quickly than could the Philippines.

On the other hand, the maintenance of high accounting rates can create a barrier to use of the telephone network as a tool for economic growth. Low long distance rates to and from a developing nation can create an incentive for business growth as it reduces the transaction costs for buyers and sellers of goods and services. Therefore, in the long run, the Philippines may well be better positioned to promote economic development through telecommunications than would be Cambodia because of the former's lower accounting rates.

Even in the United States, universal service is the subject of substantial government involvement and requires subsidies. As most readers know, the United States' federal system of government requires a split in regulatory authority over domestic telecommunications. The FCC regulates interstate and international services, while each state, district, or territory regulates telecommunications services within its borders through its public utilities commission (PUC).

In 1996, Congress passed and President Clinton signed the Telecommunications Act of 1996 (96 Act), which revamped the Communications Act of 1934, as amended (34 Act). The 96 Act amended Section 214 of the 34 Act and added Section 254. Those new laws, taken together, codified a national policy of universal service. Among the principles of this policy are requirements for: (1) the availability of quality services at reasonable and affordable rates, which includes subsidized lifeline service for low-income persons; (2) access to advanced telecommunications and information services in all regions of the U.S.; (3) access by rural Americans to services comparable to those available in urban markets, at comparable prices, which includes assistance to rural and high-cost local telephone companies; and (4) subsidized telecommunications access for schools, libraries, and rural health care providers.

Other salient principles of America's universal service policy include: (1) a requirement that all carriers contribute equitably to support universal service; (2) the ability for carriers to pass along these contributions to their end user customers, to the extent that market forces so permit; (3) eligibility for receipt of universal service funds is determined by regulatory agencies;[14] and (4) portability of universal service funds between carriers as end user customers change their local carriers. Additionally, many state PUCs administer complementary universal service programs to support services in rural markets.

The costs for these programs are not insignificant. The FCC estimated that the total cost for its universal service programs in the United States for 2000 would be $4.526 billion dollars, or approximately $25.90, per access line, on an annual basis.[15]

According to the rules of the FCC, Voice over IP service and all other Internet-based services are considered to be "enhanced services."[16] As an enhanced service (or information service), Voice over IP service is not subject to the payment of switched access charges, which has historically made contributions to support universal service[17]. Additionally, the FCC's rules do not directly impose a requirement for Internet services providers (ISP) to contribute directly to universal service support programs[18]. However, the underlying telecommunications services purchased by Internet service providers and their end user customers are subject to universal service contributions. For example, an ISP offering voice services would be required to purchase large amounts of transport capacity, which is a telecommunications service that contributes to universal service support. Moreover, end user customers that use dial-up, ISDN, or DSL access to the Internet pay rates that are subject to universal service contributions. The FCC is also considering whether to impose universal service contribution requirements to providers of cable modem service[19].

For both developing or developed nations, universal service is an important market and public policy issue. From a purely marketing perspective, the addition of more customers to any telephone network creates additional value for customers. A larger network is more valuable to local subscribers, who can reach and be reached by more persons. Similarly, a larger network is more valuable to other carriers and ISPs, as well as their respective end user customers. We submit that, in a totally deregulated telecommunications market, a carrier should charge some value for access to its customers on a terminating basis, and the value for such access would increase in direct relationship to the number of customers to whom calls could be terminated. The expansion of customers through universal service support programs has a market value that should be captured in prices for service.

Some mechanism(s) must be found to protect and, in most nations, expand universal service. So long as end user loops, wired or wireless, remain costly for some consumers by reason of either their income or geographic location, there will be a need for subsidies. Neither the people nor the governments of the world will readily embrace ENUM technology if it enhances the ability of a few to communicate, while disconnecting many from the network. Both the providers and consumers of ENUM services must be involved in universal service support programs.

Conclusion

The ENUM standard is revolutionizing the world and changing the way in which users access information. ENUM technology allows users of the service to consolidate all phone, Email and other forms of electronic information in a database file that can then be accessed by another user through the use of a single telephone number. The user has ultimate control over the type of information that can be accessed. As ENUM technology and services develop, serious public policy issues such as privacy, security and universal service should be scrutinized and addressed before the widespread deployment of ENUM in order to ensure that ENUM service providers and ENUM end users are adequately protected against potential fraud and abuse that might threaten the development of ENUM services on a global basis.

Endnotes

1. ENUM is a mechanism based on Domain Names System (DNS), which maps E.164 telephone numbers onto a set of Uniform Resource Identifiers ("URLs"). It is defined in Internet Engineering Task Force (IETF) FRC 2916. ENUM stands for Enhancement of Numbering and Naming.
2. The International Telecommunications User Group (INTUG) emphasizes that the use of data in ENUM services raises serious issues concerning privacy and that such use must conform to the various nation and international privacy and data protection rules. INTUG maintains that "reliable and workable services" must be provided which give users confidence. INTUG 2001/06 Position Paper at 8.
3. NeuStar, "ENUM: Driving Convergence in the Internet Age," at 1 (2001) ("*NeuStar - ENUM*").
4. Id. at 2-3.
5. Id.
6. FCC, "Trends in Telephone Service," (Dec. 2000).
7. The International Telecommunications User Group (ITUG) has raised concerns about the open nature of an end user's records, claiming that there could be a potential that the ENUM standard does not provide a means for the end user to limit or filter those who can access the records. Practices such as "slamming" and "spamming" an individual could potentially occur, creating serious regulatory issues. Slamming involves amending an individual telephone number so that the owner of the number is made an unwilling and unknowing customer. Spamming involves sending

the individual user unsolicited advertising materials. INTUG 2001/06 Position Paper at 7.

8. It is possible to do a reverse look-up in a telephone directory database to attach a postal address to other records, raising considerable privacy concerns.
9. The International Telecommunications Union (ITU) states that there is "no security in the conventional DNS" and that it is "possible for the DNS to be spoofed through tampering with DNS packets en route between client and server by using routing tricks to redirect traffic to a name server that impersonates a genuine server for the zone." Therefore, the integrity of the ENUM would be compromised. ITU, "GLOBAL IMPLEMENTATION OF ENUM: A TUTORIAL PAPER," at 34. Workshop Document WS ENUM-4-E.
10. The United States regulatory agency, the Federal Communications Commission, currently views ENUM as an unregulated, or enhanced, service offering. Whether ENUM is regulated in other countries, is clearly a country-by-country decision. Since the Internet crosses domestic and international borders, the difficulty in arriving at a worldwide consensus on how to stem such abuses, should they occur, will require governmental coordination to develop and expand on rules, regulations and laws. There are local, regional and international industry and government groups that have developed guidelines on protection of data and privacy. Some of these include the Organization for Economic Cooperative Development, the International Telecommunications Union and the European Union, to name a few.
11. The International Telecommunications User Group (INTUG) believes that the "primary responsibility for ensuring the privacy of users falls on the service providers." Further INTUG espouses that users should be responsible for providing accurate data records and making sure that service providers who hold their data have the necessary policies and technical measures to ensure privacy. INTUG Position Paper 2001/06 at 12.
12. http://www.itu.int/ti/industryoverview/at_glance/basic00.pdf (visited August 1, 2001).
13. See, F. Ramsey, "A Contribution to the Theory of Taxation," 37 Econ. J. 47 (1927); W. J. Baumol and D. F. Bradford, "Optimal Departures from Marginal Cost Pricing," 60 American Economic Review 265 (1970). The FCC has rejected the proposal that carriers use Ramsey Pricing for dedicated traffic routing between nations because they normally lack sufficient information about the incremental costs for transport and the associated demand elasticities. *International Settlement Rates*, Report and Order, 12 FCC Rcd 19806 (1997). Nevertheless, carrier or telephone administrations do have some knowledge of relative demand elasticities for various services and can make "reasonable Ramsey Pricing estimates."
14. PUCs determine the eligibility of carriers for high-cost and low-income universal service program funds pursuant to standards established by the FCC. The FCC determines the eligibility of schools, libraries, and rural health care providers for universal service funds based on the FCC's rules.
15. Based upon 174.712 million access lines in the United States for 1999.
16. See 47 C.F.R. §64.702(a).
17. See, e.g., *Northwestern Bell Telephone Company Petition for Declaratory Ruling*, Memorandum Opinion and Order, 2 FCC Rcd 5986 (1987) (subsequent history omitted).
18. 47 C.F.R. §54.706. See also, *In the Matter of Federal-State Joint Board on Universal Service*, Report to Congress, 13 FCC Rcd 8776 (1998).
19. *Inquiry Concerning High-Speed Access to the Internet Over Cable and Other Facilities*, Notice of Inquiry, 15 FCC Rcd 19287 (2000).

Abstract

Policy makers and regulators face many challenges as a result of the convergence of telecommunications services and information technology. This paper explains the ENUM technological protocol and the regulatory and policy issues that could affect ENUM service users. Regardless of whether ENUM technology is directly regulated by governmental agencies, there are regulatory and legal issues associated with the services provided over the ENUM protocol. Even though not all countries have the same rules and regulations, all countries will need to address the same issues because all consumers are concerned with these issues.

1. ENUM - The Technology

ENUM "is the convergence of the Public Switched Telephone Network (PSTN) and Internet Protocol (IP) Networks." ENUM technology maps a standard international telephone number (e.g., 1+202-414-9200) to an Internet Domain name. This matching of a telephone number to an Internet address (URL) would permit what would otherwise be circuit-switched traffic to be carried on a packet-switched network-the Internet. A single telephone number could be used to reach a subscriber's e-mail, voice mail, fax, instant messenger, and telephones, including mobile phones. Thus, ENUM technology would permit subscribers to use a single number on their business cards, while allowing other ENUM subscribers to reach them through a variety of media, depending on the routing instructions that were previously created on a controlling Internet web site.

2. Privacy, Security and Universal Service Considerations

Consumer privacy of individual data records and network security considerations are material to the implementation of ENUM technology. An ENUM subscriber's information provided becomes a record, or file, which then becomes part of a database of the corresponding ENUM service provider. Number hijacking could occur when an ENUM registrant's resource record is created, modified, or deleted without obtaining and verifying the proper authentication and authorization of the ENUM registrant. Spoofing, or the misrepresentation of the identity of the originator of the information, could allow unauthorized updates to the ENUM registrant's resource record. Invalid data could, in turn, cause malicious redirection of communications. Slamming and spamming could, in addition to other privacy and security invasions, also occur.

For both developing and developed nations, universal service is an important market and public policy issue. The addition of more customers to any telephone network creates additional value for customers, other carriers and ISPs. Some mechanism(s) must be found to protect and, in most nations, expand universal service. So long as end user loops, wired or wireless, remain costly for some consumers by reason of either their income or geographic location, there will be a need for subsidies. Neither the people

nor the governments of the world will readily embrace ENUM technology if it enhances the ability of a few to communicate, while disconnecting many from the network. Both the providers and consumers of ENUM services must be involved in universal service support programs.

back to index

Robert H. Jackson

A telecommunications lawyer well-versed in both transactional and regulatory issues, Robert H. Jackson joined Reed Smith in July 2001. He is a government relations professional with broad experience addressing the legal and regulatory aspects of financial, technical and marketing issues associated with the telecommunications, Internet and cable television industries.

From 1998 to 2000 he worked for Arter & Hadden LLP, and for more than 20 years before that was with U S WEST, Inc., and its predecessor companies. U S West, Inc. (now Qwest Communications, Inc.) is a Fortune 500 company engaged in domestic and international telephony and Internet services.

Some of Mr. Jackson's accomplishments throughout his career include:

- Developing a plan for a business to comply with the Trading with the Enemy Act without the necessity of procuring a license from the Office of Foreign Assets Control
- Designing a flexible plan for a large international carrier to cancel its tariffs and offer services through customer contacts
- Representing incumbent and competitive local exchange, interexchange, wireless, and international carriers, and end-user customers before the FCC and state public utility commissions
- Achieving a most favorable measurement standard for a carrier's earnings under rate-of-return regulation, allowing that company to retain an additional $10 million in profits
- Providing advice to a company enabling it to enter cable television market directly through the purchase of a $1.2 billion cable system with 500,000 subscribers
- Obtaining new FCC rules governing WATS access line prices, reducing subsidies paid to support local service by 86 percent, and therefore enabling company to retain large-volume customers on more profitable switched access services
- Handling inter-carrier and corporate financial transactions for carriers and investors

Mr. Jackson is a 1973 summa cum laude graduate of the University of St. Thomas in St Paul, Minnesota, and earned his J.D., cum laude, from the University of Minnesota. He is licensed to practice in the District of Columbia, Iowa, Minnesota and Nebraska, and is a member of the American Bar and Federal Communications Bar Associations, as well as the Bar Associations of the District of Columbia, Iowa and Nebraska.

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Jodi L. Cooper

Ms. Cooper is a telecommunications attorney with fifteen years of wireline and wireless experience, internationally and domestically. She represents U.S. and international carriers and corporations, cable companies, Internet Service Providers and Application Service Providers in the areas of regulation, licensing, policy, commercial matters, compliance, technical issues and strategic business planning. Ms. Cooper participates in the procurement of government contracts, including the U.S. Trade and Development Agency and the USAID.

Previously affiliated with ReedSmith LLP, Ms. Cooper is a partner in a legal consulting firm, representing U.S. and domestic companies in intrastate, interstate and international regulatory and commercial activities. Ms. Cooper advises wireline and wireless companies on regulatory and policy issues, deregulation, privatization and liberalization policies in domestic and overseas markets. She also obtains U.S. and international wireline and wireless licenses in all regions of the world, negotiates undersea and terrestrial cable transactions, drafts commercial agreements and represents carriers before State Public Utility Commissions.

Ms. Cooper was employed as a senior attorney for MCI Communications in the Regulatory and Public Policy Department, supporting MCI International business development, finance, marketing, sales, government contracts, engineering and overseas offices as a policy advocate before the FCC and overseas governmental agencies. During her tenure at MCI, Ms. Cooper obtained FCC service and facility authorizations for over 150 countries and coordinated with senior management to devise regulatory strategies to increase market share. She also negotiated accounting rate arrangements, cablehead access rights, interconnection agreements and tail circuit arrangements for over 25 cable systems.

Ms. Cooper was Manager, Asia-Pacific for Global One, specializing in negotiation of joint ventures, alliances and licensing, working primarily with the V.P. of carrier relations, providing regulatory and commercial support. She also worked in the International Facilities Division of the Federal Communication Commission on accounting rate, satellite and fiber optic cable systems.

Ms. Cooper earned her J.D. and Master's in Information Science, summa cum laude, from the University of Pittsburgh. She is licensed to practice in the District of Columbia and Pennsylvania, and is a member of the Federal Communications Bar Association and the District of Columbia Bar Association. Ms. Cooper clerked for Judge Rowley of the Pennsylvania Supreme Court.

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back to index

Business & Applications

Tuesday, 15 January 2002
1430–1600
South Pacific III - IV

T.2.2 Speech Technologies

Chair:
ROBERT HARBISON, Principal/Analyst, Venture View Associates, *USA*

T.2.2.1 Speech Technology–Finally Delivering on the Promises (View Abstract)

CHRIS VONWILLER, Director, Appen Pty Limited, *Australia*

T.2.2.2 VIG: VoiceXML-based Service Platform for Wireless Telephony System (View Abstract)

HEEJIN CHUN, Assistant Researcher; CECILIA YOUNJEONG KYUNG, Researcher; YOSUB KIM and WONHEE SULL, Director, Platform R&D Center, SK Telecom, *Republic of Korea*

back to sessions

Speech Technology - Finally Delivering on the Promises

Chris Vonwiller
Director, Appen Pty Limited
Australia

View Abstract

1. Introduction

Industry forecasters have long predicted a rosy future for computer speech recognition and synthesis. According to Bill Gates, "speech is not just the future of Windows, but the future of computing itself". Yet the early applications of speech technology had dubious economic success and mixed user responses.

Why has the technology been slow to deliver on the potential? The problems have been not in the technology itself, but rather in the lack of understanding of the many human factors needed to achieve applications with good user acceptance.

Speech technology combines a unique mix of telecommunications, linguistics, software engineering and human factors disciplines. Recent advances in the commercialisation of this technology have delivered a dramatic transformation in both the user acceptance of speech technology applications, and their economic benefits to operators.

This paper provides an overview of the basic elements of speech technology, and indicates the applications and industries where this emerging technology has proved successful, and shows why. Because the challenges to implement speech technology solutions is often underestimated some observations are made on the key steps needed for cost-effective solutions.

Finally, some predictions on the future impact of speech technology are made.

2. Some examples of speech technology in action

Working speech technology applications are found today in numerous commercial applications:

a) Desktop software used for dictation

- These systems are normally "trained" to recognise a specific speaker (speaker-dependent) using a specific microphone, and can achieve a high recognition accuracy (90%+) across a wide vocabulary.

- They do however require a quiet environment, and perform less well with users who have not pre-trained the software.

b) Telephone call centres

- Voice recognition applications in call centres handle a wide range of voices (speaker-independent), and are tolerant to relatively lower quality of voice signal encountered in the telephone network, including to a limited extent mobile calls from noisy environments and from speakerphones. Call centre voice recognition systems are designed very specifically to a handle designated application (for example, booking a taxi), and have limited vocabulary.

c) Consumer devices

- Speech recognition software is being designed into consumer equipment and goods, such as automobile electronics, VCRs and children's toys.
- These applications usually are speaker-independent and are limited to short utterances and a limited vocabulary such as specific command words.

d) Speaker verification

- Speech technology can be used to verify that a specific and authorised person is using a particular system.
- This might be to support credit card or banking transactions, access to a building, or control commands to a mobile telephone.

e) Text-to-speech synthesis

- Many applications of speech recognition also require a speech synthesis output, whereby text is converted to speech audio output. In order for the synthesised voice to sound natural, the synthesiser must be able to cope with the appropriate intonation patterns, punctuation and pauses based on the underlying meaning in the text, and expand abbreviations, dates and currency amounts from figure to phrases.
- Common examples of text-to-speech synthesis are found in automated call centre applications, information retrieval services including voice portals, and in reading aloud of email messages.

3. The elements of a call centre speech technology system

The structure of a typical speech technology system as might be deployed in a call centre application is shown in the diagram below. The complexity of the respective elements may vary from application to application, but the building blocks are common to most working systems (**refer Figure 1**).

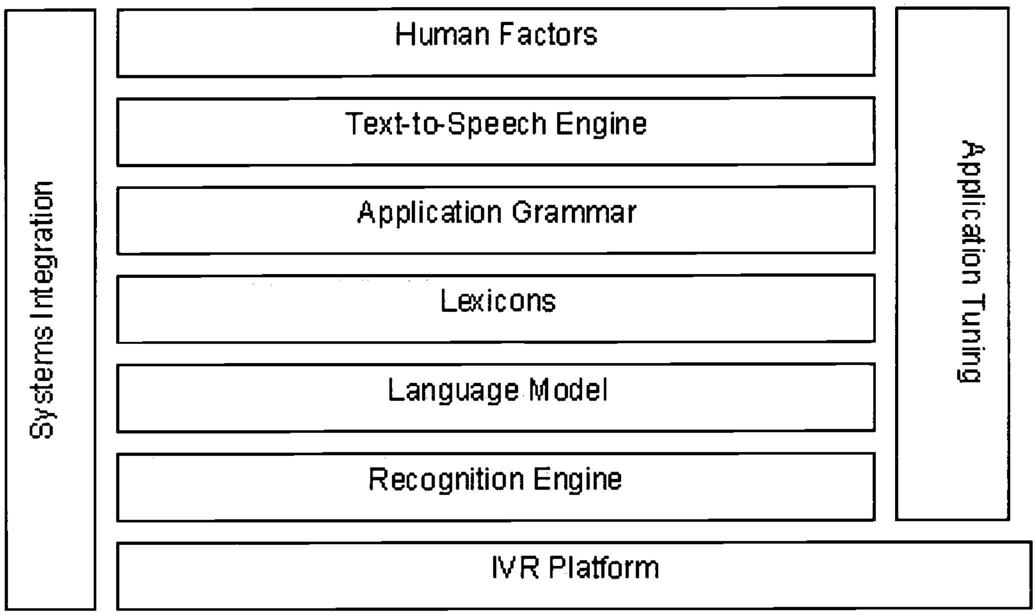

FIGURE 1 - SPEECH TECHNOLOGY BUILDING BLOCKS

IVR Platform

The Interactive Voice Response (IVR) system acts as the interface between the telephone network and the operators and the back-office systems.

IVR technology is well established, and used as the supporting platform of most call centres. Most IVR systems support touch-tone (DTMF) user interface, and allow the caller to carry out relatively simple transactions such as payment of bills. Alternatively, callers can revert to a call-centre operator for more complex transactions.

A typical speech technology application will be designed to handle only a percentage of the transactions within the call centre, generally those of a simpler and more frequently occurring nature. The balance of the calls will pass through the standard IVR or operator interface, and thus callers have multiple options with which to complete their transactions.

Recognition Engine

The most common form of speech recognisers today are based on phoneme recognition, as distinct from recognition of whole words. The number of phonemes to support (around 45 for English) is far smaller than that of a word database. Phoneme recognition also does not require training from the user to establish a comparison vocabulary. Recognition "units" can be combinations of phonemes, biphones, triphones, half syllables or single phones as well as words. Which type is used generally depends on the application.

The simplified steps of phoneme recognition are as follows:

- Capture, digitise and normalise the sounds

- Segment and analyse the spectral representation of the sound, using various parameters such as: duration, pitch, bandwidth of formants (energy)
- Compare this against a set of external common features for each unit to form an acoustic model of that unit
- Produce recognition hypotheses for the possible sounds, and their probability based on mathematical techniques such as Hidden Markov Models
- Analyse their probability against lexical rules
- Produce a single recognition hypothesis

Natural Language Recognition (NLR) is the next evolutionary step. This involves the 'interpretation' of the speech as well as the recognition. The recogniser carries out 'intuitive' processing through the use of clarifying questions to make sure the interpretation is correct (for example, if it detects a sarcastic response). NLR is possible now, but is not commonly used because it is computationally intensive.

Language model

The recognition engine is language-independent, and must be overlaid with a software model of the language in which the application is to operate. Acoustic models are very specific to the country or region in which they are to be deployed; for example UK English and US English require distinctly separate acoustic models. Development of an acoustic model requires typically hundreds of thousands of speech samples from a wide demographic sample of the population, and allows the application to work speaker-independently. The speech samples must capture:

- Different dialects, ages, and genders, and corresponding different pitches, volumes, emphasis, stresses, tense/relaxed states
- Different subtleties in how things like phone numbers, credit card numbers are typically said (this varies considerably from country to country)
- The range of communication media different (mobile phone/wireline/conference call)
- The diversity of different environments (in-car/office/public place etc)
- Styles of speech are different (pace, pitch)
- Punctuation (structure sentences, question voice etc)

Dialog design and application grammar

The development of application grammars requires a unique blend of both professional linguistic and software skills, with multi-skilled developers called computational linguists. Essentially, the objective is to develop a logical flow of a prompted dialog between the human speaker and the recognition application, in which all possible natural language expressions of the speaker can be recognised, analysed for logical meaning within a pre-defined grammar, and an appropriate response can be generated.

Each application must be closely customised for the particular application it serves. For example, a taxi booking application will only recognise valid responses covering the traveller's name, the pick-up point and time, and a destination within the taxi company's area of coverage. Recognition accuracy is optimised by strictly limiting the range of possible expressions to those appropriate to the application.

Lexicons (Dictionaries)

Most applications require supporting dictionary lists. For example, a stock price quote application needs the current list of stocks being traded, and a telephone directory enquiry service needs the list of directory entries. Each entry in the list must be coded phonetically for each pronunciation variant commonly encountered, or description commonly used. For example, if a lexicon contains the company name Sony, it may be pronounced either as sOni (as in Bonny) or s@uni (as in boney), and both variants need to be included.

Lexicons need to be constantly updated to reflect the current entries as well as new or changing pronunciation variants.

Text-to-Speech Synthesis (TTS)

Synthesis is valued for intelligibility and naturalness. Two types of synthesis most commonly used:
a) Wholly computer generated synthesis of human sound, based on phonetic rules; this is far less costly to produce than concatenated synthesis but of lower quality, tending to have a "mechanical" sound which can be difficult to interpret in noisy environments.
b) Concatenation of digitised sub-word units extracted from recorded phonemes (or words), produced by recording all possible phonemes by a 'voice talent' with separate databases for different emphasis/stress (eg for a question or a statement). This type of synthesis is much more natural-sounding.
Pre-processing templates manage application specific uses, which may otherwise cause difficulty (eg reading emails, off the web, telephone numbers, currencies, etc).

Human Factors

Human factors aspects refer to the design of the interface between the speaker and the machine, including the psychological factors and how to make the interface more intuitive. This includes the design and timing of the prompts, the intonation contours, and even the choice of the voice to ensure the "personality" of the application matches the targeted user population.

In the absence of human factors optimisation, applications will often have low user acceptance, or an unduly high percentage of callers who will seek to revert to a human operator.

Applications Tuning

Deployed applications need constant tuning to increase recognition. Such tuning includes updating of lexicons, optimising the TTS, refining grammars, and improving human factors as users become more experienced with the application.

4. The challenges of delivering working applications

Speech recognition applications first emerged in the 1960s, typically based on digit recognition. With the progressively decreasing cost of computer power, industry forecasters predicted a bright future for the technology. Acceptance in commercial applications was however rather slow in take-up, due to a lack of appreciation of the total spectrum of factors in achieving a high end-to-end performance.

Nevertheless, there is today an impressive user base of working systems operating in a range of industries and territories, as **Figure 2** shows. Estimates of the potential size of the speech technology market today now approach $1 billion.

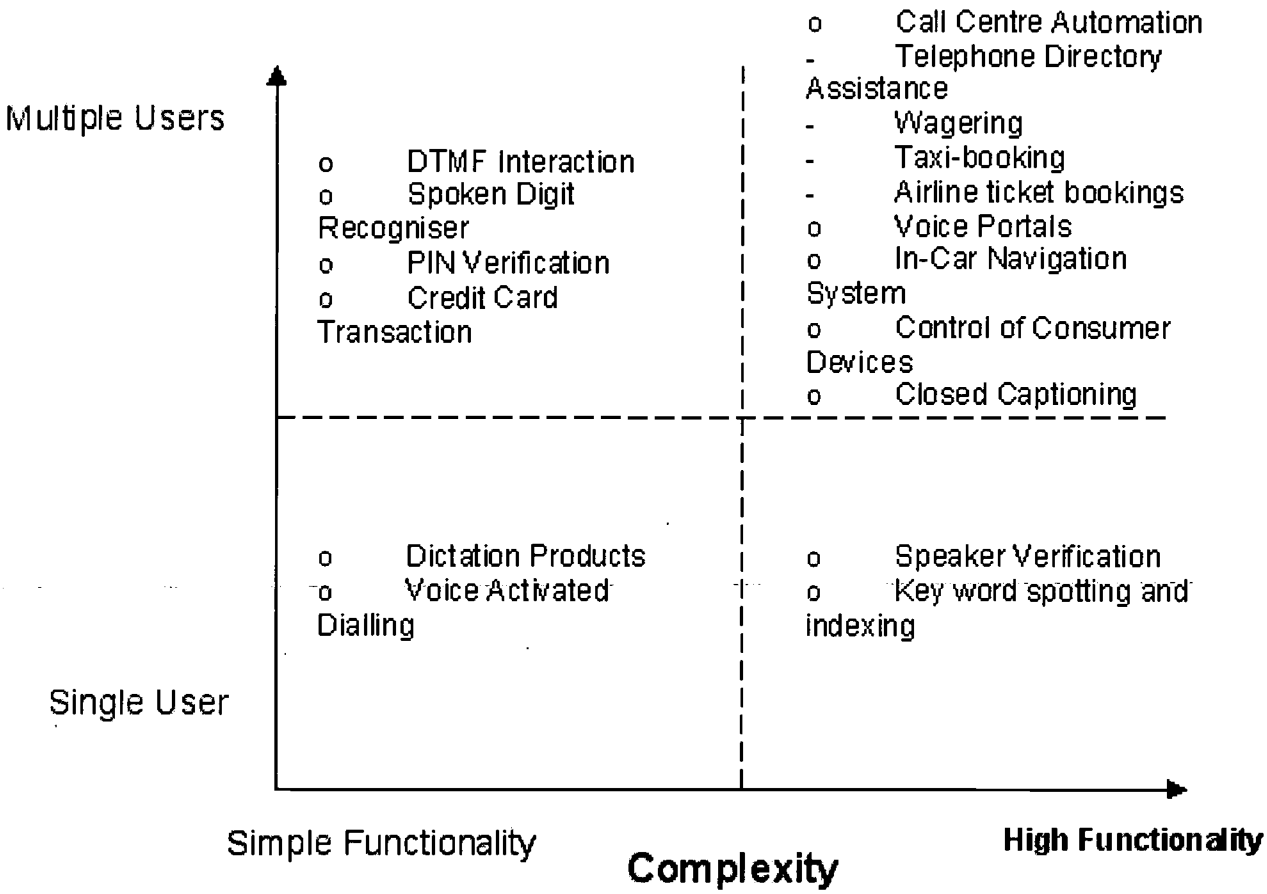

FIGURE 2 - SPEECH TECHNOLOGY APPLICATIONS

Delivery of an automated call centre application tailored to specific application can have an impressive economic payback. For example, in the provision of directory assistance by a telecommunications operator, typically the call volume is high and peaky (perhaps a million calls per day for a medium sized telco), and calls are short. The customer requests are however simple (often just saying a name), and so have a clearly defined context. The grammar entries for any one listing can be as large as 100, but the vast majority of calls for each is handled by a handful of grammars. For most directory assistance applications, around 80% of the incomings calls are enquiries for around 15% of listings. For this reason, up to 80% of the call centre workforce can be saved by deployment of this technology. The return on investment from automating the remaining 85% of listings is less compelling.

Successful implementation of an application can often take many months, with repeated tuning and grammar refinements to achieve performance targets and good user acceptance. The following table shows some of the elements necessary to achieve a working application likely to achieve good user acceptance.

Area of investment	Benefits resulting
Language model	Wider tolerance of speakers, including • Non-native speakers of the language • Callers from cell phones and noisy environments • Dialectal variation
Application grammar	Accommodation of more natural spoken language Higher functionality and more powerful applications Faster analysis and recognition
Lexicons	Higher recognition rates
Tuning	Higher recognition rates Fewer false recognitions Faster speed, reduced latency of response Higher user satisfaction
Text-to-speech synthesis	Better intelligibility of the output audio More naturalness Cheaper than an operator More flexible than pre-recorded responses
Human Factors	Better user acceptance More efficient and fewer prompts

5. Consumer applications

There is increasing interest in the deployment of speech technology, both recognition and test-to-speech synthesis, in consumer equipment. A major European Commission initiative, SPEECON, was launched in February 2000, as a multi-partner project focusing on collecting linguistic data in multiple languages for speech recogniser training. The project promotes the development of voice controlled consumer applications (CE) such as television sets, video recorders, mobile phones, palmtop computers, car navigation kits or even microwave ovens and toasters. Instead of operating these devices manually, all users of future CE applications have to do is simply talk to their equipment. SPEECON is, in the European Commission's own words, meant to "improve the functionality, usability and acceptability of future information products and services to enable linguistic and cultural diversity". SPEECON's objective is to develop the linguistic data and technological knowhow that will enable companies to develop speech-driven applications in the consumer electronics domain. During the lifetime of the project, partners will collect speech data for 18 languages or dialectal zones, including most of the languages spoken in the EU. It devotes special attention to the environment of the recordings, which are, like the typical surroundings of

CE applications, at home, in the office, in public places or in moving vehicles.

6. Conclusions and future directions

Speech technology is now well-established sector of the Information and Communications Technology industry, with a much more realistic appreciation of where the benefits can, and cannot, be delivered. In particular, applications designed to automate more common transactions in telephone call centres have demonstrated significant economic benefits. It is now clear that considerable effort is needed in the human factors aspects and in ongoing tuning of applications in order to achieve any reasonable level of user acceptance.

In terms of the speech recognition technology itself, this is now relatively mature and available from a number of vendors. Much of the ongoing development is associated with the tools and processes for engineering applications, and the extension of language models and lexicons. Text-to-speech synthesis technology, after a lengthy period in which it under-delivered on its early promise, is now showing dramatically improved performance with highly natural speech generation.

For the future, we are likely to see a number of trends and developments:

a) Call centres:

- Increasingly powerful applications, with fewer prompts and more functionality requested by users; for example reservation of airline tickets, as distinct from timetable information or flight arrival and departure data
- Higher quality, higher user-friendliness

b) Consumer applications

- Simple but natural language command functionality in consumer equipment, such as VCRs and palm held computers
- Automotive applications (device commands and navigation) will become commonplace

c) Text-to-speech

- Customised and highly natural voices
- Applications for information services, 3G mobile telephony services, and email read aloud.

back to index

Abstract

This paper reviews the status of speech recognition and synthesis technology, and its deployment in commercial applications such as telephone call centres, security, automotive and consumers appliances and the desktop. The key elements required to implement a successful application are summarized, and some of the challenges in delivering a successful system are described.

back to index

Chris Vonwiller

Chris Vonwiller is a Director of Appen Pty Limited, a rapidly growing company specialising in speech technology products and services.

Chris served for 20 years in senior executive positions in the major Australian telecommunications carrier, Telstra Corporation Limited, including Managing Director of Telstra's Multimedia products. In this capacity, he led the introduction of Telstra's ISP services, Big Pond, Australian market leader, and played a key role in the development and implementation of Telstra's transaction and content-based initiatives, including information services and Pay TV. Chris later served as the foundation CEO of Atlas Travel Technologies, Telstra's joint venture with Amadeus to provide Internet travel reservations services.

Chris is a member of the board of the recently privatised Intelsat, a Director of the Warren Centre for Advanced Engineering at the University of Sydney, and a member of some other commercial boards.

He has served as President and Chairman of the Pacific Telecommunications Council, and as a Trustee of the Committee for the Economic Development of Australia. Chris participated as a member of the Australian Government's Advisory Group in Trade in Services.

He holds degrees in Science and Engineering (with Honours) from the University of Sydney, and completed a Master of Business Administration degree with Macquarie University.

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back to index

VIG: VoiceXML-based Platform for Wireless Telephony System

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View Abstract

1. Introduction

Implementation of speech technology as like automatic speech recognition (ASR) and text-to-speech (TTS) have made possible new practical and commercial applications. In the last years, many services and products have shown up especially in telecommunication arena.

The interactive voice response (IVR) service is very universal voice service. But it has been difficult to create, modify and maintain. Although high-level interfaces and environments for service creation exist, they tend to be proprietary, platform-specific, and not widely used outside the platform provider. Therefore service development is still difficult and the service specific interface makes the deployment of service impossible.
An international standard, the Voice eXtensible Markup Language (VoiceXML or simply, VXML) has been developed recently [1] and is now receiving broader industrial acceptance [2]. It gives an interactive voice response for human and computer. It uses touch-tone keys (DTMF: Dual Tone Multi Frequency) and ASR for input, and audio prompts and TTS for output. It also makes Internet contents and information accessible via voice and telephone.

In this project, we implemented the VIG platform based on VoiceXML. It makes possible the interactive speech telephony services. It also makes the service flexible by separating service logic from user interaction.

This paper is organized as follows. Section 2 and 3 describe the VIG platform and its components. Section 4 then explains the application services in the VIG platform. Finally, Section 5 summarizes our conclusions.

2. VIG Platform Overview

The VIG platform provides to access the Internet contents through the mobile phone via voice. It converts those HTML/XML or WML contents into VXML. It is an integrated system including logical and physical components for offering transmission of contents and responses between end user and server.

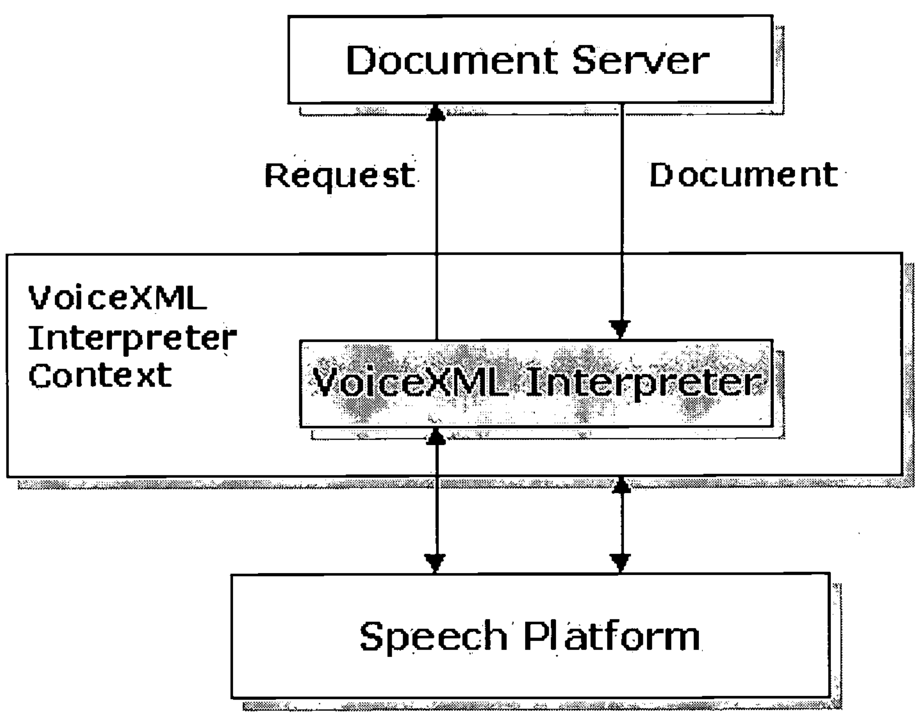
The traditional IVR system provides only platform-specific exclusive contents that is made on off-line. For loading new service into platform, it must be required to create and modify the service scenario and maintain the system.

But it is very difficult and takes long time. It sometimes caused weak contents or services.

To solve these problems, we developed the VIG platform. It can provide exclusive contents and public contents as like Internet HTML/XML contents, wireless Internet WML contents, and VXML contents. It is fast and easy to load new service into VIG platform because the new service is provided as a component of plug and play type, which is possible by separating service logic from user interaction. The VIG platform accepts all web-based technology as like web server, PHP, ASP, XML, HTTP Caching, Servlet, EJB, CGI etc.

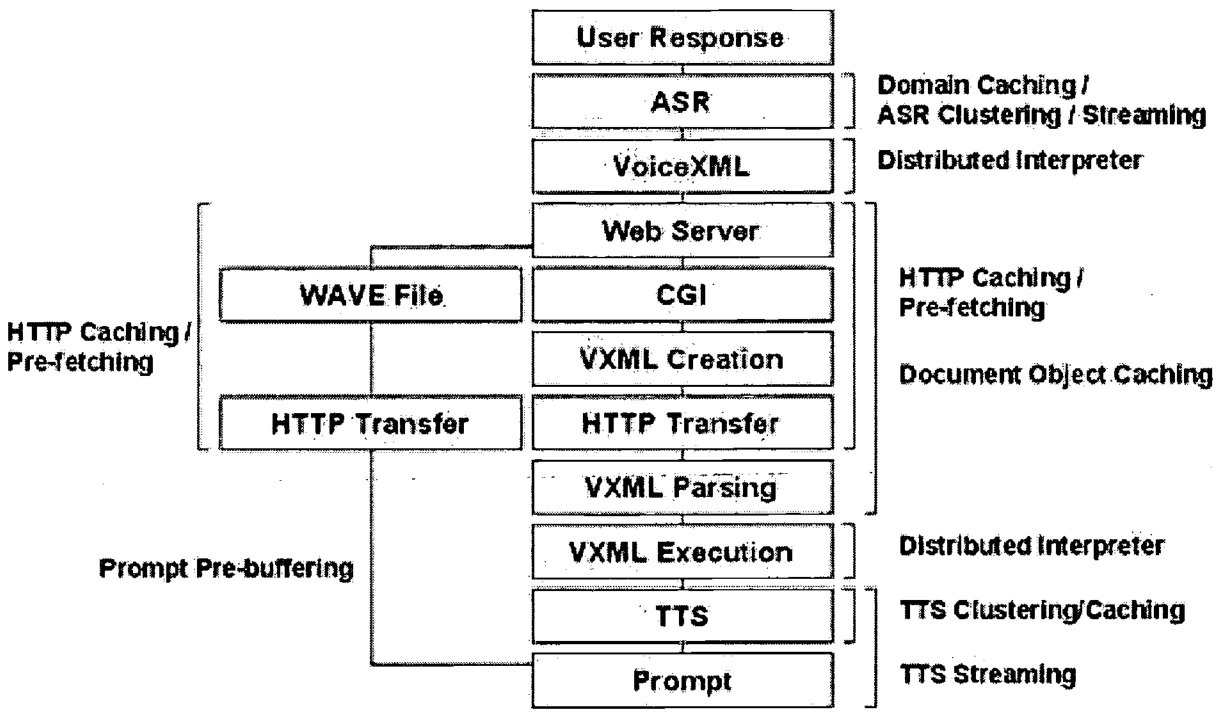
Basic VXML-based system consists of three components that are document server, VXML interpreter, speech platform. Figure 1 shows basic structure of VXML-based system. Document server transfers the VXML documents by requests of VXML interpreter. It can use web server that transmits the HTML/XML documents by requests of client. As using the web server, VXML-based voice service can use the web-based infrastructure and technology. Unfortunately it cannot use all Internet contents that are based on HTML documents. Because structure of VXML contents are different from Internet contents. It is necessary to build newly VXML contents that are separated from speech platform. Use of the remote document server, it enables variability and flexibility of voice service. It also enables people who don't know about speech technology to make VXML contents as fast and easy as possible.

VXML interpreter interprets and parses voice service scenario made by the VXML documents type. It calls speech input / output functions of speech platform and controls the flow of user dialog. It is the core component of VXML-based system.
Speech platform is speech input and output functions as like audio file output, speech record, DTMF input, speech recognition, speaker verification, text-to-speech synthesis, keyword spotting. It returns the result of speech input and output by requests of VXML interpreter.



[FIGURE 1] BASIC STRUCTURE OF VXML-BASED SYSTEM

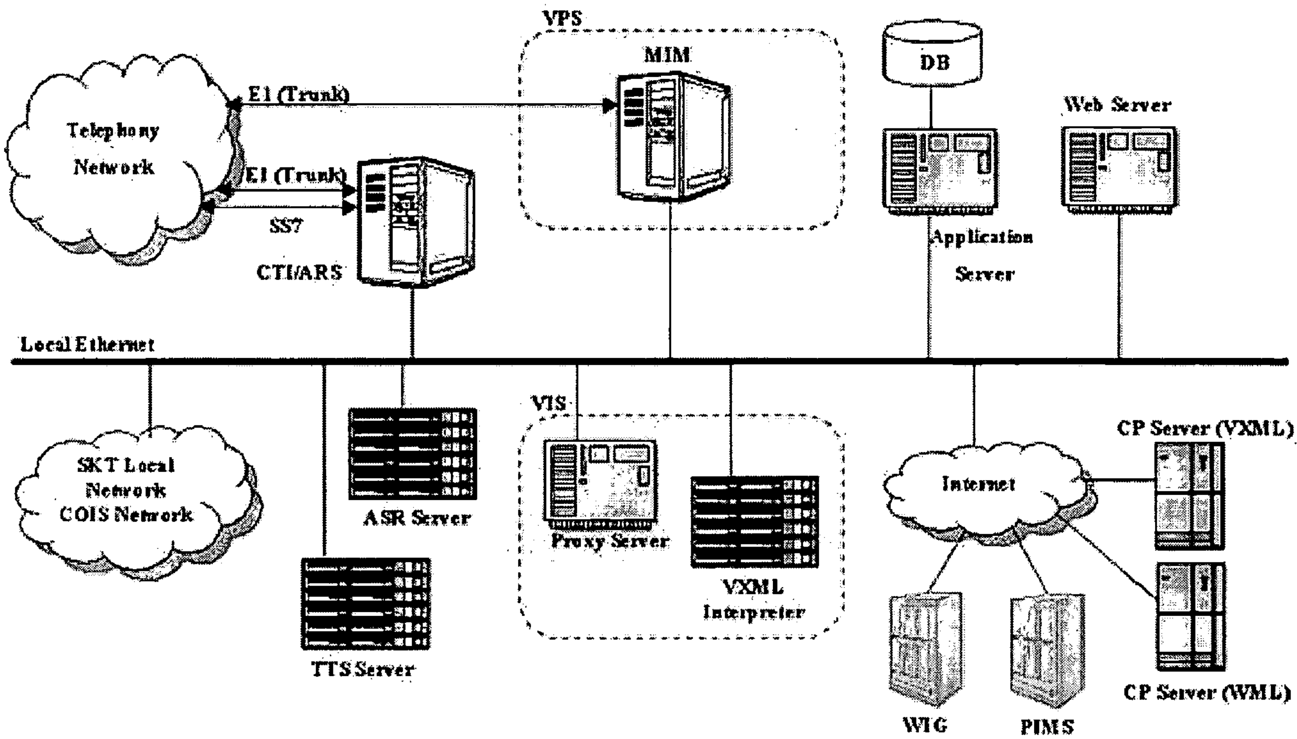
When we implement the VIG platform, we must consider response time. The overall response time of IVR system includes user response, ARS response, ARS software execution, and prompt simply. However, as shown figure 2, VXML-based VIG platform includes user response, ASR response, VXML Interpreter for fetching and interpreting the documents, web server for information collection, CGI, VXML creation, HTTP transfer, VXML parsing, VXML execution, TTS and prompt. It tends to rather grow longer than a typical IVR system. We used caching, pre-fetching, pre-buffering, clustering and streaming in order to reduce the response time.



[FIGURE 2] RESPONSE TIME OF VIG PLATFORM

3. System Configuration

The VIG platform is made up VPS (Voice Processing System), VIS (Voice Interpreter System), ASR and TTS. Figure 3 shows the organization of the VIG system. Its outline is Figure 4.



[FIGURE 3] ORGANIZATION OF VIG PLATFORM

3.1 VPS (Voice Processing System)

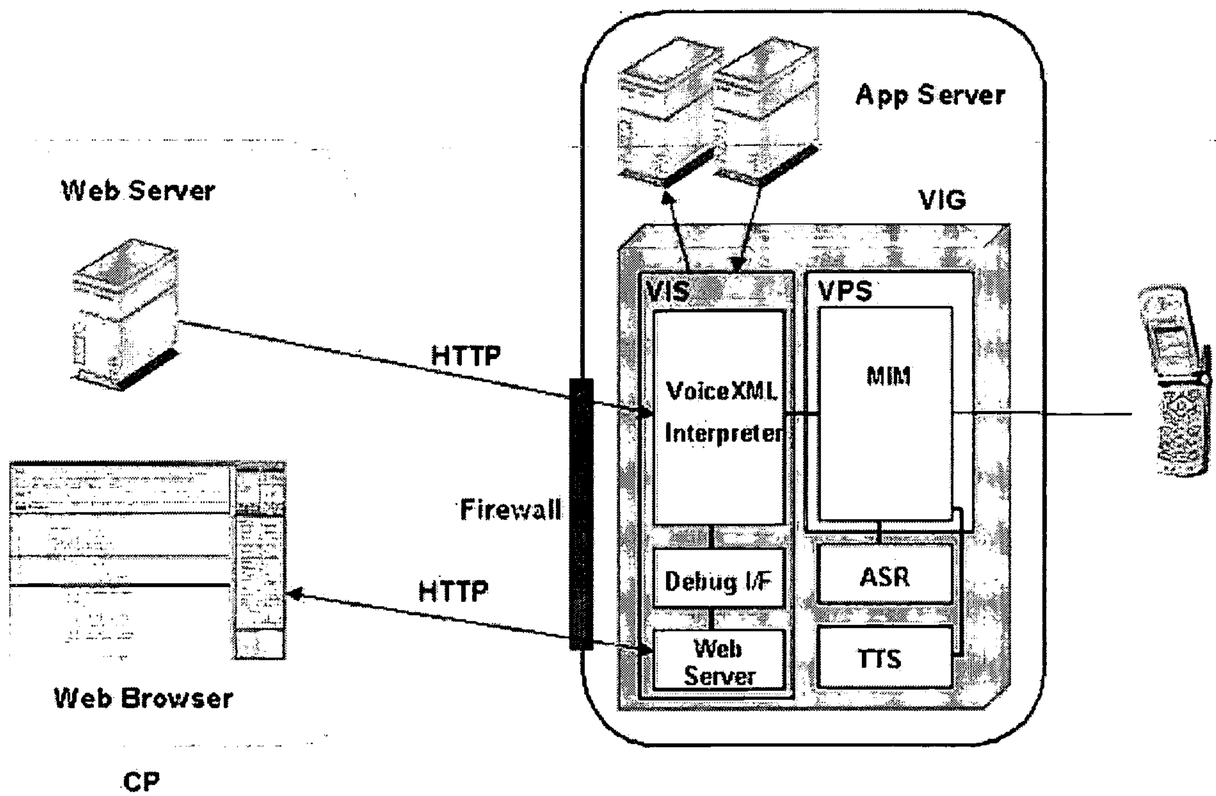
The VPS is the main server of the VIG platform that manages contents, subscribers, statistics of using the service and interfaces with voice portal service and so on. It has MIM (Media Interface Module) that controls call connection and transfers user requirements and responses to the VXML Interpreter. It utilizes ASR and TTS for user interface. The functions of VPS are follow.

- Call signal handling: It supports R2, SS7.
- Play list management: It supports background music and seamless playback of TTS and audio resources.
- Voice record / playback, DTMF/Tone detection and transmission
- Outbound call: It supports standard e-mail protocol as like SMTP and POP3.
- DTMF/Tone output, O&M, SNMP
- Logging and subscribers
- TTS / ASR load-balancing
- HTTP / TTS Streaming: It is possible to offer continuously information from the web server or TTS server to end users without delay by using double buffering on the memory.
- Pre-buffering: It is pre-buffering the next information for preventing prompt interrupt.
- Streaming ASR: The end point detection is implemented in the ASR server for improvement speech recognition rates. It transfers input data via telephony board to ASR server.
- Internal Web Caching: It is Level 1 cache, and enables main memory to use more efficiently for reducing delay time and abating loading of network and external web cache (Level 2 cache).
- Capacity: 240 channels per system.

3.2 VIS (Voice Interpreter System)

The VIS consists of VXML Interpreter, Proxy Server, WML-to-VXML Converter, VXML Builder.

- VXML Interpreter: It fetches, parses, and executes the VXML documents. The web-based debugger is provided for debugging and displaying of VXML code that is dynamically created by CGI in the same network environments, version of interpreter and libraries.
  - VoiceXML 1.0 specification compliant
  - Java-based
  - Web-based Debugger: Single step/break-point and command-line debugger
  - High Performance: Integrated object-based HTTP caching and Connected to VPS through multiplexed socket
  - Extended features: 'Push' event processing for multi-user applications and Client-side database connection (planned)



[FIGURE 4] CONCEPTUAL VIEW OF THE VIG PLATFORM

- Proxy Server: It is the web cache for minimizing delay time when users want to listen voice information by converting text information from the internet.
- WML-to-VXML Converter: It dynamically converts existing WML documents into VXML in real time and offers interfaces to content providers. It also enables to cache the result of converting for improving response time.
  - Real Time Conversion
  - Optimal Fetching and Caching
- VXML Builder: The content providers can make easily and manage systematically VXML contents by

offering VXML Builder that is base on the libraries and templates.
    - Integrated by PHP
    - Web-based Authoring Tool
    - Having Template pool
    - VXML and HTML dual generation by one click
    - CP (Contents Provider) Interface with security policy
- Capacity: 160 channels per server

The speech platform consists of TTS and ASR for voice user interface. These engines are VoiceWare Co. speech engines.

3.3 TTS (Text-To-Speech)

TTS server is for management channel and interface with MIM. We use streaming and multiplex technology to minimize initial delay time during long sentence converting.

- Multithreaded and streaming
- Multiplexed socket
- Self Error Recovery
- Supported Engine: Voiceware VoiceTextTM
- Capacity: 120 channels per server

3.4 ASR (Automatic Speech Recognition)

The ASR server is implemented dynamic domain caching and streaming ASR to improve speech recognition rates.

- Buffered Streaming: The ASR server receives streaming speech data continuously to carry out end point detection to the server. While new domain loading, streaming data is buffering regardless of ARS status.
- Memory-based Domain Caching: It caches domain data structure from the domain lists to main memory.
- Multithreaded
- Multiplexed socket
- Supported Engine: Voiceware VoiceEZTM
- Supports File Domains and Dynamic Grammars
- Capacity: 60 channels per server

4. Application Services of VIG Platform

The voice portal, voice chatting and star morning call services are provided as the application service of VIG platform currently. It is possible to load new voice based service to VIG platform.

4.1 Voice Portal Service

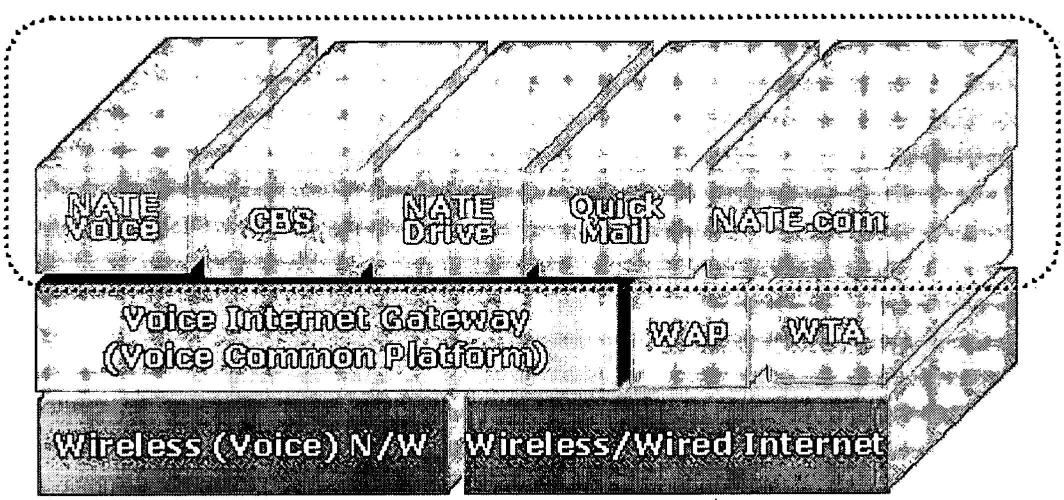
The NATE Voice is our voice portal service that offers general information as like news, weather, sports and stock quotes. It also provides location-based service - for instance friend find etc. -, e-mail and voice dialing using out-bound call. Especially SMS (short messaging service) callback and personalized information are also available. Users can access to NATE Voice by pressing the '*' and 'SND' button.

End users can access the voice entertainment service by popular entertainers such as fan letter, greetings, and horoscopes. The fan letters service is made up of writing and replying via voice, and listening. The changing the greetings by entertainers is also provided. The horoscope service provides the marital harmony of the customers and popular entertainers as comparing the voice of the customers with entertainers by using speaker verification technique. End-users only say, "I love you".

4.2 Other Services

We will launch voice chatting service to end-users in April 2002. It is provided mobile to mobile chat using the voice disguising such as the voice modulation and mixing technologies.

It is possible to be provided the location-based CBS (Cell Broad Casting) service, Quick Mail by using TTS transfer, NATE Drive for providing traffic information, and offering service WAP contents by converting WML to VXML etc. It also offers the conferencing. Figure 5 shows example of voice services on the VIG platform.



[FIGURE 5] EXAMPLE OF VOICE SERVICES ON THE VIG PLATFORM

5. Conclusion

The VIG platform provides to access the Internet contents that are implemented by HTML/XML or WML by converting into VXML through the wireless phone. The VIG platform is made up of VPS (Voice Processing System), VIS (Voice Interpreter System), Authoring Tool, WML-to-VXML Converter, ASR and TTS servers. The VPS is the main server for processing voice information service that manages contents, subscribers, statistics of using the service and interface with voice portal service and so on. The VIS converts WML, XML or HTML documents into VXML and offers interfaces to content providers. We evolve the existing voice portal platform into

VXML-based service platform that can produce many voice applications as fast and easy as possible. The voice portal, voice chatting and voice entertainment services are provided as the application service of VIG platform.

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back to index

Abstract

In this paper, we describe the voice Internet gateway (VIG), VoiceXML-based service platform. It offers voice information by converting text information which is web-based contents including WAP (Wireless Application Protocol). The VIG platform enables various voice services as a plug and play type. We evolve the existing voice portal platform and new voice service into VIG platform. We can support many voice applications as fast and easy as possible in consequence.

back to index

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back to index

Country / Region

Tuesday, 15 January 2002
1100–1230
Honolulu Suite

T.1.3 East Asia

Chair:
JAGADISH RAO, Consultant, East West Alliance Inc., *USA*

T.1.3.1 The Successful Employment of Broadband and Mobile Internet Access Service in Korea and Its Implications (View Abstract)

HYEONMO KU, Director, Planning and Coordination Office, Korea Telecom; IK-SOO SON, Researcher, IT Technology Management Research Institute, ETRI; JAEJOON SHIN, Senior Researcher, Management Research Lab and TAEYOL YOO, Managing Director, Planning and Coordination Office, Korea Telecom, *Republic of Korea*

Presenter:
JAEJOON SHIN, Senior Researcher, Management Research Lab, *Republic of Korea*

T.1.3.2 Internet and E-Commerce Development in Asian Tigers: A Comparison of Chinese Taipei and Hong Kong (Academic peer reviewed) (View Abstract)

NIR KSHETRI, PhD Candidate, College of Business Administration and NIKHILESH DHOLAKIA, Professor, College of Business Administration & Associate Director, Research Institute for Telecommunications and Information Marketing (RITIM), University of Rhode Island, *USA*

T.1.3.3 Convergence Between Broadcasting and Telecommunications and the Impact of the New

Carrier Licenses

EMILY LUK, Trainee Solicitor, Deacons, Graham & James, *Hong Kong SAR, China*

back to sessions

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back to index

The Successful Employment of Broadband and Mobile Internet Access Service in Korea and Its Implications

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(View Abstract)

1. Introducing Remarks

Korea - a benchmarking case by foreign countries

The fast growth of Korea's broadband and mobile internet access service is referred to as a good benchmarking case by foreign countries including OECD member states, broadband Internet players, consulting firms and mass media[1]. As Korea's past high speed economic development model did in 70's and 80's, so does the booming of internet access services in Korea attracts a global attention. As shown in Table-1, the penetration rate of broadband internet service in Korea leads the world, leaving other countries far behind. As of May 2001, almost a tenth of the population (9.20%) are using broadband Internet service. This is the highest rate among 30 OECD member states. The fast expansion of Internet access in Korea, however, is not the only case in wired broadband area. The same story goes for mobile internet service as well. As of October 2001, over 80% of the total mobile users own mobile internet enabled terminals, which has created a vast pool of mobile internet users.

This paper discusses the key success factors for the booming of broadband internet and mobile internet service in Korea from the market as well as regulation point of view.

Countries	Penetration (2000)	DSL Coverage	Cable Modem Coverage
S. Korea	9.20%	92%	48%
Canada	4.54%	69%	93%

U.S.A.	2.25%	50%	96%
Austria	1.70%	75%	53%
Netherlands	1.68%	40%	94%
Belgium	1.42%	75%	100%
Sweden	1.21%	-	65%
Denmark	1.05%	65%	70%
OECD	1.26%	-	-

Table 1. Penetration rates and coverage of broadband networks in OECD member
Source: OECD, May 2001.

2. Internet Service in Korea

Broadband Internet Access

Before 1999, most of the residential internet users and SOHOs (small offices and home offices) used dial up modem for internet access. Since 1999, when broadband access service was introduced, the number of users of broadband Internet access service has shot up and as of September 2001, the broadband users reached 7 millions which puts every one out of three Internet users in Korea enjoys broadband Internet access service. Yet, "the growth" does not end here. According to analysts, by the year-end of 2001, 7.5 millions will use broadband access service.

Then, what is the dominant broadband technology in Korea? Unlike the European continent and America, it is ADSL. ADSL users have reached 4 million subscribers, which accounts for 57% of the total broadband Internet service users in Korea. Cable modem with 2.4 million users follows ADSL from afar, and LAN and BWLL for high-density residential areas such as apartments have 0.6 million subscribers.

Looking back the growth of broadband service, cable modem service provided by Thrunet and Dreamline was the most popular service at the beginning. However, ADSL caught up fast and Korea Telecom, being the dominant telephone network operator in Korea, became the most dominant player in broadband market with ADSL service. The key success factors for the dynamic expansion of broadband internet access in Korea will be discussed later.

(unit: 1000)

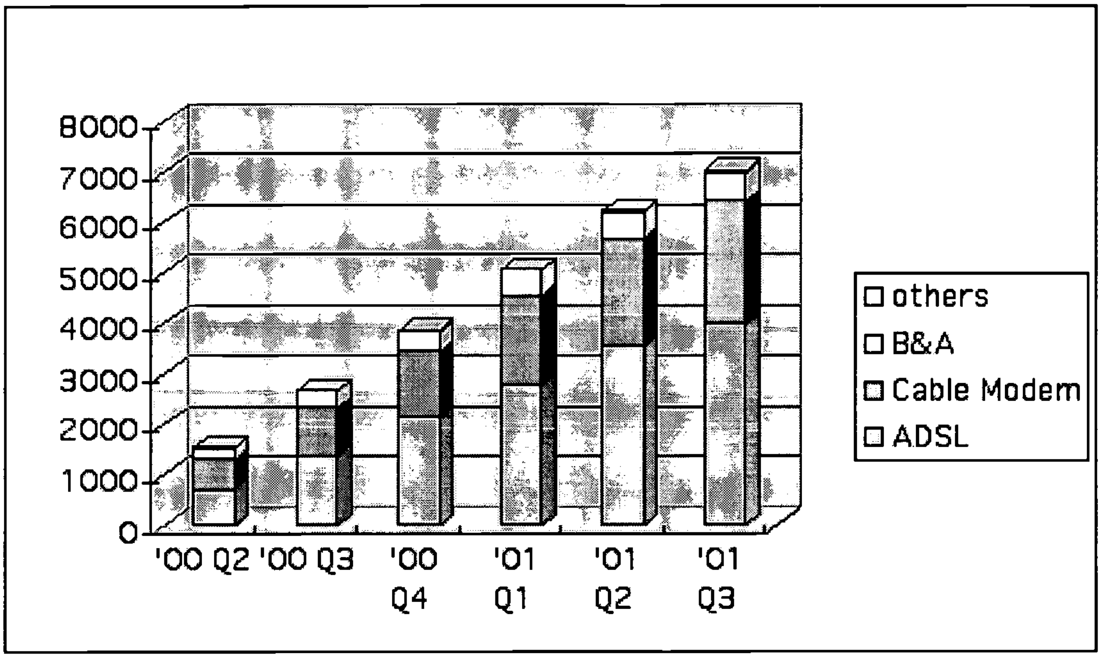

Figure 1. Broadband Internet Access in Korea (as of 3Q 2001)

Mobile Internet Access

The same dynamic growth as we experienced in wired broadband Internet business happens in wireless area. Thanks to the success of Internet and mobile communications, the mobile Internet market is also forecasted to achieve an explosive growth as a main revenue generator in the future.

In Korea, mobile carriers began mobile Internet services at the third quarter of 1999. The increase of mobile Internet-enabled handsets has since been quite remarkable. For one year in 2000, the handsets shot up from 2.2 million units to 15.8 millions, 59% of the total mobile users. The growth continued this year. By October 2001, over 80% of the total mobile subscribers own internet enabled handsets (Refer to Figure 2).

There are a variety of mobile internet platforms used by mobile carriers. SK Telecom, Shinsegi Telecom & LG Telecom uses WAP version while KT Freetel and KT M.com uses Microsoft ME. There is also Internet SMS (ISMS) type of handsets that uses SMS technology for browsing.

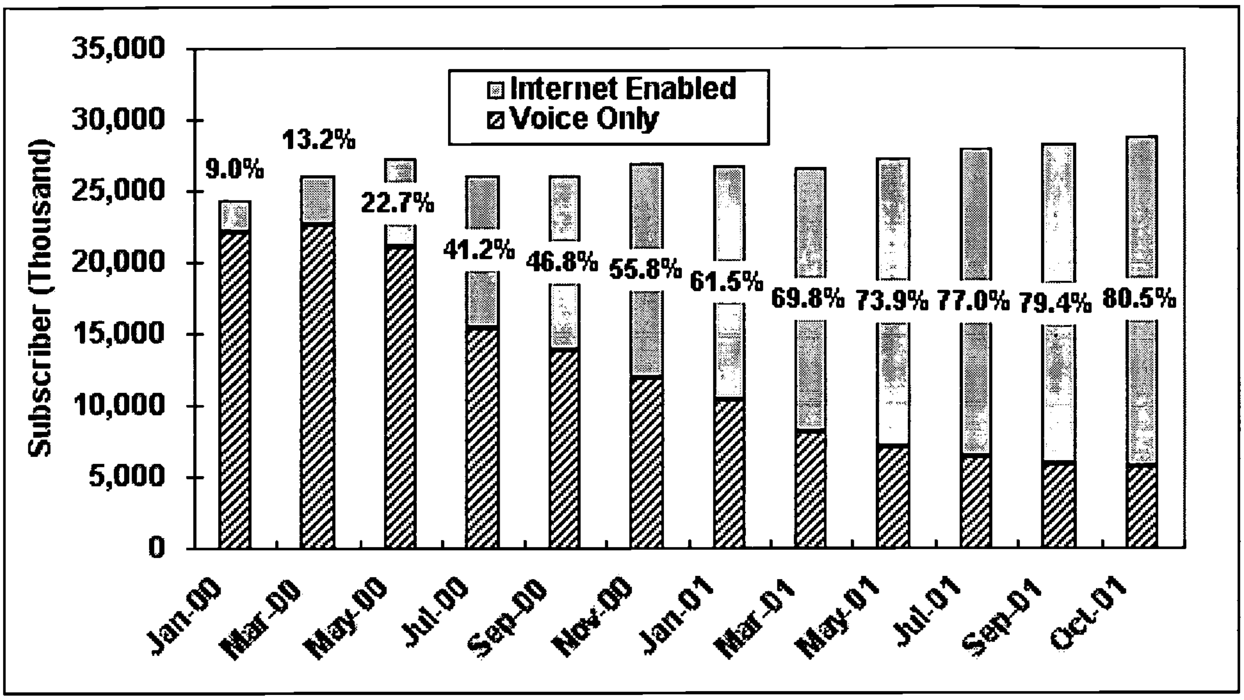

Figure 2. Monthly Trend of Mobile Internet Subscriber in Korea

Source : MIC, 2001.11

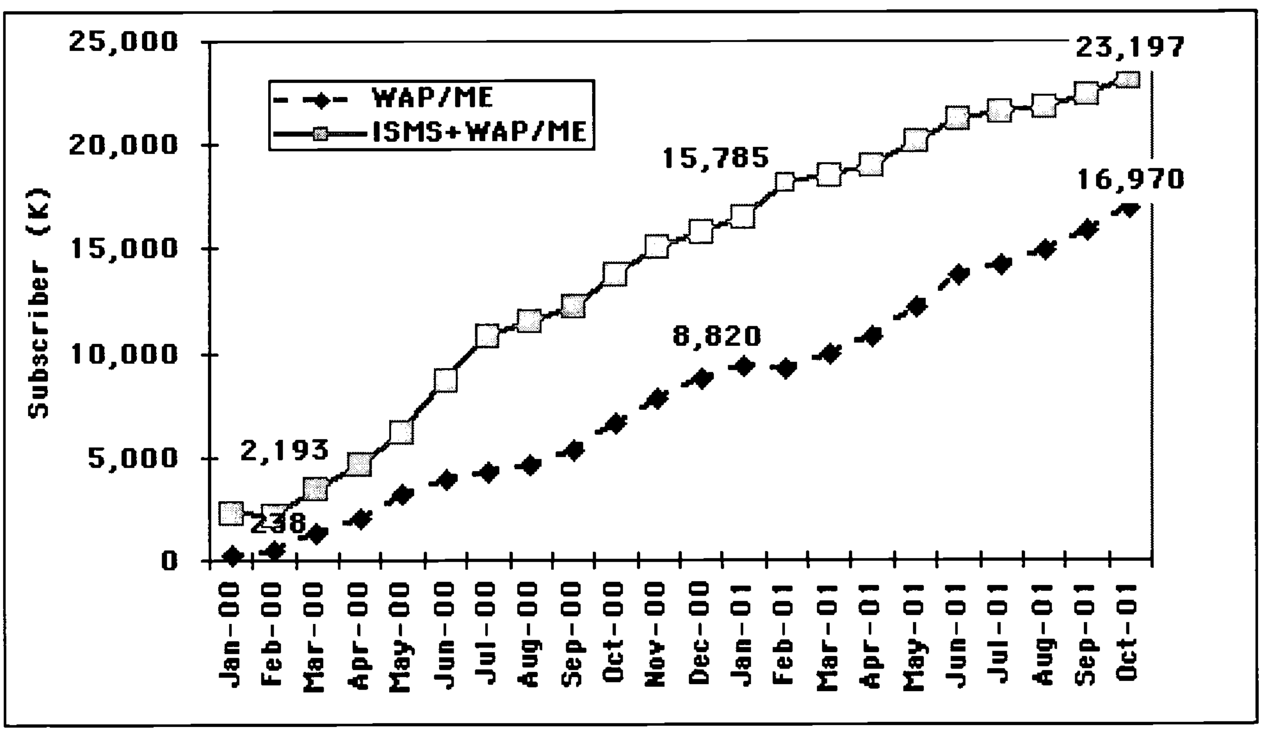

Figure 3. Monthly Trend of Mobile Subscriber by Browser Technology in 2000

Source : MIC, 2001.11

3. Key Success Factors For Broadband Internet Access Service

The key success factors for the booming of broadband internet access service in Korea can be summarized into four factors; 1) explosive growth of internet usage, 2) competition between carriers, 3) cost reduction and 4) regulator's policy.

Explosive Growth of Internet Usage

In Korea, Internet experienced seven-time growth of its users only for two years from 3.1 millions in 1998 to 22 millions in 2001. Over 95% of students at middle schools, high schools and universities are using Internet. Even female users are 43%. Moreover, the average amount of time spent online per week increased by 2.5 times from 4.2 hours in 1997 to 10.4 hours in 2000. 35% of the usage is for information surfing and 22%, game/entertainment. The number of PCs currently distributed — this is a threshold for the growth of Internet business - is 13 millions, and this means that 46% of all the households possess PCs[2].

Thanks to this usage base, Internet business in Korea has also been experiencing an explosive increase in e-business, online game, Internet broadcasting, information search, email and community service, which need the help of broadband Internet access service

Competition Between Carriers

Another driving force for the explosive growth of broadband Internet access service is the competition between rivals. To be honest, we cannot say this policy guaranteed late entrants to survive in the market. As a case in point, local call market was 95% procured by Korea Telecom, when it was open, and hence new entrants could hardly survive. In the end, Hanaro Telecom, the second local call player, recognised that they could not win and focused on broadband Internet access business instead. Their choice was not wrong. The revenues of wire-line carriers from telephone business started to drop in 1998, due to the exponential increment of mobile usage. Even the incumbent wire-line carriers endeavored to find a new business.

When Hanaro turned their eyes to broadband Internet access market, the potential was so high, because of the Internet fever of the time. Hanaro launched ADSL in 1999, and gained positive responses in the market. Their subscribers were scaled up. However, haplessly, Hanaro did not have enough money and time to establish their own networks, so that it could not catch up with the demand of the market. At that time, so far as broadband Internet access service is concerned, Korea Telecom took "wait and see" policy and delayed the launch of ADSL. They still stuck fast on to ISDN. This was a good opportunity for newcomers who wished to make a head start in this area. New rivals attempted a foray into the territory of Hanaro, making use of cable TV networks, and pulled 0.6 million subscribers at the drop of a hat. They were Thrunet and Dreamline. Eventually, Korea Telecom had no choice but to jump into the ADSL business, giving up ISDN. It was too big and prospective to lose. Korea Telecom gradually edged its rivals out of the market with well-established telephone networks, distribution channels, and profuse funds. As a result, Korea Telecom grabs almost 50% market share since May 2001 — this share is still almost the same.

Cost Reduction

As its subscribers have increased, its supply cost has decreased. For instance, the unit cost of copper-lines for ADSL has come down by 50% since the early 2000, so the recently supplied lines cover the cost. Still, the benefit of the cost reduction does not go to all the players equally. This implies that the gap between broadband Internet access service providers rather becomes wider. The operators, which are establishing broadband Internet access facilities and networks on a large scale, reduce its cost to a great degree. The operators with higher market share also can fortify its competitiveness, because the supply cost reduction does not apply to the existing facilities. But, small players hardly enjoy this effect.

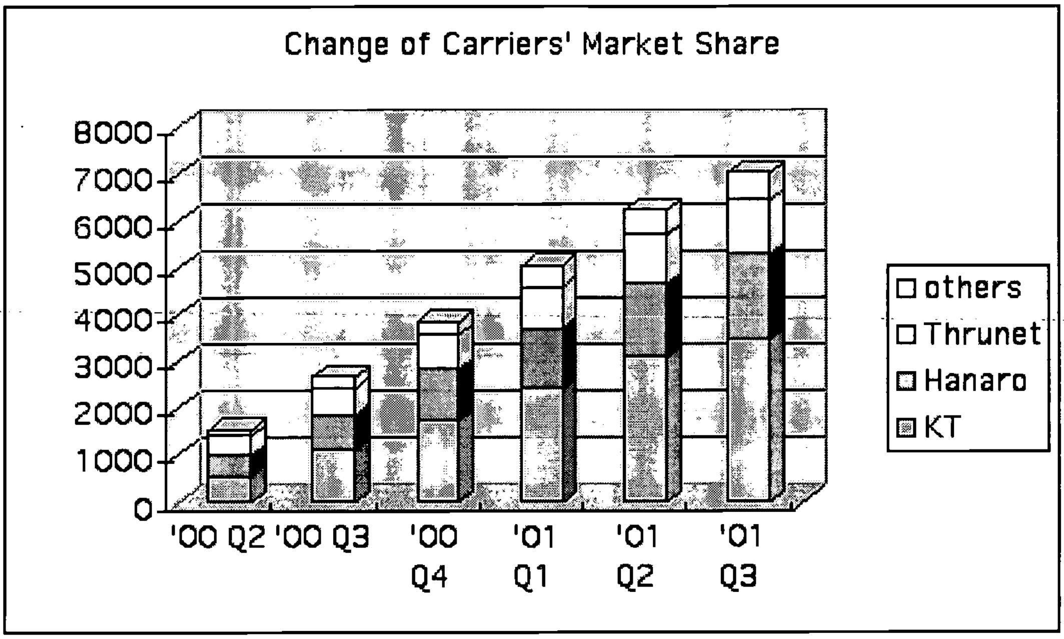

Figure 4. Change of Broadband Players' Market Share

Regulator's Policy

Last but not the least, national regulators play an important role in accelerating competition and maintaining the level of service quality. They activated the appropriate competition rather than hang on to excessive interference. While the market was expanding, the standpoint of Korea's regulators was different from their traditional regulation-oriented principle. They had strongly regulated Korea's telecommunications market. Still, as for broadband Internet access industry, they did not step in the pricing process and competition between operators. They just occupied the middle ground. Nevertheless, they were strict with the quality, and regulated the exaggerated advertisements. Furthermore, they demanded that carriers should measure and publicise the quality of their services — this made the quality competition between rivals possible. Afterwards, these attitudes of regulators were admitted appropriate enough to minimize side effect of the hot competition.

4. Key Success Factors For Booming of Mobile Internet Access

- The key success factors for booming of mobile internet access can be summarized into three factors; 1) explosive growth of mobile communication, 2) competition between mobile carriers and 3) regulator's policy.

Explosive Growth of Mobile Communication

During the past decade, Korea's mobile market achieved a remarkable growth - the average growth rate of the last 10 years is over 80%. The number of mobile subscribers increased from 166,000 in 1991 to 28.8 million as of October 2001.

SK Telecom was the first Korean company to launch mobile communications service in 1984. Shinsegi Telecom entered the cellular market in 1996 and three other carriers launched PCS service in 1997. Since the launch of PCS service, Korean mobile communication industry has shown a very rapid growth. This vast pool of mobile subscribers will be the strong driving force for mobile internet

Competition between Mobile Carriers

The most rapid growth period is from year 1997 to 2000. However, as subscribers increased, the penetration rate reached saturation. By October 2001 the penetration reached 60%. As the market reaches saturation, mobile carriers look for other sources of revenue, the mobile internet. All five operators[3] focus their marketing strategy on their mobile portal.

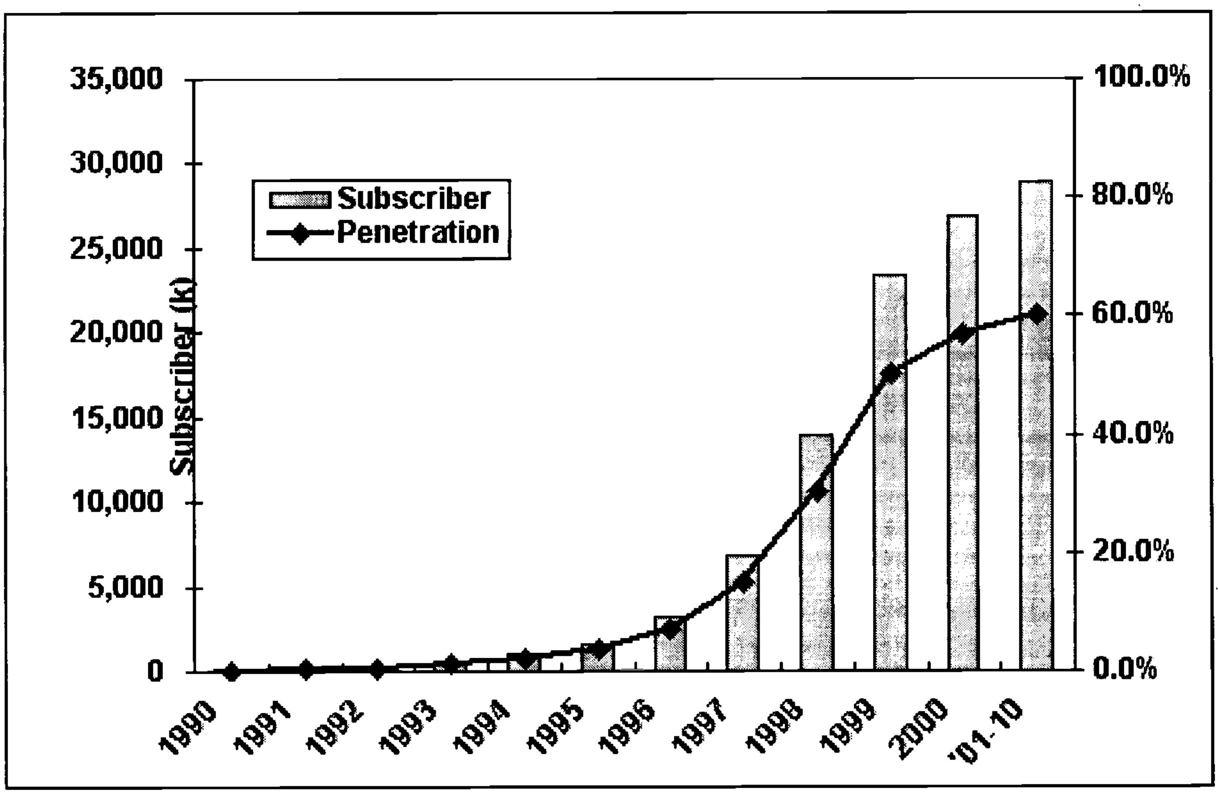

Figure 5. Growth of mobile subscriber in Korea (1990-2001)

Source : Ministry of Information and Communication

Carrier	SK Telecom	Shinsegi Telecom	KT Freetel	LG Telecom
Service launch	Mar 84	Apr 96	Oct 97	Oct 97
Frequency band	800 MHz	800 MHz	1.8 GHz	1.8 GHz
Air Interface	CDMA	CDMA	CDMA	CDMA
Mobile Internet launch day	Dec 99	Dec 99	Sep 99	May 99
Brand	n.Top	i-touch	Persnet	EZ-i
Browser	WAP	UP	ME	UP
Language	WML	HDML	M-HDML	HDML
Mobile Subscriber	11,424	3,268	9,715	4,424
(Market Share)	(39.6%)	(11.3%)	(33.7%)	(15.3%)
Internet Subscriber	4,812	734	4,713	3,385
(Market Share)	(34.0%)	(7.2%)	(41.2%)	(17.7%)
Data Connection Fee (10sec)	1.15c	1.08c	1.15c	1.15c

Table 2. Mobile Telecommunication Carriers in Korea
Source: Reconstructed from MIC and Carrier's homepage
Note: 1. All figures are at the October 2001
2. 1 US$ = 1300 Korean Won

Regulator's Policy

To promote the usage of mobile internet industry a series of regulatory policies have been implemented. The Ministry of Information and Communication (MIC) mapped out a "Basic Guidelines on the Promotion of Mobile Internet Industry" in June 2000 and based on this, Telecommunication Business Promotion Bureau of MIC announced "Action Plan on Promotion of Mobile Internet Business". The main features of these policies are as follows.

a) Promoting Content Development

Most of the content for fixed Internet is free of charge. But the lack of business model and the recent depression in IT industry made content providers (CP) to look into the ways to charge users. In the long run, it would be beneficial to both CP and users, if CP can build a profitable business model and users can get more value out of the content. In the case of mobile Internet, paid content is encouraged to ensure the delivery of quality content. The content fee can be decided upon the demand of the market. So, mobile carriers are advised to equip their billing systems by the end of 2000.

b) Opening up Mobile Network System

Mobile Internet market has reached a point where the expansion in usage rather than in subscriber basis occurs. This means that mobile carriers should open their value chain from network to content. So, MIC will stipulate legal basis for opening up the networks of mobile carriers in order to establish a fair competition environment. If the mobile carriers' networks are open, lots of independent ISPs can provide mobile Internet services through their own gateways. Besides, portal sites also can attract content providers who do not have to be dependent on mobile carriers.

Besides these policies, R&D investment on IMT-2000 technologies will be continued. Approximately, 2 million dollars will be spent on developing terminals and application software. Lastly, MIC will begin to consider legal regulations for mobile transaction, mobile electronic-certification system and mobile security system, because the whole mobile commerce market is expected to tremendously expand in the next few years.

5. Epilogue: the Future of Broadband and Mobile Internet Access Service in Korea

Considering the demand of schools and offices for LAN and leased lines, broadband Internet access service is expected to be employed by almost all of the Internet users in Korea at the end of 2001, and by the end of 2002, by 9 millions, that is, two thirds of the total households. This means that local loop called the last mile evolves from PSTN to broadband access line and as a result, telcos, ISPs, and Internet users are going to face a big change.

In the telecom carrier's view, PSTN is an inefficient asset. In general most telephone lines are engaged for a short time, even if PSTN is always there. However, at the moment, the broadband Internet access service rapidly grows, and substitutes existing telephone lines. Its usage increases in a large volume, and creates additional revenues. Take an example. KT is undergoing the revenue shrinkage in telephone business[4]. Nonetheless, its total revenues are expected to augment by as much as 10% in 2001, under the auspices of the success in broadband access service. The increasing usage of the last mile means that telcos are able to extract new revenues and profits from the last mile that has been thought as an old-sunk asset. Moreover, it could produce new business opportunities when telcos combine traffics on the broadband network with other on-line and off-line services and products. Surely, broadband access service gives a good opportunity for telcos and ISPs alike to commence new business.

For mobile carriers, voice revenues have also been decreasing steadily for several years. Hence, mobile carriers need to converge mobile data and Internet service for new sources of revenues. According to

Ovum, the worldwide data revenues in 2001 are only 6% of the whole mobile communications market value, however, by 2006, the data market is expected to increase as much as 13%. As for Korea, at the moment, there are 3.4 million active mobile e-commerce users, and this is expected to augment to 20 millions by the end of year 2005.[5]

Internet users may also experience a big change. Most of them use broadband Internet at workplaces, schools or universities, and want the same speed at home as well. They need it to take pleasure in shopping, leisure, useful information, education and message delivery at home. They are getting accustomed to high speed magic. As a matter of fact, in Korea, more housewives now purchase the necessities of life, trade shares, deal with their money online, and make use of email instead of telephones. Their traditional life patterns are changing with Internet. Shopping at the brick and mortar shops is not their unchangeable life style any more.

Mobile Internet services will also give an impact to our lifestyle. It will change our communications habit, transaction tendency, and the ways of getting new information. The applications of mobile Internet will not be a slow copy of Internet. On the contrary, applications will mainly capitalise on the fact that users are mobile, continuously connected to the network and interested in personalised services. The key to the success of mobile Internet is whether it can provide useful information, when and where it is needed.

In a way, this trend may isolate them from real society. However, in another way, it builds online communities and motivates active social participation. Besides, it is no more surprising that netizens in Korea show and share their opinions of current affairs on the net — they are influential interest groups. In Korea, Internet has become a powerful communications media along with newspapers, radio and TV.

When telephone came out in the world, it changed people's life styles. Like this, the growth of broadband and mobile Internet access service does not only speed up the rollout of a new telecommunications means; as a infrastructure, it plays a role in creating new life styles, new business opportunities, new communities and new social or political phenomena. Still, time is not ripe for us to decide whether these are all desirable or not, because Internet access service has two faces. On the one hand, as it spreads, it makes people's life easier and more comfortable. On the other hand, it may infiltrate their private life, or widen the gap between the information poor and rich[6]. Besides, Internet cannot merely provoke new wrongdoings such as hacking and cheating, but also elaborate existing ways of crimes. Internet also speeds society up. So, it magnifies at once positive and negative aspects of society, and vice versa.

Simply put, the success of Internet access service can cause a serious social disaster, unless its social effects are not deeply considered. We must bear in mind that with the success of broadband and mobile Internet access service, we are given another issue we have to solve for the bigger achievement.

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2. Ovum, (2000). E-Commerce: Market Strategies
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Endnotes

1. IT Daily, 8 June 2001, p 2.
2. National Statistical Office, Social Statistical Survey Data of Information and Telecommunications in Korea, 2001.
3. Because of fierce competition among operators, there are only three mobile carriers in Korea. After M&A, the three big players are SK Telecom, KT Freetel and LG Telecom
4. Korea Telecom experienced 7.5% decrease of revenue in traditional telephone business by CAGR during 1998-2000.
5. Ovum, Mobile E-Commerce: Market Strategies, 2000
6. National Statistical Office, ibid, 2001.

back to index

Abstract

The fast growth of broadband Internet access in Korea is referred to as a good benchmarking case by other countries including OECD member states. As of September 2001, the number of broadband Internet users reached 7 millions in Korea, which means every one out of three Internet users enjoys broadband access. Reviewing the employment process, we found that the key success/accelerating factors for this booming can be categorized into four areas; 1) explosive growth of Internet usage, 2) competition between carriers, 3) cost reduction by economy of scale and 4) regulator's policy.

The same story goes for mobile Internet service. The increase of mobile Internet-enabled handsets has been quite remarkable. For one year in 2000, the handsets shot up from 2.2 million units to 15.8 millions, 59% of the total mobile users. The growth continued this year. By October 2001, over 80% of the total mobile subscribers own Internet-enabled handsets. The key factors of this success can be summarized into three factors; 1) explosive growth of mobile communications, 2) strenuous competition between mobile carriers and 3) regulator's policy to promote the usage of mobile Internet. Here in this article, besides the key success factors for the booming of broadband Internet access and mobile Internet service in Korea, we also discuss the future of these two services. We believe that this discussion will generate some useful implications for other countries, which are interested in these service areas.

back to index

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Internet and E-Commerce Development in Asian Tigers: A Comparison of Chinese Taipei and Hong Kong

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View Abstract

Introduction

Internet and e-commerce, despite their English speaking and western focused nature (Hedley 1999), are diffusing more rapidly in Hong Kong and Chinese Taipei than in many Western and English speaking countries. A recent e-readiness ranking of the 60 main economies of the world by the Economist Intelligence Unit (EIU) puts Hong Kong and Chinese Taipei in the groups of "e-commerce leaders" (rank 13) and "e-commerce contenders" (rank 16) respectively. In terms of e-readiness, Hong Kong and Chinese Taipei are ahead of European countries such as Belgium, Italy, Spain and Portugal; English speaking countries such as New Zealand; and Asian "capitalist-roaders" (Viksnins 2000) such as Korea and Japan.

Asia's share in worldwide e-commerce is estimated to rise from 5% in 2000 to 10% in 2004, and Hong Kong and Chinese Taipei are expected to account for a significant proportion of this growth (Lee et al 2001). Cognizant of such growth potential, many multinationals involved in e-business as well as venture capitalists are showing an increasing level of interest in these economies (Chan 2001).

A deeper and clearer understanding of the factors influencing the rapid growth of the Internet and e-commerce would help design appropriate e-commerce models to target consumers in these economies and also to formulate appropriate policies to accelerate Internet diffusion in other countries. While some studies have compared Internet diffusion in Hong Kong and Chinese Taipei (e.g., Foster et al 2000), to our knowledge, no published study has made attempt to make a comparative analysis of Internet and e-commerce diffusion loci of these dynamic Asian economies. This paper attempts to fill this research gap by making a comparative analysis of the determinants of Internet and e-commerce diffusion loci in Chinese Taipei and Hong Kong.

We use historical methods to identify and analyze the causes of rapid Internet and e-commerce diffusion in Chinese Taipei and Hong Kong. Our approach is guided by the following two research questions: a) What factors led to Hong Kong and Chinese Taipei's rapid Internet and e-commerce development? and b) What factors are responsible for the difference in the Internet development loci of the two economies?

The remainder of the paper is organized as follows. In the following section, we provide a brief survey of the current stages of Internet and e-commerce development in Hong Kong and Chinese Taipei. This is followed by a brief discussion of the methodology used. Then, we attempt to identify and analyze various factors influencing Internet and e-commerce diffusion in the two economies. Next, we revisit the Internet development situation in Hong Kong and Chinese Taipei and provide some conclusions.

A brief survey of Internet and e-commerce development in Hong Kong and Chinese Taipei

Table 1 provides a comparison of Hong Kong and Chinese Taipei in terms of some essential indicators related to Internet and e-commerce growth. Data triangulation from several sources indicates that B2C e-commerce is more developed in Hong Kong than in Chinese Taipei. A study conducted by Nielsen//NetRatings found that 55.5% of the population had Internet access in Hong Kong in July 2001 compared to 52.3% in Chinese Taipei. Similarly, iamasia (Interactive Audience Measurement Asia) found that 34% of the population used the Internet in Hong Kong compared to 31% in Chinese Taipei in the early 2001 (Asian Business 2001). By 2004, however, 61% of Chinese Taipei population is expected to use the Internet thanks to its vibrant semiconductor and PC hardware industry . In terms of gender composition, 44% of the Internet users in Hong Kong are women compared to 42% in Chinese Taipei . In the early 2001, a larger proportion of Internet users shopped online in Hong Kong (13%) compared to Chinese Taipei (10%). Hong Kong's Internet users view 1123 pages per month and 63 pages per session compared to corresponding figures 618 and 55 respectively for users in Chinese Taipei .

TABLE 1: A COMPARISON OF CHINESE TAIPEI AND HONG KONG IN TERMS OF SEVERAL DIMENSIONS RELATED TO INTERNET AND E-COMMERCE DEVELOPMENT

	Chinese Taipei	**Hong Kong**
EIU e-readiness ranking 2000 ranking Business environment (out of 10) Connectivity (out of 10) 2001 ranking	27 8.13 5 16	9 8.52 8 13
Technology achievement index (UNDP 2001)	NA	0.455 (rank 24 out of 72)
Number of Internet users (July 2001) No. of hosts under top- level domain	11.60 million 424,209	3.94 million 98,183

Percentage of households with: O one PC Multiple PCs	59 26	59 22
No. of telephone main lines 2000 (Dec)	13 million	3.9 million
No. of mobile phones 2000 (Dec) No. of ISDN subscribers (1998)	17.6 million 8.76	5.3 million 15.3
No. of Internet service providers (1999)	15	49
Language	Mandarin Chinese (official)	Cantonese and English (both official)
Index of economic freedom	2.10 (rank 20)	1.30 (rank 1)
No. of credit cards (million 1999) GDP per capita (PPP) 1999, US$	8.06 16,100	13.1 23,100
GDP Composition (1997) Agriculture (%) Industry (%) Services (%)	3 33 64	0.1 14.7 85.2
Population (2000)	22.2 million	7.1 million
Land area (Km2)	32260	1042

Sources: Asian Banker 2001(http://www.theasianbanker.com), Budde 2001, CIA 2001, Cyber Atlas 2001, Foster et al 2000, Heritage Foundation (2001) http://www.ebusinessforum.com, UNDP 2001.

Rapid growth in broadband use is likely to bring a radical change in Internet usage pattern between the two economies. By mid-2001, the proportion of households with broadband penetration reached 40% in Hong Kong and 8% in Chinese Taipei . Consumers in these economies exhibit a higher level of preference for mobile phones than their counterparts in Europe or America (Wilson 2001). The pervasiveness of mobile phones in these economies (Table 1) is likely to accelerate the diffusion of mobile e-commerce (m-commerce) in the future, which is still in nascent stage. An estimate suggests that by 2003 m-commerce will account for about half of $900 million B2C e-commerce market in Hong Kong (Lawson 2000).

In B2B e-commerce, however, Chinese Taipei is much more developed than Hong Kong. Managers in most Chinese Taipei companies have Silicon Valley work experience and possess the willingness and the ability to reengineer their companies to leverage the power of the Internet (Foster et al 2000). The U.S. know-how combined with Chinese Taipei entrepreneurship, engineering, and manufacturing skills give

Chinese Taipei companies an edge (Tanzer 1998). Chinese Taipei companies adopted electronic interchange and the enterprise systems much earlier than Hong Kong based companies. The latter are small and medium sized enterprises (SMEs) , and tend to focus on short-term profits and lack high-tech manufacturing capability, which led to slower speed of EDI and ERP adoption (Foster et al 2000).

Methodology

We use historical methods to understand the forces influencing Internet development in Hong Kong and Chinese Taipei. Historical methods entail two stages: research design and historical analysis (Smith and Lux 1993). The research design phase includes question framing and selecting research procedures. The starting questions to be addressed are mentioned in (a) and (b) above. Secondary data analysis, library research, and online search are used to address the above questions.

The second stage - historical analysis - entails investigation, synthesis and interpretation. In the investigation phase, we isolate the factors leading to the rapid Internet and e-commerce development in the two economies and the difference in their diffusion loci. In the interpretation phase, epistemologically, we are interested in identifying and analyzing three levels of causes of the rapid Internet diffusion in the two economies: deep structural, contextual, and triggering causes. We are also interested in the interaction of the causes or the "causal complex"(Fischer 1970).

The principal product of such historical analysis is an understanding of the organizational, individual, social, political and economic circumstances that led to the current stages of Internet and e-commerce development in Hong Kong and Chinese Taipei. The structure of causes uncovered by this study provides valuable lessons for the Internet and e-commerce sectors of advanced as well as developing economies of the Asia-Pacific region.

Factors impacting the diffusion of Internet and e-commerce in Hong Kong and Chinese Taipei

Geographical factors such as location, climate, population size and density play important roles in the economic development as well as the Internet and e-commerce growth. In a quantification of the contributions of geography to a nation's performance, Sachs et al (2001) found that coastal regions and those near navigable waterways are far richer and more densely settled than interior regions. Similarly, nations in tropical climatic zones are likely to be poorer than those in temperate zones. In case of Hong Kong and Chinese Taipei, location in navigable waterways and in tropical zones tend to produce opposite effects on income level - but the former overwhelms the latter .

Rapid development in undersea cable technology has further increased the importance of a seacoast location in the information age. Undersea cables are more appropriate for capacity expansion and also fare much better than satellites in longevity and security dimensions. Thanks to such development, from 1988 to 1998, the proportion of transoceanic messages and data carried by undersea cables increased from 2 to 80 percent (Mandell 2000).

Hong Kong is the most densely populated economy in the world and there are only a few economies that have higher population density than Chinese Taipei. It is a much easier task to wire a densely populated tiny island like Hong Kong in comparison to other giants such as Mainland China and India, which partly explains Hong Kong's rapid Internet development.

Although structural factors such as seacoast location and higher population density favor Internet and e-commerce development in Hong Kong and Chinese Taipei, several other factors such as small size, lower bandwidth (compared to North American and European countries) and Eastern and non-English speaking culture tend to produce opposite results. Some studies suggest that economies like Hong Kong and Chinese Taipei, despite high degree of e-business readiness, are too small to maintain any e-retailers (BCG 2000). The effect of small population size on e-commerce development is likely to be mitigated with the sharp reduction of tariff and non-tariff barriers and WTO members' agreement in not imposing customs duties on electronic transmissions (WTO 1998). Since Hong Kong is already a WTO member and Chinese Taipei is expected to get the WTO membership soon, e-retailers located in these economies can sell their products virtually anywhere in the world and vice versa.

Unavailability and higher cost of leased fiber connection are other barriers in Asia. The Asia-Pacific region - home to 60% of the world population - accounts for only 12% of the total worldwide bandwidth (Frontline.net 2001). Intra-regional leased fiber connections in Asia are more expensive than connections to Europe and North America. For instance, in 2000, the cost of a 155 Mbps leased fiber connection between Japan and Hong Kong was $1 million per month, compared to $882,000 between Japan and the U.S. and $142,000 across the Atlantic. Likewise, a 155Mbps connection between Chinese Taipei and San Francisco cost 11 times as much as that between New York and London (Lawson 2000). ISPs in these economies have to pay for the full cost of leased lines to Internet backbones in the U.S. which makes Internet access more expensive (Petrazzini and Kibati 1999).

Moreover, since the bulk of software, interfaces and web content is in English which is not the native language of these countries, they are at a relative disadvantage in Internet and e-commerce adoption. Being an ex-British based economy, the bilingual society of Hong Kong fares much better than Chinese Taipei on the English language dimension. In fact, English is one of the official languages in Hong Kong whereas Mandarin is the only official language in Chinese Taipei (CIA 2001). However, the rapid decline in English language content on the web and availability of software and interfaces in other language has reduced the importance of English language skills in Internet and e-commerce development .

"Western focused" and "English speaking" characteristics of the Internet as explained above require higher level of effort for a given level of Internet and e-commerce development in Asia than in Western and English speaking countries. Several barriers need to overcome to move into information economy and such barriers. Braudel (1980) argues that movement from one to the next of each of the economic activities - road transport, sea transport, mercantile activity, industrial development, banking, information revolution - must be "shown to correspond to a break in the barrier, to an obstacle overcome" and not to have "sprung into being through a series of ruptures" (p.88). There are similarities as well as difference in the ways governments, organizations, and consumers respond to such discontinuities in Hong Kong and Chinese Taipei.

Entrepreneurial people, innovative business models of the enterprises involved in e-commerce, and the governments' effective macro-economic policies are the factors that are overcoming the barriers to Internet and e-commerce caused by the interactions of several structural and contextual factors mentioned above. E-retailers in Chinese Taipei have developed new business modes to cope with such problems as low credit card penetration (Table 1) and consumers' concern about security issues. For instance, e-commerce companies in Chinese Taipei are using different payment and delivery options to overcome the problem of security. E-commerce companies have made cooperative arrangement with the 7-Eleven convenience store, according to which products ordered online can be delivered to the customer's nearest 7-Eleven and paid for over the counter either with cash or credit (Lee et al 2001). Books.com.tw, a B2C site, has already started offering such service, and expects a significant increase in its book sales. Such a model is different from those used by B2C companies in the U.S. such as Amazon.com.

Hong Kong's entrepreneurial culture has a long history of adapting its strategies to changing circumstances (Jessop and Sum 2000). The rule of law, lack of trade barriers, low taxes, simple system for the licensing of businesses, protection of private property laws, and the world's "freest banking environment" have contributed to Hong Kong's development as a major trading port and financial center of East Asia (Heritage Foundation 2001). Heritage Foundation has described Hong Kong as the world's freest economy for seventh consecutive year in 2001. Chinese Taipei is not as free as Hong Kong. Considering barriers to international trade, for instance, Chinese Taipei government has listed 991 product categories that require relevant authorities' approval for import and another 279 that require import permits (Heritage Foundation 2001). Moreover, its banking sector is tightly regulated.

In recent years, Hong Kong's manufacturing trajectory - organizing low cost manufacture in cheaper Asian locations - became unsustainable because of steep increase in labor and land cost in those locations and competitive challenge from Japanese companies (Berger and Lester 1997). The best alternative for Hong Kong in such situation is to climb the "technology ladder" by producing higher value-added goods domestically (Jessop and Sum 2000). It has taken several initiatives such as "Digital 21", citywide broadband implementation, and the new Cyberport to climb the technology ladder.

Digital 21 is a collaboration between the Information Technology and Broadcasting Bureau (ITBB) and the Information Infrastructure Advisory Committee (IIAC). It is a "package of initiatives through which Government, business, industry and academia can work together" . Similarly, the $2 billion Cyberport project has already attracted many investors. By November 2000, 15 leading IT and IS companies such as Cisco Systems, CMGI, Hewlett-Packard, IBM, Microsoft and Oracle signed letters of intent to become anchor tenants and over 175 other companies registered interest in becoming tenants in the Cyberport .

Despite some market interventions, the Chinese Taipei government has provided effective "macroeconomic linkages" (Wade 1990) that have been critical in transforming Chinese Taipei from one of the poorest economies in the world in the 1960s to its current level. The state enterprises supplied and controlled primary materials and provided selective protection and tax exemptions and rebates, which boosted its competitive advantage in IT products. These activities resulted in Chinese Taipei's viable market economy with strong effects in technology upgrading, manufacturing growth, and export promotion (Wade 1990).

Chinese Taipei took measures to guide enterprises into more complex activities and reduce their dependence on technology imports. Measures were also taken to ensure that firms develop innovative capabilities that are more flexible, more responsive to markets and much more broadly spread in the economy (UNDP 2001). Such "guided capitalism" was able to influence the microeconomic activities at the firm level (Tsai 1999). Consequently, companies based in Chinese Taipei have become the largest or the second largest direct foreign investor in every country in Southeast Asia and China (Chen and Lee 2001).

Chinese Taipei is the world's third largest IT hardware player behind Japan and the US and the world's largest supplier of LAN cards, monitors, mouse devices, PC motherboards, notebook PCs, scanners, and other PC products. In fact, the household PC penetration rate is higher in Chinese Taipei than in Hong Kong (Table 1). Since computer and telephone are the prerequisites to use the Internet and e-commerce, Chinese Taipei's higher PC penetration rate is one of the important factors that explain the relatively small gap between Hong Kong and Chinese Taipei in Internet diffusion, in spite of the much larger gap in the per capita GDP of the two economies.

These macroeconomic linkages were also able to attract a huge amount of venture capital (VC), which created a virtuous circle of IT development. In fact, Chinese Taipei has been "Asia's capital for venture investment activities" (Chen and Lee 2001). The US experience shows that availability of VC is a critical factor for the success of e-commerce. The annual investment into new ventures from about 170 VC funds registered for special government benefits, and an additional estimated 300 not seeking government incentives as well as from foreign-based players, is estimated to be $20 billion in Chinese Taipei (Chen and Lee 2001).

Chinese Taipei's two major tech hubs - Taipei and Hsinchu - are the other significant outcomes of the macroeconomic linkages that are playing a critical role in its Internet and e-commerce development. To attract technologists back from Silicon Valley, Chinese Taipei government set up Hsinchu Science Park, Chinese Taipei's "Silicon Valley", in 1980 and offered various tax breaks and a promise that they would not be interfered with (Micklethwait 1997). In the Wired magazine's rankings of the 46 major locations in the world that matter most in the new digital geography, Taipei and Hsinchu scored 13 and 11 respectively (out of the maximum possible score of 16) which compares with Hong Kong's score of 9 .

The "macroeconomic linkage" provided by Chinese Taipei government influenced IT diffusion in Hong Kong as well. The currency depreciation from 1986 onwards and the rising cost of land and the high standards set by the government's Labor Law forced some Chinese Taipei manufacturing firms to divert their investments to cheaper locations (Jessop and Sum 2000). Obviously Mainland China was the most attractive destinations. Chinese Taipei, however, lacked direct contact with the mainland since 1949 and a sensible strategy for the Chinese Taipei companies was to establish commercial links with the mainland through Hong Kong (Foster et al 2000). In fact Hong Kong is serving as a bridge, a channel, and a window between China and rest of the world, not just Chinese Taipei. Chinese Taipei companies brought not only money and manpower in Hong Kong but also the latest technology.

An economy's natural and physical capitals cannot contribute much unless the country invests in human capital . Human capital continues to be important in the information age. Chinese Taipei and Hong Kong have put high priority on human capital development. They emphasize technology-oriented curricula at higher levels and try hard to attract scholars and researchers (UNDP 2001). For instance, Tanzer (1998) reports that engineers in Chinese Taipei Semiconductor companies have been earning as high as $500,000, which is very high given that Chinese Taipei's per capita GDP Is less than half that of the U.S. Thanks to such measures, these economies have a huge pool of skilled engineers and deep technological and industrial bases, which are prerequisites for e-commerce development.

The Chinese Taipei government, however, has been surprisingly slow in enacting e-commerce laws. An analysis of Asian economies in terms of their adoption of digital and electronic signature (DES) puts Chinese Taipei at the basic level 1 whereas Hong Kong is at the advanced level 3 (Kshetri and Dholakia 2001). In Chinese Taipei there is no formal legislation to recognize DES. Hong Kong has laws to recognize DES and also legal provisions for the functioning of certification authorities. DES are being extensively used in Hong Kong. By early 2001, Hong Kong courts relied upon electronic records for more than 50 cases (Canham 2001). The absence of appropriate e-commerce laws is hampering online transactions in Chinese Taipei. The legislature in Chinese Chinese Taipei, however, is considering new laws to regulate E-commerce (Einhorn et al 1999).

Revisiting Internet and E-commerce Development in Hong Kong and Chinese Taipei

Higher per capita income, strategic location, higher population density, multicultural bilingual society with entrepreneurial culture and better e-commerce laws explain Hong Kong's better performance in B2C e-commerce. Chinese Taipei's macroeconomic linkages that are able to penetrate effectively to the firms' microeconomic policy and the link of its managers with Silicon Valley companies, on the other hand, explain the better performance in B2B e-commerce. For the given level of per capita GDP difference between the two economies, however, the gap in B2C e-commerce between Hong Kong and Chinese Taipei is relatively very small.

Discussion and Conclusion

An important contribution of this paper is to identify and analyze the factors influencing the rapid growth of the Internet and e-commerce in Chinese Taipei and Hong Kong. Our analysis indicates that the factors driving the development of the Internet and e-commerce in the two economies are quite different. Despite much higher per capita GDP of Hong Kong compared to that of Chinese Taipei, there is relatively very small gap in B2C e-commerce between the two economies and in B2B e-commerce Chinese Taipei is more developed than Hong Kong. The fact Chinese Taipei is a creator of technology whereas Hong Kong is only a user explains this phenomenon.

The causes of Internet and e-commerce diffusion identified in this paper, however, are not "detachable, isolable, homogeneous, independently operative, and hence susceptible of being added to or subtracted from the causal complex" (MacIver, 1964, p.94). Put differently, they cannot be "individually analyzed and assessed" (Fischer 1970, p.179). Not all the factors identified in this paper can be exported to other countries. Some "exportable" factors include government's macroeconomic linkage, higher emphasis on human capital development and the formulation of right strategy that fits to the changed circumstances.

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back to index

Abstract

Using historical analysis, the authors examine the determinants of Internet and e-commerce diffusion loci in Chinese Taipei and Hong Kong. Structural and contextual factors such as seacoast locations, high emphasis on R&D and human capital development and rapid advancement in undersea cable technology favor Internet development in both economies. Hong Kong's history of formulating appropriate strategy to adapt to new situations, higher income and denser population explain its higher Internet penetration than Chinese Taipei. The vibrant semi-conductor and PC industries, an outcome of the macroeconomic linkages provided by the government, and the network of its companies with the Silicon Valley, on the other hand, are the critical factors that made Chinese Taipei a technology creator and a global leader in B2B e-commerce.

back to index

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back to index

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back to index

Conference Sessions

Country / Region

Tuesday, 15 January 2002
1430–1600
Honolulu Suite

T.2.3 South Asia

Chair:
GEORGE LISSANDRELLO, President and COO, Infoserve International, Inc., *USA*

T.2.3.1 The New Technologies, Business Ventures and Encouraging Telecom Policies in India (View Abstract)

SOWRI RAJAN KOMANDUR, Head, Telecom Division, India Telecom, *India*

T.2.3.2 Telecommunications Policy Under Strain: Toward Universal Access in India (View Abstract)

HEATHER HUDSON, Professor & Director, Telecommunications Management and Policy Program, University of San Francisco, *USA*

T.2.3.3 Basket Case to Emerging Tiger (View Abstract)

FAZLUR RAHMAN, Chairman, South Asia Multi Media and FQM FAROOQ, *Bangladesh*

back to sessions

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back to index

The New Technologies, Business Ventures and Encouraging Telecom Policies in India

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View Abstract

Introduction

With the privatisation process gathering stem and state owned companies hitting the stock market, the Indian capital market has the potential to be worth $1 trillion by 2005 according to Chairman, Morgan Stanley Dean Witter. According to him the biggest advantage India has, compared to China and other countries in the west is that it is not a hardware economy. Intellectual capital and software development is India's biggest strength.

In India, the state Government of Andhra Pradesh continues to be on a roll. It would be formulating a new policy and bring in legislation for infrastructure development and to make the state a destination for global investors. We find the Govt's strong commitment to invite private sector participation for infrastructure development.

New Technologies

New technologies like data over cable and Net over cable will bring convergence into India where the market is readying. The cable TV industry is seeing phenomenal growth. The demand for set-top boxes is likely to grow in India. There is interest in India in technologies like Blue-tooth, 3G and GSM though they are in their infancy even globally. Internet access is a high growth area and the local manufacturers are likely to work toward making IT products cost effective.

GPRS provides end to end packet switching capability from mobile terminal upwards enhancing GSM data services significantly, especially for bursty internet /intranet traffic. The theoretical limit of GPRS Data rates are 115-144 KBPs. BPL Mobile is one of the first networks in India to provide a GPRS network. The next step in evolution is 3G - enhanced Data rates for GSM Evolution (EDGE). EDGE can be used as a means to provide higher bit rates in any time division multiple access network. EDGE will allow operators to use existing GSM radio spectrum to offer wireless multimedia IP based applications at speeds of 384 KBPs per channel. As more and more demand for data rates build up. ETSI and ITU-V came to formulate 3G or UMTS or IMT 2000. In 3G the radio spectrum used is in 2GHz band and the air interface used is Wide band Code Division Multiple Access (WCDMA). The services offered by 3G networks are expected to be mainly multimedia. Already work is commenced for 4G networks.

The idea behind 3G was to offer subscribers exciting new features such as video clips and high speed Internet access. Operators have spent vast sums around $125 billion in Europe alone, buying licenses to enable them to offer services. Previous technologies such as GSM, WAP and GPRS were all late as well NTTDOCO the wireless arm of NTT, which was supposed to launch the works first 3G service in Japan has blamed software glitches for its decision to delay the launch until October. As planned, instead of launching next year, most 3G operators are now talking about 2003.

Regulators are also being pressed to relax other aspects of license terms. In Germany, for example the operators are required to provide 3G coverage for 25 percent of population by the year and of 2003 and 50 percent by the end of 2005. In Spain the terms have been modified to allow delay until 2002. Amid all this uncertainty, it is clear that it will be several years before 3G becomes widely available.

3G Licenses

3G licenses are being auctioned for billions of dollars in the developed world. In India, the circumstances are different. Mobile phones are new to the country. The Internet penetration in the country is very low. The number of users for Wireless Internet access will be relatively small percentage of the total Internet users and the market will be relatively small. The demand for 3G will be driven by wireless Internet access. No doubt 3G will help Indian business because access speeds to the Internet will be many times faster than the traditional Internet access. The policy framework that makes 3G available to service providers who will provide broadband services to business, should encourage competition at competitive prices.

The concepts of 3G systems are currently being developed across the industry. The acceptance by DOT of TRAI's recommendations for limited mobility services and the bids for entry of a fourth cellular operator are bound to have a possible impact on growth of cellular services in India. The private operators are also gearing up to launch limited mobility services based on CDMA. According to COAI, the number of cellular subscribers would surpass fixed line subscribers by 2008. The total cellular subscribers now stand at 3 millions. The service providers are MTNL, BSNL, Bharati, Essar, Hutchinson, BPL Mobile, Spice Telecom, Reliance, and Tata Cellular. The equipment vendors are Lucent, Siemens, Nokia, Ericsson, Alcatel, Motorola and Midas.

US Telecom major Motorola is in discussions with Reliance, Bharathi and Tata's for setting up the infrastructure for their CDMA networks. Motorola's new big push, GPRS which is to bring in applications into mobiles earlier than 3G, is also set for a roll out with Hutchinson for rolling out the GPRS services in Mumbai and Delhi. India and China are big markets and most of the companies expect 100 percent growth in the next five years. In the next five years, the total consumer base is likely to go upto 50 million alone for GSM and CDMA services and a big increase is expected in data services on the CDMA and GSM networks rather than just voice at present. Motorola Software Center in Banglore is working on applications for these services and also on delivering solutions for operators when 3G arrives and to facilitate the upgrading of the networks. Since 3G is taking some more time to implement, the idea is to use 2.5G technology in GPRS rather waiting for 3G. World wide CDMA based cellular services are offered on parts frequency spectrum close to 800MHZ and 1900MHZ, GSM-based services operate on 900 and 1800 MHZ. India has adopted the plan of linking the allocation of the spectrum to the physical roll out of the network. This method has been adopted because the introduction of CDMA services has become linked to basic operators offering limited mobility.

Most Indian operators adopted GSM technology for 2G Cellular operations and CDMA technology for wireless-in-local loop. India expects as many as 75 GSM mobile net works by 2002.Most of 2G networks are looking forward for migration to 3G Services as smoothly as possible.

Bharti, Hutchinson and BPL-Batata are in the race for the number position in the Cellular industry. Bharti is a bidder in four circles. BPL-Batata has submitted bids for three circles through Birla AT & T. the BPL-Birla-AT & T - Tata alliance has emerged as the largest cellular combine in the country with 9.85 lakh subscribers at the end of June, 2001. It followed by Hutchinson at 8.31 lakh and a third slot is Bharti with 8.5 lakhs subscribers. Escotel is at the fourth with 3.33 lakh subscribers followed by the Modis spice in Karnataka and Punjab at 3.02 lakh subscribers. Reliance follows by way behind with 2.23 lakh subscribers. The state owned MTNL has just about 18,640 subscribers in Delhi and Mumbai. The BSNL is moving ahead rapidly with its plans to add 1.5M Cellular Subscribers.

Internet

The internet service providers Association of India (ISPAI) is trying to formulate an agreement that defines the procedure for interconnection and peering among ISP's for better internet traffic management. The agreement is expected to define rules for standardization of tariffs among ISPs for bringing and selling bandwidths. This will be submitted to TRAI for approval. The ISPAI also is approaching the development council for telecom, a body comprising of BSNL, MTNL, ASSOCHAM, FICCI, CII, and DoT to arrive at a revenue sharing with basic telecom service operators.

Even with 4 billion internet addresses, current web technology is expected to be swamped 2005 amid a flood of devices ranging from third generation phones to refrigerators and cars that will need an address to link the web. It is predicted by experts that the world's 480 million mobile phone users to day will top 1 billion by 2003, while internet users will surge from 400 million to-day to 1 billion by 2005 and 3 billion by 2010. Those devices are in addition to an estimated 1 billion cars by 2010 and billions of Internet appliances forecast for the future. Internet protocol version 6

(1 PV 6) offers salvation from the coming crunch with enough addresses. It would replace to-day's 1 PV4 and skip 1 PV5. The new standard is seen as critical to maintain Europe's competitiveness in the third-generation or 3 G wireless market. North America not only controls 74 percent of the world's Internet addresses, but it is at least two years away from 3G wireless networks.

There are in the main four methods of providing higher bandwidth to the Internet surfer:

- Along existing copper or fibre optic telephone lines using new technology like digital subscriber line (DSL).
- Along digital-all the way lines like Integrated Services digital network (ISDN)
- Through the Cable TV
- Direct to home (DTH) through satellites linking to a private dish antenna in the back yard.

However, broadband in consumer parlance means a bandwidth of between 25 to 100 times better than what is now achieved by Plain Old Telephone System (POTS) with 56 KBPS at best. DSL will work as long as communication network is predominantly fibre optic. One popular DSL technique is called ADSL. This provides faster speeds of download than upload.

The other bandwidth through Cable TV network has its attractions in countries like India where thousands of homes do not own a telephone or a PC nevertheless have a TV set and Cable connection. There are an estimated 35 million Cable TV connections in India against 7 lakh telephone Internet connections.

The BSNL has completed the first phase of National Internet Backbone. The DoT has planned for the internet backbone (NIB) and the phase one of the project is close to completion. The NIB network is expected to provide easy Internet Access points for BSNL internet service and private internet service providers. The backbone is expected to interconnect the service the far-flung service provider to take them to their own international gateways or VSNL's gateways. The backbone also is expected to serve as a facilitator for ISP to ISP interconnection within the country. Even players like Reliance and Bharti are also trying to build. The backbone will have a capacity of 8 MBPS and will go up to 155 MBPs. Six of its nodes will have connectivity to international gateway with connectivity speed of 34 MBPS. All the secondary switching areas of BSNL will be connected to backbone. The NIB has a three tier structure. The first tier consists of 14 stations with high capacity digital trunks with the highest level of redundancy. The second tier will have 8 stations and the third tier will have 406 stations with lesser access capacities under the second phase the capacity among the 4 metros will go upto 5.5 gbps. There are plans to increase this capacity to 40 gbps by the year 2002. VSNL, India's International telecommunication service provider has a contracted band width of 1 Gb for its international operations and 1.4Gb for its domestic operations. Out of the total of 1,500 links in the country, 200 links are being used for internet access via radio links.

Reliance Infocom, the lead company of Reliance group plans to connect the top 115 cities in the country through its 60,000 route kilometer broadband network. The capital outlay, excluding license fees, for the company is presently estimated at Rs. 25,000 crore in the next three to five years. This is the first private sector player to be awarded LOI for national long distance services and also bogged LOIs for 18 telecom circles to provide basic services. The broadband network will cover all the southern states in addition to states like Maharashtra, Delhi, West Bengal, Gujarat, Rajasthan, Haryana, Uttar Pradesh, Madhya Pradesh and Orissa, out of 60,000 Km network, work on 13,000 Km length is nearing completion.

Tata Internet Services (TISL), a company promoted by Tata Industries that markets internet services under the brand Tata Nova is in talks with smaller ISPs to extend to reach to B and C class towns across the country. TISL also is taking to infrastructure, basic and cellular service providers and is considering the prospect of leasing and hiring infrastructure from them on a revenue sharing basis. The TISL claims to have about 30 corporate customers and 12,000 retail subscribers in four cities that include Mumbai, Bangalore, Hyderabad and Chennai in a period of 2 months. Value added services such as network management services, messaging solutions, disaster recover solutions, and backup and recovery solutions will form part of the company's data centre business services.

Worldtel chosen Reliance group as its Indian partner for optical fibre back bone project. Originally planned for Tamil Nadu, Worldtel subsequently expanded its plans to link southern states through a high bandwidth infrastructure backbone and also extend it to other states. It planned to offer the service in Andhra Pradesh, Karnataka, Kerala, Gujarat, Maharashtra and West Bengal.

The Bharti is building a 20,000 Km fibre optic network linking 27 cities. The company already has a 4000 Km network in place in Madhya Pradesh and is building a Fibre optic link between Mumbai and Chennai. Fibre optic Networks are in place in Delhi and parts of Haryana as well.

The total international-long-distance market in India right now is Rs. 4,900 crore. Merrill Lynch expects revenues of Rs. 1,000 Crores for reliance in Fiscal 20001-03, if it is not able to buy VSNL. The internal estimates reportedly project revenues of Rs. 30,000 Crores. Which is roughly a third of the total telecommunication market demand by fiscal 2004-05. The annual total telecommunications market is around Rs. 42,000 crore. Such high assumptions are based on a rapid take-off in traffic, particularly data traffic.

Reliance Infocom is setting up an advanced IP based intelligent next generation network with terabit bandwidth. The Reliance Optic Fibre network involves an investment of Rs. 20,000 crores and will put India on the international information highway. This network would convey communication, information and entertainment technologies by combining the vision, resources and management skills of Reliance with the latest technology from world leaders in Communication.

The cabinet approved to allow Rail Tel Corporation of India to enter into joint venture agreements with public sector undertakings of the Ministry of communications and Railways. The Indian Railways be allowed to hold 51 percent equity stake in Railtel, while the balance would be allotted to joint-venture partners.

According to Mc Kinsey business plan for Railtel the subsidiary would need an investment of Rs. 1,649 crore over a period of six years to build the network back bone across a 33,000 Km. Route. Investments would be required in the areas of optic-fiber network, electronics and license - fee payments as when Railtel applied for the NLDO license.

VSAT Service

Very Small Aperture Terminal (VSAT) service providers would now be able to offer services in KU-band. The guidelines for VSAT services, announced by the DoT, envisage an entry fee of Rs. 30 lakh for the new operators and an revenue share of 10 per cent. In order to facilitate high speed data communication, the operators have been allowed to offer a data transmission speed of 512 KBPS. Earlier this was limited to 64 KBPS. The license fees for the companies acquiring VSAT licenses for their captive use will be required to pay a fee of Rs. 1,600 per annum per VSAT subject to a minimum of Rs. 16 lakh per annum. The licenses will be awarded for a period of 20 years, extendible by 10 years. The guidelines also not permit the VSAT operators to interconnect with the public switched Telephone network (PSTN) for voice and services.

Broadband Ventures

Lager players like Bharti enterprises and Reliance Industries and second ring contenders like BSES. Telecom and Dishnet DSL have taken note of the warning signals and done a rethink on their original strategies. Though the backbone is in place, owning the subscriber to get the return out of huge investments in putting up the network is important. BPL, Euron, and spectra net have gone low profile, on their broadband plans. The infrastructure sector is dominated by public sector giants like BSNL, Gas authority of India (GAIL) and Indian Railways. Between them they have 2,37,200 Kms of Fibre in the ground. The BSNL alone has 2,30,000 Kms in place. In India anything over 64 KBPS is loosely defined as broadband though it is universally acknowledged that a minimum bandwidth of 2 MBPS is required.

In the year 2002, two large players, namely Bharti and Reliance will be launching their domestic long distance service in the country along with basic services in a number of State Circles. These players are building state-of-the-art broad band network in 250 cities by laying infrastructure in different cities. These two will be a tough competition for BSNL in future. The BSNL has been corporatised and it is the largest incumbent in the country with a turnover of Rs.23,034 crores in 2000-01. It may take another two years before the government divests its security for BSNL. More value added services, coupled with limited mobility service promise to make basic service more viable.

At present VSNL offers 237 international destinations and operates seven international gateways in India. International long distance telephony accounts for more than 90 per cent of VSNL revenue. VSNL is confident that even after deregulation, it will remain India's dominant provider of international telephone services. VSNL has invested heavily in technology and infrastructure and its assets are worth now Rs.24.13 billion.

ATM

ATM, which stands for a synchronous transfer mode, is a high speed connection- oriented data transfer technology that can transmit voice, video and data simultaneously through small, fixed length packets called cells. ATM differs from conventional modes of data transfer as its fast allowing speeds that surpass 2 Gbps. There is no wastage of bandwidth. An ATM network is scalable in terms of number of users and bandwidth. It can also accommodate existing applications. India's international telecom carrier and leading ISP, VSNL has floated a global tender for ATM switches. The company would be installing eight such switches with individual capacity upto 20 GBPS in various locations over India. The project aims to connect VSNLs international gateways through an ATM backbone network. VSNL's network today carries various kinds of traffic from voice to video-conferencing to data. Apart from managing its international leased lines, the company has to carry inter-gateway traffic on its networks and cope with video traffic from uplink sites in Hyderabad and Dehradun.

SDH

SDH or Synchronomous Digital Hierarchy is currently deployed world over and also by the DOT, which fails to scale beyond a certain point. Typically 2.5 GBSDH is what is deployed. It can go upto 10GB (1gbps = 1000Mbps). A higher rate SDH stream carries a number of lower rate SDH stream by interleaving them in time. This technique is called Time Division Multiplexing or TDM. For example 10gbps stream carries 64 "tributary" 155 mbps streams by transmitting one byte 8 (bits) from each tributary stream inturn. SDH is only one wave. DWDM has many waves and hence a more scalable technology. For example we can transmit many different 10gbps signals each using a laser transmitting at a different wave length, simultaneously over the same optical fibre. Today DWDM systems supporting 160 wave lengths transmitting at 10GBPS each are commercially available. Such a system has a capacity of 1.6 terabits per second. This is the equivalent of 25 million telephone calls, which means that the traffic resulting from all the phones in India can be carried on a single strand of fibre, even if all these phones are active simultaneously.

Networks that carry data, voice and broadcast media separately are being replaced by broadcast networks that can carry multiple types of content on the same media. Customers having access to broadband networks thus demand a common service provider for voice, data and video services leading to convergence across industries like IT (computer ISP and data com) telecom (voice) and media (broadcast and consumer electronics). Traditional consumption devices such as television PC and telephone, which have been catering to one type of content-either video, or voice or data, will now handle multiple data types and access multiple types of networks. Examples are mobile internet, digital set top boxes with internet voice capability. The need to access any content (voice, data, video) any where (location), any how (network, consumption device) and anytime is driving convergence phenomenon. The needs and expectation of consumers will increase and this will create a challenge and an opportunity for vendors in these spaces.

Data Centres

The Data Centre Industry in India is still in a very nascent stage. Companies setting up Data Centers in India.

Foreign	Indian
Intel	Sathyam Infoway

IBM	Reliance
Compaq	Mantraonline
Euron	Global Electronic Commerce
Exodus	Netmagicians
Intec Group	Wanland Data com
EMC Crop	
Comsat Max	
Network Applications	

ADSL defines how data can be transmitted between a users' premises and local telephone exchange over normal telephone wiring. The purpose of ADSL is to set high speed access to the internet. ADSL was originally devised as way of delivering digital television over telephone wires. Now the main use of ADSL exploits the analogue bandwidth that is potentially available in the wires that run from the user premises to the local exchange. ISDN runs at 64 Kbps or 128Kbps. ADSL can potentially download at 8 MBPS.

Indian telecom network is the ninth largest in the world with 3.6 crore telephones with a sustained growth. The number of internet connections shot up to 23 lakhs and the number of cell phones doubled to 36 lakhs within a year.

The growth of the internet has caused an exponential increase in the amount of data that is processed and transacted. This has given rise to data centres servers farms that carry out hosting of large volumes of corporated data along with providing functionality like datamining, data warehousing etc., Data storage services are expected to generate revenues worth Rs.6500 crores in 2008. Hitech habitats and tax benefits are important government initiatives to promote the services. The Government has recently released first set of terms and conditions that are broad-based and are aimed at liberalising the data centre operations in India. The international data centers will be permitted on IPLCs only and will cater to calls from foreign and PSTN. However no PSTN connectivity will be permitted at Indian end on Indian and even linking to any private or public network is not permitted for the IPLC, even if it is of the same organisation.

Switching in India

In India, the first private telephone exchange was setup in 1875. Calcutta was the first city to have a telephone exchange in 1852 when 50 lines Siemens exchange was installed. Common control switching was introduced in India in mid 1960's. Cross Bar accounted for 15 percent of the local network. Stored programme control (SPC) electronic exchange was put into service in Delhi in 1974. The country's first factory to make digital electronic switching equipment has been set up by Indian Telephone Industries LTD (ITI). The factory had technical collaboration with a French Firm Alca Tel-Thomson. The centre for

Development of Telematics (CDOT) was set up in India to develop advanced Communication Technology and products indigenously, to digitize India's telephone network and prepare for Integrated Services Digital Network (ISDN). The systems focus on Indian conditions like high traffic loads and low telephone density, busy hour attempts, high temperature and dusty environment and power supply problem.

Today the trend is towards IP networks and convergence of voice and data. There is a shift from circuit switching to packet switching. There is a shift towards software switching. There is an evolution of open standard. Today all switches can talk to each other through common signaling protocol. There is optical switching using fibre optics for basic switching function.

As technologies develop, bringing ever increasing business and consumer services, the current infrastructure is being pushed to its limits. This is due to the segmentation of the internet. As the broadband consumer connections increase in size and distinction, the infrastructure demands will expand significantly. In fact internet is composed of a series of separate fibre optic networks that are interconnected at a handful of points in the US and around the world. Core internet traffic is generally exchanged at dozen or so worldwide network access points. Internet service providers connect directly to backbone networks, or to larger ISPs with directions. But some of the providers are moving away to private peering in multiple locations.

We are noticing shift from a utility based business model of communication, in the backbone and city rings and other areas to a technology based model. Previously technologies were determined by the ITU on a centrally planned basis, but now technologies are determined in the market place. The combination of optical and IP Technologies are blending and hence we find most rapidly improving technologies. They make improvement in computing or processing information or storing information.

Only Lucent, Ericson, Seimens, Alcatel and the centre for Development of Telematics are the switching technologies finding place in India. CdoT has been licensing its technology liberally to a large number of Indian companies over the years. More than 11 companies are licensed to produce main automatic exchanges upto 40,000 lines and more than 30 are licensed to provide rural automatic exchanges of 100 to 200 lines.

In India the government operators DOT, MTNL, and VSNL are continuing to make large investments in expansion and technology upgrades. The ISP (Internet Service Provider) association of India is approaching Development Council for Telecom, a body comprising BSNL, MTNL, ASSOCHAM, FICCI to strike a revenue sharing deal with basic telecom service operators.

The policy initiatives by the Government of India are broad based and are aimed at liberalizing the call center operations in India. The cell center (domestic and international) are permitted on a non-exclusive basis. International cell centers are permitted on international public leased circuit and will cater to calls from foreign end PSTN, but no PSTN connectivity is permitted at Indian end. The domestic call centers will have PSTN connectivity at one end or both ends or at multi points.

The special state Government policies and the trust given by the National IT task force and Naascom are further helping the growth of IT enabled services industries in India. Thus the potential for India is very high in the sector of IT enabled services.

The group on IT and Telecom (GOT-IT), which met here to discuss the convergence communication, bill 2000 decided in favour of two bureaus under the super regulator one to regulate content and the other to regulate carriage.

IT Enabled Services

These services are expected to grow 15 fold by 2008, which provide enormous opportunities to the Indian Players. As per NASSCOM report, the estimated revenue for IT enabled services is likely to grow from Rs.2,400 Crores (Indian rupees) to Rs.81,000 crores by 2008 and the estimated market may amount to $142 billion approximately. The factors that are driving the growth of IT enables services are outlocation, outsourcing and world wide web. Obtaining services outside the national boundaries of a company is called outlocation and obtaining services from another organisation or third party is called outsourcing. The main organisational configuration include owning a subsidiary, a joint venture through FDI and contract out.

Currently Call Centres and animation are largest opportunities accounting for 85 percent of the IT enabled services. There are also other important segments like Medical Transcription, Back Office Operations, Revenue Accounting, Insurance Claims Processing, Legal Data bases, Content development Payroll, Logistics management, HR Services Network Management and Web Services.

The National Task Force on IT and software development recommends establishment of Hi-tech Habitats. Call Centres are permitted under software technology Park Scheme.

In view of the recent changes in the world economy, the Indian players are trying to diversify into European and Japanese markets. They are trying to leverage partnership of US companies having presence in the European markets to gain a foot hold there. To bring about a growth in IT, the government is trying to improve country's digital infrastructure and further liberalise the telecom sector.

The capacity of a Fibre-Optic Cable (OFC) is mind-boggling. To-day's technology allows an OFC to carry 1.6 terabits (1000 gigabits) per second. A fibre alone can carry, at to-day's technology, 160 data streams and each stream has a capacity of 10 gigabits.

Networking and Internet Business Ventures

Seimens Software Communications is concentrating on telecommunication management systems, developing software tools for Call Centre Solutions. Most of the work is done for the public switching division of Siemens, for access network, mobile network.

- Tellabes Software development Centre in India is the first in Asia-Pacific. It is undertaking communication software development.

Ericsson communications focuses on datacom and solutions for ISPs, virtual private networks for corporate access platform for narrowband and broadband communications, voice over IP and Internet over cable.

Infosys, Wipro technologies, Tata Consultancy Services(TCS) carried out work for Nortal, Lucent etc,. The HCL technologies has concentrated on internet and e-commerce related solutions in the Indian IT service industry. It is also developing embedded software for next generation multimedia cell phones. They are developing image modules for image conversion, encoding / decoding etc.

British Telecommunications has formed a joint venture with Mahindra (40:60) for telecom software development and has established development centres at Mumbai, Pune and London over the years the company had good income. This year (2000-2001), the company targetted a turnover of Rs.4,500 million.

Hughes software system is another leading company in communications software. It has developed software for specific requirement of Hughes Network system in the areas of VSAT -based networks, voice and cellular telephony and packet switching. Hughes is concentrating on high growth areas of internet, voice over Internet Protocol, wireless application protocol and broadband. Huges is trying to be one stop shop for voice over IP.

Motorola has established its subsidiary, Motorola India Electronics Limited (MICL) in India. The MICL is working on software for third generation (3G) telecom products.
The Lucent Technologies with its R&D centres at Pune, Banglore and Hyderabad is working on wireless technologies, (GSM), wireless in local loop and 3G, switching technologies

India is emerging as a crucial centre for developing software for the global telecom industry. Leading telecom companies of the world like BT, Hughes Network Systems, Tellabs, Ericson, Lucent, Motorola and Alcatel are working with India as their base. The export of telecom software during the year 1998-99 from India was to the tune of $275 million out of the total exports of $ 2.65 billion. The software thus exported was system software related to switching and wireless technologies. This software was carried out by subsidiaries of foreign telecom companies or as a contract work by leading Indian Software Companies. It is viewed by the National Association of Software and Service companies of India (NASSCOM) as per the study made by them that telecom software exports from India would increase to $3 billion by 2002-03. The study has indicated that opportunities are there in embedded system software, protocol development, mobile internet solutions and intelligent services. The AT&T, Alcatel. Hughes, BT, Ericsson, Motorola, Seimens have been outsourcing their software requirements through 100 percent subsidiaries or alliances with Indian software companies such as Infosys, TCS and WIPRO.

Telecom Policy Issues - Market Position

Kerala tops the waiting lines with as many as 8 lakhs applications pending for connections. Four states, Haryana, Punjab, Tamil Nadu, and Kerala and the Union territories of Pondicherry and Andaman and Nicobar have achieved complete telecom coverage. Sanchar Dhabas were planned to be set up all over the country, which will offer the complete spectrum of telecom services including Net access and function according to the standards set by the universal standards obligation fund. On the rural side still 2 lakh villages are yet to get telecom coverage of the 6.07 lakh villages in the country 3.80 lakh villages have been tele linked.

The liberalisation issues set in motion by the Government are (1) unrestricted entry for Basic telephone service (2) Limited mobility by hand held sets using wireless local loop(WLL) technology (3) unrestricted entry in National long distance service (4) 100% FDI in ISPs without gateway (5) 74% FDI in ISPs with gateway.

The goals are telephone for all at affordable prices by 2002, achieve 7% tele density by 2005, achieve 15% tele density by 2010, Internet dhabas in all block head quarters. Infact innovative services rather than infrastructure will drive and differentiate the market. All service providers will have to enter into market requirements in a packet environment. Converged networks will ensure optimisation of infrastructure usage with the same bandwidth carrying all traffic.

Internet providers in India are rapidly working to boost infrastructure in a market showing the highest growth rates in Asia- Pacific region. Setting up dedicated internet gateways will enable India's Internet access providers to increase and improve the quality of bandwidth or network capacity and help attract more customers in the long run. Internet service providers in India currently buy bandwidth from state run VSNL but a few of them launched gateways after the government ended VSNL monopoly in June 1999.

The Indian mobile market is at the threshold of 3 million subscribers and the base is projected to increase to 25 million in 5 years. The existing GSM networks will grow with the participation of players like DOT, VSNL and MTNL and this will increase the market in a big way. Regulatory problems are also being sorted out and the expanding market needs to be tapped even as competition hots up. Mobile usage will increase in larger city areas and smaller Metros like Hyderabad.

The deployment of general packet radio service (GPRS) along with 2.5 G will come as on overlay on the existing networks. GPRS provides the first implementation of an overlay packet data network over existing GSM network bringing true internet protocol (IP) capacity and enabling connection to a wide range of Public and private data networks using industry standard protocols. Around 10-15% who have data requirements will use GPRS networks. A bulk of these will come from cities. A combination of the wireless and local networks can provide near mobile services. The second tier will be for limited mobile service users and will go for the CDMA network as opposed to GSM, which has a thin wireless and local loop. CDMA has more spectrum as opposed to GSM where spectrum is likely to get exhausted. CDMA will offer fixed broadband wireless access on a point to multipoint basis. This could include high speed wireless access to corporate users like ISPs, call centres and data centres. CDMA operators will be able to offer higher speed packet data initially and can later expand services over IP. New technology like blue tooth will open up arena for new mobile devices. Recently a fourth operator has been allowed in GSM networks with the government as third operator.

Ericsson has signed an MOU with Indian Telephone Industries (ITI) to jointly address the voice over IP (VOIP) market. The company will provide the equipment while ITI will provide the services associated with it. The target customers are all service providers such as DOT, MTNL, VSNL and other private companies Ericsson's IP telephony solutions enable phone-to-phone, fax to fax, PC to phone, PC to PC services over IP networks. The advancements in technology are pushing handsets markers to upgrade them with GPRS and WAP standards. Nokia, Ericsson and Motorola are competing with each other.

With the Indian Government opening up the telecom sector to private players, industry hopes for voice over cable to the given go-ahead in the convergence bill. Conventional voice is an analog signal converted to digital and transported across the medium, which is compression and decompression. In short it is energy converted to signal. Compression, expansion and conversion are also similar in a VIOP environment. But in a conventional TDM setup connections are made from start to end points using 64 kilobits channel for communication. With the advancement of digital signaling techniques, the 64Kbps requirement is brought down to around 8 Kbps. 64 Kbps per second and to end including TDM switches. Blocking of that space. Advancement in compression technique for voice channel, there is more efficient use of channel by statistical multiplexing multiplevoices to go across the same channel to multiple destinations. And that is where IP or packet based transmission comes in. Voice is converted to compressed digital signals and sent as a data packets across the multiple channels. Two things happen in this conversion. There can be an effect on quality of voice replication and faster techniques for compression and decompression will be needed at both ends. Now there is advanced technology that takes care of compression and decompression while maintaining quality of voice. Globally with internet, the dependence on data is growing for business and growth of data traffic over voice traffic is considerable. A packetised environment has the ability to integrate multiple modes of access into the network. Broadband connectivity like cable, wireless, and DSL into narrow band networks become possible at the users end without too much dependence on the vendors' switches. A packet system uses open architecture for transportation, compression and signaling standards for calls. The old TDM systems use proprietary standards. Now the end users and eco-system partners can develop applications using packetised architecture, which is a benefit in software development skills.

Internet is the key driver in the growth of telecoms industry in terms of multimedia content and e-business. Voice still in Asia comprises the majority of enterprises communication. on average Asian users spend more on voice communications. It is mostly traditional circuit switched. But VOIP is also coming up. IP eliminates the barrier of distance and it makes easier to develop and integrate voice / data convergence applications and services for enterprises.

Today's telephone network provides a high quality service at a continually decreasing cost and is well suited to private point-to-point conversations. Voice enabled web applications services are integrated with existing web functions such as community chat, business conferencing online customer service, live web events, on live greeting cards etc. some of the applications for web based VOIP services are (1) a live voice conversation with e-business representative over a dial up modem connection (2) joining a multipoint web-based sales conference from cellular phone (3) call centre agents answer customer calls that originate from PCs etc. and terminate through PSTN to the existing customer service on the web requires a real time solution to best address the needs of the customer. Therefore the e-tailers, manufacturers etc. that offer services via web are beginning to deploy real-time voice communication over the internet (VOIP). Integrating VOIP into e-commerce site can be easy by adding 15 to 20 lines of HTML code. This eliminates the need for e-commerce sites to deploy a complicated application and ensures high quality service for consumer.

The bandwidth availability, service reliability and also how IP telephony will work with existing equipment like PBX are some of the issues corporations are facing. Many corporations are thinking ways to augment existing equipment for IP telephony. It means fixing an existing PBX with an adjacent box that diverts traffic to gateways to go through an intranet or the internet. Lucent and others are working to develop PBXs that have built-in IP telephony gateway functionality. CISCO Systems Inc are integrating IP telephony capabilities into routers. On the public network side, Siemens Telecom Networks and other companies are planning to outfit their central office switches with IP telephone gateway cards. Some companies are working on to integrate IP telephony gateway with PBX equipment. There is also a drive toward moving PBX functionality to servers so that enhanced functionality can be added more easily. Some companies are offering server-based IP-PBX. The IP-PBX replaces line interface card and circuit switch card with packet switched network. PC applications such as Net meeting, Ethernet phone etc. available instead of trunk cards, gateway. Enterprise IP telephony applications are the call center gateway, CT server, and enterprise WAN. Thus IP networks will merge the transmission of voice, data and video and permit consumers to enjoy the multimedia capabilities on the telecommunications systems.

Convergence and Competition

India is one of the largest and fastest deregulating markets and it has entered a new stage in sector reforms. The Government of India also recognised the need for competition to serve the consumers the best. The reforms were driven for the last 10 years keeping in mind the interests of licensed private operators. As we watch the decisions given by the government recently, we find the balance shifted to the long neglected consumer. Now the principle in unrestricted entry and unlimited competition in all types of telecom services. The BSNL, a huge corporation and biggest in the country is waiting for the convergence bill through opening up of international long distance service, looking into 3G mobile license option. The internet telephony is linked to tariff re-balancing and opening up of international long distance.

The essential features of convergence bill is that there is one super regulator covering both telecom and broad casting. The regulator also will give licenses.

In the era of convergence, for regulating the emerging telecom scene, the consumer is the most important person. All policies benefit only consumer of telecom services. The technology united by convergence should not be divided by licenses. There should be plurality players in the market place and even plurality when it comes to the quality and price of telecom services. There should be commitments by the government, licensing agency, regulatory authority and financial commitments entered into by the licensees.

The government has finalised the competition bill of 2001 and it will be introduced in the parliament. The salient features of the bill cover prohibition of anti-competitive agreements, prohibition of abuse of dominance, regulation of combinations (acquisitions, mergers and amalgamations of certain size), establishment of competition commission of India and definition of its functions and powers.

The communication convergence bill 2001 in the tallest draft. The proposed convergence law aims to promote, facilitate and develop in an orderly manner the carriage and content of communications, including telecommunications, multi-media. It also aims to establish an autonomous commission to regulate all forms of communications. The new law mandates that no one shall use any part of the spectrum without assignment from Central Government or the statutory body under new law, namely, the Communications Commission of India.

The Communications Commission of India (CCI) seeks to establish an open licensing policy, ensure a level playing field for all operators and promote equitable interconnection across various networks. Once the communication convergence Act comes into force, the TRAI will be abolished. The Cable Television Network Act of 1995 will also become non-existent, unlike the TRAI, the CCI will have powers to issue license to service providers as also allocate and manage wireless spectrum.

TELECOM Plans - 2000-2010

The New Perspective Plan 2000-2010 outlines government projections, targets and objectives for the telecom sector.

Perspective Plan 2000-2010

Taking into account the liberalization policies of the government through the New Telecom Policy and various objectives and targets set therein, it had become necessary to frame a New Prospective Plan that would cover a period up to the year 2010, hence the plan.

Objectives of the Perspective Plan

Consolidation of the network and maintaining high quality of service comparable to international standards is the key aim of the plan. Other objectives of the Perspective Plan are:

- The telephone connection shall be provided on demand and it shall be sustained.
- The network shall be made fully digital. All the technologically obsolete analog exchanges will be replaced with digital exchanges.
- To provide digital transmission links upto all SDCAs during the Ninth Plan period.
- Digital connectivity shall be made available to all the exchanges by 2007.
- Extensive use of optical fiber system in the local, junction, and long distance network so as to make available sufficient bandwidth for the spread of Internet and information technology.

- ISDN services shall be extended to all the district headquarters, subject to demand.
- To provide Intelligent Network Services, progressively, all over the country.
- To set up Internet nodes, progressively, up to district headquarters level.
- Upgrading existing STD/ISD PCOs to full-fledged Public Tele-Info Centres (PTICS) for supporting multimedia capability and Internet access.
- Replacement of life expired, analog coaxial and radio systems.
- Introduction of wireless technology (supporting Internet access) and optical fiber technology in subscriber loop will be gradually increased.
- Introduction of latest telecom services like national directory enquiry, computerization etc.

TAX capacity expected by March 2000 is 18.68 lakh lines. This will be augmented every year to make the subscriber trunk dialing facility to all the telephone exchanges and subscribers. The National Telecom Policy envisaged that in urban areas PCOs should be provided for every 500 persons by 1997. This overall target was achieved in March, 1999. As a rough estimate, the urban population is likely to reach 36.8 crore by the year 2010. However, since the telephone density in urban areas also improves, the requirement of additional urban PCOs will be comparatively loss. And so, PCOs will be made available on demand. For this it is envisaged to add about 6 lakh urban PCOs during 2000-2010 and the status as on March 31, 2010 is expected to be 12 lakh PCOs. The total investments for 2001-2002 would be around Rs.40,000 crores by BSNL.

Conclusion

India holds immense business and investment potential in a number of telecom segments, though the process of deregulation started late. The country of course needs more deregulation and mature policies and better infrastructure to sustain levels of growth in telecommunications.

The communication software segment is expected to be the fastest and most profitable segment of the Indian software industry in 2001-2005. The private long distance and basic telephone operators, third and fourth cellular operators would propel the domestic market.

India has just liberalised its licensing reforms for the national long distance service. The bandwidth provider, if acquires a NLD license, will be in a position to offer calls across the sub-continent at competitive rates. The international voice telephony is stated to open by April 2002 and also the internet telephony competition and urge to survive will force telecom operators to try and bridge the digital divide. Convergence will provide an additional impetus.

Thus the future prospects of the business ventures in the telecom sector taking advantage of the policies and new technologies are bright in India.

back to index

Abstract

In this paper, we find an account of the new technologies taking ground in Indian Telecom Sector. The policies of the government contributing for development of sector with bright prospects for private business ventures in telecom and information technology are highlighted.

back to index

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Dr. Sowri Rajan Komandur has got extensive experience for about 30 years in the areas of planning, execution and management of Telecommunications in India. He is associated with projects relating to Circuit Switching Telephony, Rural Communications, Transmission Systems and Value Added Services. He is also a research oriented executive and contributed a number of papers in National and International Magazines and conferences. His topics for research are Telecom Planning, Telecom Policy and Regulation. He is having wide International exposure due to his frequent participation at various International fora.

He holds a degree in Telecommunications, a post graduate degree in Mathematical Economics and Ph.D. Degree in Urban Economics and Information Technology. He wants to contribute to telecommunications by his presentations.

1. Trained at USTTI, USA on UNESCO Fellowship in 1984.
2. Chairperson of a Technical session on "Telecom Planning", at annual conference of Pacific Telecommunication Council (USA) in Honolulu, in 1992.
3. Chairperson of discussion group on Satellite Communications at Annual PTC conference (USA) in Honolulu, in 1994.
4. Participated in a number of workshops and seminars at Annual PTC conference in Honolulu in 1996.
5. Invited as a speaker at World Telecom Forum, Geneva by ITU in 1995 Oct. and a paper on "Telecom Sector Restructuring Policy, Implications in Developing and Developed Countries - Present Trend in India" - was presented.
6. Participated in Communic Asia 1996 International conference in Singapore and spoke on "Telecommunications and Social Dimensions".
7. Participated in Annual PTC Conference in Honolulu in 1997 by taking part in various workshops and seminars.
8. Participated in International Conference on Advanced Communication and Competition (Asia-Pacific) at Bali in Indonesia in March, 1997 and spoke on "Advanced Communications and Competition in India".
9. Participated in International Conference Telecom Malaysia 1997 at Kaulalampur in November 1997 and presented a paper on "The importance of Security measures for data transmission in Telecommunications Network".

10. Participated in a number of seminars and workshops at Pacific Telecommunications. Annual Conference in January 1998 at Honolulu, U.S.A.
11. Speaker at Asia-Pacific Fibre Optics 1998 conference in October 1998, the topic is "Fibre Optics-Indian Context" at Singapore.
12. Speaker at the specialist session on Information Technology at "Technology summit and Technology Platform"S in October 1998 in New Delhi as organised by confederation of Indian Industry.
13. Speaker at Pacific Telecommunication Council's Conference at Honolulu (USA) in January 1999, on the topic: "Telecommunications in India and Challenges for growth".
14. Speaker / Published paper at International Conference on Computer Communication 1999 (TOKYO) in September 1999. "The Indian Telecom Sector - Private Sector Initiative - Regulation and Government".
15. Participant World Bank, Washington, D.C. Symposium "Network Economy - Global Information Infrastructure" from September 1999 to October 1999.
16. Presented paper at ITS (International Telecommunications Society) Biannual Conference July2-5, 2K held in Buenos Aires, Argentina, Topic being "The Telecom Policy of India - Globalisation and Global Information Society".
17. Invited to participate at the Info Dev Symposium of World Bank "Information and Communication Technologies for poverty reduction" in October, 2000 at Egypt.
18. Listed in Asia's 'Who-is-Who? 1990' and 'The Man of the year 1998' by the American Biographic Institute (ABI) USA.
19. Invited for Infodev Symposium at World Bank Washington to be held in December, 2001.

back to index

Telecommunications Policy Under Strain: Toward Universal Access in India

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View Abstract

1. Current Status of Indian Telecommunications

1.1. Access and Goals

India presents daunting challenges, with its population now exceeding 1 billion, 24 languages spoken by more than one million people, and more than 600,000 villages. Current teledensity in India is estimated at 2.2 to 2.8 lines per 100; in rural areas it is only .4, or 4 lines per 1000.[2]

In the 1990s, India began an ambitious program to restructure the telecommunications sector, establishing a regulator, and auctioning licenses for a second operator in each region. In 1999, further reforms were announced in the New Telecom Policy (NTP). NTP-99 has set targets of national teledensity of 7 percent by the year 2005, and 15 per 100 by 2010. Further, it has specified the following universal service objectives:

- provide voice and low speed data service to all the villages in the country by 2002;
- achieve Internet access for all district headquarters by 2000;
- achieve telephone on demand in urban and rural areas by 2002.[3]

In the year 2000, there were about 26 million DELs (district exchange lines).To achieve teledensity targets of 15 lines per 100 in urban areas and 4 lines per 100 in rural areas by 2010 will require an additional 148 million lines, or about 5.7 times as many lines as exist in the country in 2000.[4] In addition, in 1999, there was still a waiting list of about 4 million, which was not expected to diminish in the next few years, despite increased investment, because of increased demand stimulated by lower prices as well as population growth.

1.2. Regulation and Industry Structure

In 1997, the Telecommunications Regulatory Authority of India (TRAI) was established. Its responsibilities include setting tariffs, revenue sharing between government and private operators, dispute settlement and consumer protection. The Ministry of Communications' Department of Telecommunications (DOT) retained functions of licensing, setting technical standards, and spectrum management. NTP 1999 separated policy and licensing functions from operations, putting operations under the Department of Telecommunications Services (DTS), under the DOT. DTS was corporatized in October 2000, and is now known as BSNL.

For fixed local services, the country was divided into circles or service areas, with a Fixed Service Provider (FSP) granted a license to compete with the DTS in each area. For wireless services, two cellular operators were licensed in each area. The government authorized DOT's MTNL to be the third wireless operator. The TRAI has recommended that fourth cellular licenses be granted through a multistage bidding process.

Introduction of competition has been a struggle in India. Under the initial auction approach, many private operators were unable to arrange financing and complete projects because revenues fell short of projections. The government has revised its license fee structure from fixed fee to revenue sharing and imposed certain restrictions on license agreements. Other major steps to increase competition include:

- Domestic long distance has been liberalized. It had been a government monopoly.
- The international monopoly of VSNL is to end in 2002 instead of 2004. (Because VSNL is now 47% privately owned, the remainder being government held, it will be compensated for early termination of its monopoly.)[5]
- The ISP sector was liberalized in 2000. ISP's can now establish their own international gateways; previously, they had to use VSNL gateways.

2. Policy and Planning

2.1. The Larger the Network, the Greater its Value.

A basic rule of connectivity known as Metcalfe's Law is that the number of connections and thus the potential value of network increases almost as the square of its users. Theodore Vail, the early visionary president of AT&T, understood this principle, and realized that the Bell system could be much more than a connection for the nation's elite if it extended access at affordable prices throughout the society. The expanding network would generate more value for customers and more revenue for AT&T. (In contrast, many PTTs including India's DOT have grown slowly, keeping rates relatively high. They offered a service elites could afford, but did not provide the greater access that could have contributed to national economic growth as well as revenue for the PTT.)

Metcalfe's Law has relevance for policy as well, because it, in conjunction with the evidence of the role of telecommunications in socio-economic development[6], suggests that the policy makers' top priority should be ensuring availability and affordability of networks so that anyone who wants to use them can do so. Strategies designed to increase access rather than to protect incumbent operators are likely to contribute more to economic growth. India appears to be moving in the right direction, with the introduction of competition in wireless, domestic long distance and international services (as from 2002). However, such ongoing policies as the dominant position of DTS, the regulatory distinction between fixed and wireless services, and the banning of IP telephony are not fostering growth of the network (see discussion below).

2.2. Separating the Goals from the Means

Policy makers and regulators have a tendency to confuse the goals with the means. The role of the government should be to set goals and not to dictate how they should be achieved. An Indian example would be the requirement to upgrade village PCOs for data communications. Perhaps the goal should be stated as providing access to e-mail and the Internet in every village. The means may range from upgrading PCOs, to establishing public access in schools or community buildings, or in privately run business centers or tea shops. The government's role should simply be to ensure that reliable and affordable networks are available to each community.

2.3. Assuring Independence of the Regulator

The common wisdom is that regulators must be independent both of the industry and of the political process. In countries that began with the PTT model, the concern is to make the regulator independent from the PTT to avoid conflict of interest between operator and regulator, a necessity in a competitive environment where equitable rules must be set and enforced for all operators.

A distinction is also often made between policy making, typically carried out through a government ministry or department with responsibilities for telecommunications, and regulation, to be carried out by an Aindependent@ body, i.e. that is not related to the operator nor directly responsible to a minister. Yet in telecommunications, the distinction between regulation and policy quickly becomes blurred, because of the pace of technological change and market pressures in the communications industry.

It appears that India has made a different functional distinction in placing much more limited responsibility in TRAI as an adjudicator and arbitrator, while retaining responsibility for licensing as well as policy making within the DOT[7]. There has apparently been wrangling between the DOT and TRAI due to lack of clarity in their responsibilities and overlap of powers. The government modified TRAI Act in 2000, splitting the TRAI into two bodies, one with regulatory and advisory functions and other with adjudicative functions, known now as the Telecommunications Tribunal. However, this split will not resolve the conflict between DOT and TRAI over policy and regulation, nor the potential conflict of interest within DOT, which both grants licenses and operates networks, through its corporatized entity,BSNL.

It is also likely to be far more difficult to eliminate bias, whether intentional or not, of DOT employees toward their former employer. It may be possible to guard against explicit bias favoring BSNL, but perhaps a more significant danger is that DOT employees will start with assumptions of what is feasible and practicable based on their DOT experience. Strategies that could address this problem would be to include professional staff such as economists in the DOT from other ministries, use external consultants without ties to the DOT, and request public filings and comments so that all relevant views may be considered.

Another danger of the confusion in powers between the DOT and the TRAI is that the government will not respond in a timely manner, so that the Indian telecommunications industry will lag foreign industries or lose opportunities to enter new markets. For example, there is currently no timeframe for addressing IP telephony, whereas in China, IP networks are being built to carry voice and data at greatly reduced cost.

2.4. Oversight with Enforcement

The marketplace is generally the best mechanism for bringing innovative and affordable services to most users, including the majority in rural areas (see below). However, there will be an ongoing need for oversight to monitor progress toward meeting targets, to enforce compliance with performance standards, and to review and revise benchmarks. For example, there will be a need for monitoring to determine whether there are disparities in access, quality of services, or pricing that need to be addressed.Operators must also be held to their license conditions if licensing is to be an effective means of extending access. It appears that this has not been the case for village phones required to be installed by new fixed service providers (FSPs) in India. TRAI notes that only 12 village public telephones (VPTs) had been installed by three FSPs in the first 24 months, while a total of 42,841 VPTs were required under the terms of the licenses.[8]

One strategy to avoid this problem is to set firm enforceable deadlines for decisions on license applications and other time-sensitive matters. This approach was used in the US 1996 Telecommunications Act which set specific deadlines for the FCC to complete various rulemakings and directives required to implement the Act.

2.5. Participation in the Regulatory Process

It is often thought that the issues in telecommunications policy and regulation are so technical or arcane that most people would have nothing useful to contribute to the decision-making process, and that public participation would add little of value. However, all regulatory agencies are overworked and understaffed, and cannot find or analyze all the data that would useful to guide decision making. Major users are likely to have well thought out views on the impact of proposed regulations or the need for reforms that would enable the telecommunications sector to better serve their industries. The ability of small users and consumers to contribute may seem less likely; it may take some time for their representatives to get up to speed on telecommunications technology and economics. However, the contribution of such groups may also provide perspectives that might otherwise be overlooked.

India is making efforts to increase participation, through requests for comments on draft policies and posting of existing and proposed regulations on websites. However, there does not appear to be sufficient attention to the needs of users, both large corporate and institutional customers and individuals.

2.6. Old Distinctions No Longer Relevant

Classifications and distinctions which once were useful may no longer be relevant. For example, telecommunications services have been classified by the ITU and its members into fixed, mobile and broadcasting. Regulators typically issue separate licenses and approve separate tariff structures for fixed and mobile services, yet these distinctions have become blurred. Mobile telephone service was designed for communication while in vehicles; however, modern cellular and PCS systems are used for personal communications, and can often be considered a substitute for fixed network connections. India has indicated that FSPs may be able to offer mobile services through wireless local loop (WLL) networks, but this proposal shows that the Indian administration still sees distinctions between fixed and mobile that are irrelevant to users who simply want access to the network.

2.7. Resale: An Effective Means to Increase Access

Authorization of resale of local as well as long distance and other services can create incentives to meet pent-up demand even if network competition has not yet been introduced. Franchised payphones in India allowed local entrepreneurs to resell telephone service before services were privatized and liberalized. Indonesia's franchised call offices known as Wartels (Warung Telekomunikasi), operated by small entrepreneurs, generate more than $9,000 per line, about 10 times more than Telkom's average revenue per line[9]. Franchised telephone booths operate in several francophone African countries; in Senegal, private phone shops average four times the revenue of those operated by the national carrier[10]. In Bangladesh, Grameen Phone has rented cellphones to rural women who provide portable payphone service on foot or bicycle to their communities.

Resale of network services can also reduce prices to customers. Most interexchange carriers in the US are actually resellers that lease capacity in bulk from facilities-based providers and repackage for individual and business customers, offering discounts based on calling volume, communities of interest, time of day and other calling variables. Competition in domestic long distance is now authorized in India, and is to be authorized for international services in 2002. The fastest way to lower prices through competition will be to authorize resale.

2.8. Users will Find a Way...

Protecting dominant carriers that continue to charge prices far above those for comparable services in other countries not only penalizes users, as noted above, but drives the more agile to find alternatives. The users' response to unaffordable prices is increasingly to bypass the network. People with telephones in most developing countries can access callback services to make international calls at a fraction of the price charged by their own international operators.

Many monopoly operators claim that callback is siphoning off revenues that they need to expand their networks, which would also probably create more jobs. However, the relationship is not so simple. India appears to be following this approach, by refusing to even consider authorization of IP telephony, citing the risk of incumbent operators losing revenues[11]. However, the impact on the economy may be more significant. For example, China has authorized IP telephony, which enables users to cut the cost of many domestic and international calls dramatically. Concerning callback, OFTA, the Hong Kong regulator, negotiated an early termination to Hong Kong Telecom's monopoly on international services. Before the termination of the monopoly, OFTA effectively introduced international competition by licensing competitive local companies which offered callback access. In fact, the Hong Kong government encouraged its own departments to use callback to save money.

3. Extending Access

3.1. Rural Demand

In designing networks and projecting revenues, planners often assume that there is little demand for telecommunications in rural areas. Similarly, telecommunications service providers may be reluctant to extend services to poorer populations who are assumed to have insufficient demand to cover the cost of providing the facilities and services. Their forecasts are typically based solely on the lower population densities than are found in urban areas, coupled with a Aone size fits all@ fallacy that assumes all rural residents are likely to have lower incomes and therefore lower demand for telecommunications than urban residents.

Rural residents may need telecommunications to order parts and supplies, check on international prices, and arrange transport of their produce to foreign markets. A study for the World Bank estimates that rural users in developing countries are able collectively to pay 1 to 1.5 percent of their gross *community* income for telecommunications services[12]. The ITU uses an estimate of 5 percent of *household* income as an affordability threshold[13]. Using a conservative estimate, 20 percent of households in low income countries such as India could afford a telephone[14]. This estimate exceeds the Indian New Telecom Policy's target of a national teledensity of 15 by 2010 (the target for rural areas is just 4 lines per 100).

Just as income may not fully explain demand for information technologies and services, lack of access to telephone service cannot necessarily be attributed to lack of demand or purchasing power. For example, in many developing countries, television sets are much more prevalent than telephones. In industrialized countries, both TV sets and telephone lines are almost universally available. However, in middle income countries there are twice as many TV sets as telephone lines, while in low income countries, there are more than 5 times as many TV sets as telephone lines (see Table 1).

Even in the poorest countries, there may be much more disposable income available than per capita GDP data would indicate, and there may be significant demand for other information services. In India there were about 3.3 times as many TV sets as telephone lines in 1999. There are also some communities in India where cable TV subscribers greatly outnumber telephone subscribers.

Table 1: Access to Telephone Lines and Television Sets

Country Classification	Tel Lines /100	TV Sets /100	Ratio TV Sets/Tel lines
High Income	54.1	61.9	1.1
Upper Middle Income	13.4	26.3	2.0
Lower Middle Income	9.7	22.7	2.3
Low Income	2.5	13.1	5.2

Derived from: ITU, *World Telecommunications Development Report*, 1998.

3.2. Commercial Viability of Rural Services

Of India's 607,491 villages, 374,605 or about 62 percent had village public telephones (VPTs) as of April, 2000, leaving an additional 232,886 to be served in less than two years to meet the NTP's goal of serving all villages by 2002. Three competitive fixed service providers were required to install a total of 42,841 village pay phones in their first 24 months of operation. However, they had installed a total of only 12.[13]

Why such a shortfall? Some officials suggest that rural poverty limits demand and the commercial viability of rural telephony. TRAI's analysis indicates that if long distance service is available in rural areas, telephone services can be profitable. Based on an analysis of a large sample, TRAI estimates the average annual revenue per line of VPTs with direct dial long distance (STD) at R35,472 (about $760) and only R744 (about $16) for VPTs without STD. However, the STD village phones, which generate almost 50 times as much revenue, account for only 7 percent of all village pay phones at present. TRAI notes that some of the factors contributing to low ratio of STD to non STD phones are:

- lack of reliable transmission media
- lack of availability of STD facilities in all rural exchanges
- high security deposit required from the franchisee to provide the STD facility
- high cost of call loggers (people to record calling information)
- technological limitations of some analog radio systems that result in poor call completion rates.[14]

TRAI estimates installation costs of village pay phones at approximately R75,000 (about $1600). Using their high estimate of a 24 percent annual cost recovery and midrange estimate of 10 percent annual operating expenditures, the annual cost per VPT is about R 25,500 (about $550). TRAI does not state what percentage of the STD revenues would retained by the VPT. However, it appears that STD village phones would actually have a positive cash flow.

3.3. A Something is Better than Nothing@ Fallacy

The lack of access to rural services from most rural payphones appears to be an example of the persistent assumption that "something is better than nothing" is the only policy that is technically feasible or economically justifiable for rural areas. However, a corollary of the above analysis, that revenues in rural areas may often be higher and costs lower than assumed, is that is no longer technically or economically justifiable to set rural benchmarks lower than urban benchmarks for access B both to basic telecommunications and to the Internet.

For example, 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. While the US and other industrialized countries must upgrade outdated wireline networks and analog exchanges in rural areas, developing countries such as India can leapfrog old technologies and install fully digital wireless networks. Thus Indian regulators could also adopt rural comparability standards to avoid penalizing rural services and businesses in access to information services. For example, 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 the new digital networks they were installing in rural areas met those specifications, and that older networks should be brought up to those standards.[15]

3.4. Fixed Lines Close Large Gaps Too Slowly

In developing countries without sufficient wireline infrastructure, such as India, wireless personal networks can be used for primary service. In China, there are more than 10 million wireless customers. In Uganda, within one year of licensing a second cellular operator, attractive pricing and aggressive marketing of prepaid service using rechargeable phone cards have resulted in there now being more cellular customers than fixed lines in the country. For most of the new subscribers, their cellphone is their first and only telephone[16]. Other developing countries where wireless is used as a primary service include Colombia, Lebanon, Malaysia, the Philippines, South Africa, Sri Lanka, Thailand, and Venezuela[17]. Table 2 below shows Asian developing countries where wireless mobile lines contribute significantly to teledensity, providing 25 percent or more of all subscriber connections. The ratio in India is only 6.6 percent.

Table 2: Mobile as Percentage of all Telephone Lines:

Selected Asian Countries

Country	Mobile Phones/All Lines
Cambodia	76.3%

Philippines	48.1
Malaysia	40.3
Thailand	31.0
China	28.5
Indonesia	26.8
Bangladesh	25.6
Mongolia	25.1
India	6.6

Source: ITU, *World Telecommunications Development Report*, 2000.

4. Recommendations: Applying these Lessons in the Indian Context

4.1. Teledensity Targets

It seems unlikely that the existing fixed service operators will be able to finance and roll out fixed line networks on a scale to meet these targets despite the huge pent-up demand for service. To meet the NPT's goals will take innovative strategies and incentives that have not been tried before. Indian policy makers will have to Athink outside the box@ to create an environment where these and other goals can be accomplished. For example,

- The distinction between fixed and mobile from a planning perspective should be ignored. The teledensity goal should be achieved by whatever technological means is appropriate. This is likely to mean that for many people, their first and only network access will be by cellular (wireless) phone. To take maximum advantage of wireless, cellular operators must have incentives to extend coverage and to offer a variety of pricing packages (using prepayment, smart cards, resale, bundled and unbundled services, etc.)
- Other innovative strategies should be explored to take advantage of existing infrastructure and entrepreneurship. For example, cable TV operators could be licensed to provide local telephone services, with interconnection to the national network.

4.2. Village Access

To achieve the teledensity village telephone goals, new approaches are also clearly required, as it seems highly unlikely that the operators will meet these targets based on experience to date. To provide public payphones to all remaining villages:

- All new village phones should provide STD (necessary both to generate revenue and to provide villagers with access to the national network and to Internet/data services).
- Cellular operators should also be required to provide wireless VPTs to villages covered by their networks.
- Other operators should be allowed to provide village services through resale.

In addition, to increase the revenue from all VPTs and provide access to data and voice in all villages, existing VPTs should be upgraded to STD. To accomplish this goal:

- Rural switches be upgraded to provide STD.
- Where rural switches have not yet been upgraded, VPT circuits should be routed to switches that provide STD.
- The franchisee deposit requirement for STD should be lowered, or an alternative scheme devised that would minimize risk to the service provider while being financially feasible for the franchisee to obtain and offer the service. For example, prepaid phone cards (that could be Arented@ to customers) could reduce the risk of lost revenue while providing affordable access for customers.

4.3. Data Services

The principle of Amoving targets@ should be applied. It is probably realistic to interpret Aslow speed access@ at present as 56 kbps, which can be delivered over a reliable dial-up network using a dial-up modem. As demand for higher bandwidth grows, policies to facilitate higher speed access, such as to businesses, government offices and community access centers, should be developed. Such services could be provided via the existing telephone network (e.g. ISDN or DSL), over cable TV networks, or by wireless or satellite. Access to affordable broadband will require further opening of the network to competition so that all of these (and other) options could be offered, depending on location and demand.

4.4. Internet Availability

The FSPs should be required to provide connectivity, leaving it up to district governments or other agencies to figure out where to provide Internet access and how to provide local facilities such as a PC, simple terminal, or net appliance. CDOT could be asked to develop a community access package, or a competition could be held to design a community access package suitable for villages. The package might include such features as low capital and operating costs, rugged design to cope with heat and dust, modular design for simple installation and maintenance, perhaps solar power, etc.

Implementation should probably be done on a phased basis, beginning with villages that have requested

Internet access. Each village could be asked to demonstrate its commitment to getting access by designating a location for the equipment and two persons to be trained in operation and troubleshooting (a variation of the technology plan required for schools to participate in the E-rate program in the U.S.). Installation, training and support could be contracted out to NGOs, small businesses, or others that could demonstrate the competence to provide these services.

5. Conclusion: Implementing the Vision

This paper places telecommunications policy within the context of development policy. It assumes that extending affordable access to reliable telecommunications services should be the primary goal of Indian telecommunication policy, in order to facilitate economic growth and delivery of social services in rural as well as urban areas. Policies capitalizing on India's strengths in technological innovation and entrepreneurship, and eliminating barriers to providing service by any appropriate means (including wireless, IP networks and resale) are likely to be the fastest and most equitable means of achieving the goal of universal access to telecommunications and information technologies and services throughout India.

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Endnotes

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[5] Deepak T.H. M and Vaibhav Parikh. AIndia@ in *The Deacons' Guide to Telecommunications in Asia.* Hong Kong: Asia Law and Practice, 2001, p. 145.

[6] See, for example, Cronin et al., 1993; Hudson, 1995; Hudson, 1997; Saunders et al. 1994.

[7] DOT/DTS. ANew Telecom Policy 1999-2000 Details.@ www.dotindia.com/flash/NewTelPo_Details.htm.

[8] TRAI, p. 22.

[9] ITU, *World Telecommunication Development Report, 1998*. Geneva: ITU, 1998, p. 77.

[10] ITU, 1998, pp. 77-78.

[11] Deepak and Parikh, p. 145.

[12] Kayani, Rogati and Andrew Dymond. *Options for Rural Telecommunications Development.* Washington, DC: World Bank, 1999, p. xviii.

[13] ITU, 1998, p. 35.

[14] ITU, 1998, p. 37. It should be noted that this calculation appears to assume even distribution of income throughout the society at higher income levels, which is not necessarily true.

[15] Meeting at Department of Transport and Communications attended by the author, Manila, January 1998.

[16] Personal interview, Uganda Communications Commission, Kampala, November 1999.

[17] ITU, 1998, p. 49.

Abstract

India has become known as a nascent information economy, with investments in cyber industrial parks, high tech start ups, and a "brain drain" (and remittance generator) of engineers and programmers to Silicon Valley and beyond. Yet telecommunications facilities and services are not available to a vast majority of Indians, including those who are literate and those who have disposable income available for communications. Current teledensity in India is less than 3 lines per 100 population; in rural areas it is only .4, or 4 lines per 1000.

While there has been progress, access remains very limited in many areas. Some 240,000 villages do not yet have access to basic service. More than 90 percent of the existing village pay phones in the country do not have standard trunk dialing (STD), i.e. direct dial connection to the national network, although phones with long distance connections can generate enough revenue to be profitable.

This paper examines Indian policies and their implementation, and provides a comparison with current policies in some other developing countries. It then proposes reforms and new initiatives to increase access to affordable and reliable telecommunications services.

back to index

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back to index

BASKET CASE TO EMERGING TIGER

Fazlur Rahman & FQM Farooq
Bangladesh

View Abstract

1. INTRODUCTION

1.1 Immediately after the emergence of Bangladesh through a bloody war of liberation, the country was beset with avalanche of problems. The agriculture sector was busted, the industry segment was devastated, the communication infrastructures were destroyed, the education system was stagnated, health services were shattered, administration was cracked and the overall economy was ruined. With the millions of its people killed in the liberation war, Bangladesh was crippled at the very outset of its journey as an independent nation.
1.2 Whatever level of development it had achieved before the liberation, it was ruined during the war of liberation in 1971. Dr. Henry Kissinger ridiculed Bangladesh as an international basket case. Even after passing by of three decades in the meanwhile, Bangladesh is still a least developed country trying to change its fate and aspiring to graduate to a medium income nation. Bangladesh, a landmass of only 148,000 square kilometers in area, has its population increased from 75 million in 1971 to 130 million in 2001. The location of the country near the mouth of Bay of Bengal has made it susceptible to regular onslaughts of natural calamities like floods, tornadoes, cyclones and storm surges every year. This affects the life of its people, their agriculture, education, health and housing in effect the entire gamut of their socio-economic existence.

2. THE VISION

2.1 The explicit commitment of this young nation is to ensure creation of a self reliant economy where poverty will be totally eliminated, hunger will be absent, health services will be easily available, total literacy will be established and housing will be readily available. Bangladesh has the potential to develop its economy at much faster speed. Exploitation of conventional possessions like agricultural outputs and mineral resources under a sound development policy, managerial excellence and constant vigilance will certainly result in sustainable economic emancipation.

3. TELECOM SCENARIO

3.1 The interpretation of economic development is widely diverse depending upon the state of the society involved, point of time when the consideration is being made and the shape of the culture it is related to. The same qualitative or quantitative parameters may mean necessity in one society while it is not more than comfort in another or a matter of luxury in the third one. The same is true at different point of time in the same society or at the divergence of cultural configurations. However, it may well be defined as the production and trade of goods and services as well as the unrestricted and balanced distribution of the same.

3.2 There are certain strategically important and emerging realities in the context of present day Bangladesh in its endeavor to effect rapid growth. There is an intensive network of all weather roads connecting even the remotest villages is a significant achievement unimaginable even a decade and a half back. Electricity and Telecommunication reached in all Upazillas and beyond in many villages. There has been a significantly positive change on the map of the poverty situation in the country reducing the percentage quantitatively and improving the condition qualitatively. The affordability of the people to have basic clothing has increased and the quality of housing has improved markedly. The access to health services has undergone noteworthy change for the better. The population growth has been contained to a great extent [1.48%] and the percentage of literacy is in the rise quite radically [above 60%].

3.3 Telecommunication is increasingly playing its catalytic role towards this goal. A clear indication of a take off by Bangladesh is apparent. An appreciable bias towards a development approach leading to poverty alleviation rather than total focus on industrialization only is a positive aspect of the present state of affairs. This is a tangible step forward towards a total growth through numerous local growths. Cellular Mobile Village Public Telephone is an example.

4. TELECOMMUNICATION AND IT IN DEVELOPMENT EFFORTS

4.1 There is a definitive relationship between telecommunication and development. The economic impact of investment in telecommunication has been found to far outweigh the marginal cost. There is an overwhelming consensus of evidence that the benefits of investments in telecommunication far exceed the cost. The gain to be obtained is much higher in the less developed countries with lower per capita gross national product. It has been estimated that for a country like Bangladesh with per capita income around US $ 300, the contribution of one additional telephone to the GNP would nearly be of about US $ 6,000.

4.2 A further analysis has revealed that, in an environment where teledensity is less than 5%, the raising of the density by 1 percentage point pushes up the GNP by over 0.8%. Moreover, the importance of telecommunication is such that the proportion of indirect economic benefit obtained in different sectors through the use of telecommunication and the direct economic returns gained in telecommunication sector itself is 69:1 for commerce, 78:1 for handicraft industry, 85:1 for service trade and 126:1 for equipment manufacturing industry.

4.3 Bangladesh is one of the most poor and densely populated areas in the world. It has a population of about 834 per sq. km. Average per capita income is around US $ 1 per day and the teledensity is about 0.8 per 100 population. Telecommunication is a cost intensive Industry. The economic condition does not permit financing necessary capital cost for raising teledensity to anywhere near a developed country. Resource gap demands new strategy to achieve this goal. Rather than concentrating on raising the teledensity, Bangladesh Telegraphs and Telephones Board (BTTB) diverted its attention towards building the countrywide backbone infrastructure and private Cellular Operators are expanding their subscriber bases. The Private Cellular Operators Subscribers' Base will soon overtake those of BTTB's fixed telephones. Combined efforts of Government, Non-Government Organizations, Financial Institutions and Local People are helping the Networking Revolution. Bangladesh aspires to provide access to telephone service to its teeming population through telecommunication networking with mobile cellular telephones.

4.4 The engine for the enormous transformation that the world is likely to witness will invariably be the information and communication technology (ICT). ICT has made the world smaller. A person need not sit in a conventional office. He may attend to his daily office work sitting at any corner of the world. Not only that, the cost of such communication will be negligible. The shattering of the barrier of distance and near cost less communication has provided the poor countries like Bangladesh unique opportunities. A doctor sitting in New York will get his report prepared or a department store get its accounts ready from its agent sitting somewhere in Bangladesh. The conventional conception of offices or shops is getting completely replaced by virtual offices or shops. All these are being done to reduce the costs of product or service.

4.5 The intelligence of ICT is the software, the useable instructions for the computer that helps one to do what one wants. Every day the ICT is being used for newer works in better ways and consequently the necessity of having newer and better software will be increasingly felt. Making of software does not require Bangladesh spend its precious foreign currency to import big and costly machinery, transporting them or installing them by the experts. It requires only the enactment of relevant law, formulation of appropriate policy and provision of proper facilities.

4.6 In the following table, the mentioned data reveal the prospect of ICT in the world as a whole and the regional as well as that of Bangladesh. It may be mentioned here, in this context, that among the Internet Services, not based on software, which are likely to be transferred to the Asian countries, include Customer Services worth US $ 42 billion, Human Resource Service valued at US $ 50 billion, Data Management US $ 20 billion, Accounts Services US $ 20 billion, Distant Education US $ 19 billion, Network Management US $ 8 billion, Website Service US $ 7 billion, Engineering Design US $ 6 billion, Translation-Transcription US $ 1 billion. Presently, these are being processed in India, Singapore, Hong Kong, Philippines and a few other countries of Asia. A sizeable part of these works may easily get transferred to Bangladesh.

TABLE 1 PROSPECT OF ICT

Items	US $	
	1998	2003 & 2010
Organization to Organization	1.3 b	617 b
E-Commerce (computer, book, songs, garment)	10 b	100 b
Transfer of Work to Developing Countries	40 b	103 b
Non-Software Internet Service Transferred to Asia	10 b	180 b*
Internet Connection in Asia	15 m	64 m*
Internet Connection in India	0.3 m	9 m
Internet Connection in Bangladesh	0.03 m	1 m

* for the year 2010

4.7 Though there is a misconception that industries based on Information and Communication will require only the computer engineers, there will be jobs for hundred other disciplines. Software design is a part of the whole game. Manpower will be required for data entry, data management, accounting, security services, web page services, marketing, engineering consultations, education, CAD service and many more of which there are good numbers of qualified hands available in Bangladesh. It can benefit tremendously from ICT based activities.

5. STATE OF BANGLADESH ECONOMY

5.1 It may not be out of context here to have a glimpse on the economic scenario of Bangladesh in order to study is future prospects. The economy of the country was in a dismayed condition during pre-liberation period. Moreover, whatever achievement it made was largely destroyed during the war of liberation. In spite of the best efforts of the successive governments and the commensurate assistance from the development partners, the prevalence of poverty and inadequacy of services are haunting the lives of the millions. The change in position during the last decade, as shown below in the following chart may be of relevance.

TABLE 2 DEVELOPMENT PERFORMANCE DURING 1987-1999

Development Parameters	87-88	91-92	95-96	98-99
Population in million	na	111.46	120.58	129.20
Life Expectancy in years	56.0	56.3	58.9	60.8
Population Growth in percent	2.19(e)	1.88	1.75(e)	1.48
Employment in Agriculture in percent	73.8	68.5	63.2	na
Employment of Female Labour in percent	10.4	41.4	38.0	na
Agricultural Value Addition as percent of GDP	37.2	36.0	30.0	29.2
Rice Yield per Acre in kg	604	692	720	796
Industrial Production Index (1981-82 as 100)	145	189	174	200
Generation of Electricity 106 KWH	6,541	8,894	11,474	13,872
Number of Telephones in million	0.17	0.22	0.39	0.46
Vehicles on the Road in thousand	104	133	190	233 (e)
Paved Road in kilometer	12,321	13,627	17,554	na
Export FOB in billion Taka	41.16	74.12	144.52	297.00 (e)
Exports as percentage of Imports	41.57	57.53	56.86	66.36
Per Capita GDP in Taka	5,439	8,137	13,622	17,137
Per Capita Expenditure on Education in Taka	115	140	285	350 (e)
Per Capita Expenditure on Health in Taka	60	61	133	130(e)
Literacy in Percent	na	32.4	45.1	60
Per Capita Daily Calorie Intake in kcal	2,215	2,266	2,244	na

na: data not available
Bangladesh Bureau of Statistic

5.2 Bangladesh remained persistently deficient in the production of food. A large part of its export earnings as well as a significant amount of the external assistance was spent in importing rice to feed the hungry millions. Literacy was at a very low level. The number of doctors, hospital beds, schools and telephone per thousand populations were miserably low. The population growth was alarming. Unemployment was sky high. However, the last decade has witnessed an appreciable success in the agriculture ensuring the macro-economic stability. In comparison with the situation prevailing in mid-eighties, when the annual production of food grain used to harbor around 15 million metric tons, the farmers are now successful in raising the production level to 25 million metric tons.

5.3 Single largest contributor to the export arena is the ready-made garment industry. It constitutes more than 70 percent of the total export earning. Contrarily, the performance of jute and jute-goods, which once held the topmost position, has come down to only around 7 percent. The garment industry took its root only at the beginning of the eighties and now provides job opportunities to more than 1.5 million workers most of whom are women. The number of factories rose from less than 100 in the early eighties to about 3,000 now. The export earning at the beginning of the decade was US $ 624 million. This figure jumped almost 7 folds to US $ 4.2 billion at the end of the fiscal year 1999-2000. It is estimated that the earnings will cross the six billion marks by the end of the year 2001. The growth of garment industry has facilitated the growth of factories for garment-related accessories. Similarly, garment related exports have also generated boost up in the banking, insurance, transport, housing sector. Telecommunications have been intimately involved in the growth of this industry.

5.4 Bangladesh has a good deposit of natural gas in land and off the shore. There is a strong possibility of liquid hydrocarbon deposits also. In fact, Bangladesh is at a primary stage of gas and oil exploration. The availability of limestone, hard rock, coal, ignite, silica sand, white clay, radioactive sand etc are also of significance. Taking the findings of all various studies into consideration, the total gas deposit is estimated to be minimum 37.3 trillion cubic foot and maximum of 94.6 TCF, the mean value of which stands at 61 TCF.

5.5 One of the greatest resources that Bangladesh has in abundance and can be more effectively used is its manpower. Bangladesh, with the exception of some of the city-states, has the densest population in the world. Hundreds of thousands of skilled, semi-skilled and mostly unskilled people from Bangladesh are working in the Middle East and South East Asian countries. Comparatively fewer jobs in the country and large-scale shortage of manpower in the host countries have attracted a vast majority of our unemployed youths. In the year 1990, Bangladeshi expatriates numbered less than a million, made remittances back home to the tune of at least US $ 0.7 billion . By the end of the century, the number of migrant workers in foreign soils rose to more than 3 million and the volume of annual remittances jumped to US $ 1.64 billion . The gross national savings of the country, which now stands at around 20 percent of the Gross Domestic Product, is largely because of the earnings that the wage earners send home.

6. BANGLADESH PERFORMANCE AND REGIONAL PORTRAIT

6.1 Bangladesh has traveled a long way from the early days of its liberation, progressed significantly during the last quarter of the last century and entered the third millennium with an unambiguous indication of its emergence as a prospective thriving nation state. A comparative analysis of some key indicators of development of some regional countries, as depicted below, will bear testimony to this postulation.

TABLE 3 PERCENTAGE INCREASE OF DEVELOPMENT INDICATORS OF REGIONAL COUNTRIES FROM 1990 TO 1998

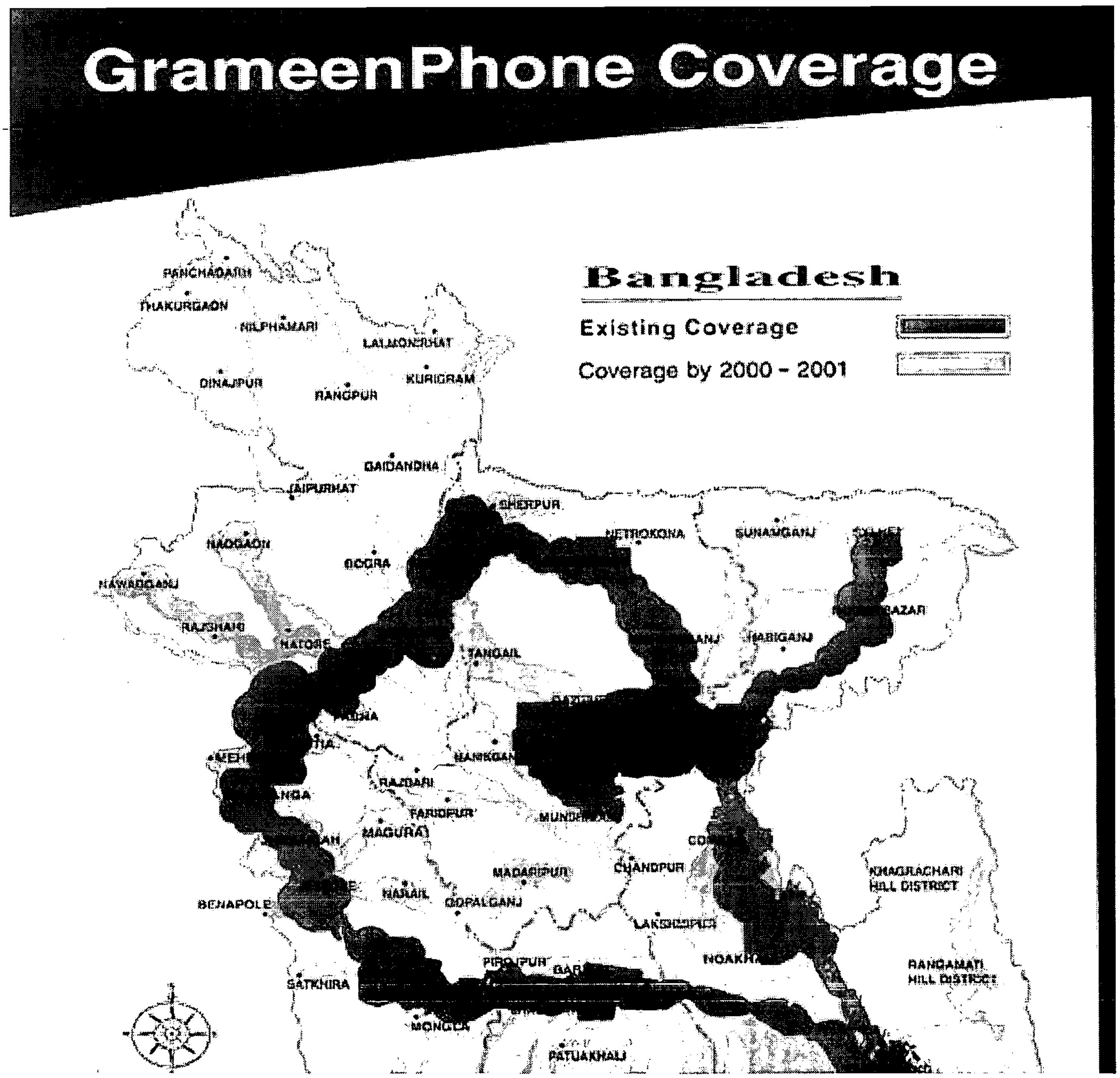
Indicators	Bangladesh	India	Nepal	Pakistan	Sri Lanka
Population	10.86	11.54	21.05	16.10	11.77
Life Expectancy	5.17	6.78	11.54	10.71	2.82
Birth Rate	(-) 37.50	(-) 10.00	(-) 15.00	(-) 16.70	(-) 10.00
Death Rate	(-) 54.55	(-) 18.18	(-) 21.43	(-) 33.33	(-) 25.00
Export	120.26	31.19	235.19	31.97	35.53
Per Capita GNP	72.41	25.71	23.53	23.68	10.96
Import	70.00	34.24	38.46	48.49	21.82

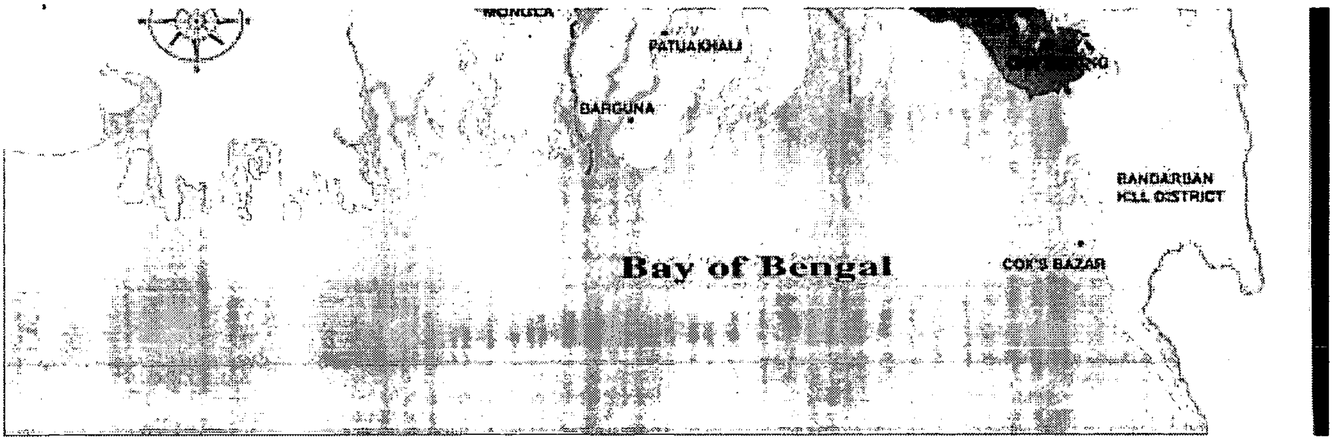
Physician per 1000	27.71	0.80	66.90	31.27	(-) 81.16
Energy Consumption	245.61	107.3	1184.0	89.70	115.64

World Development Report, World Bank Atlas, FAO Year Book, UN Statstical Bulletin

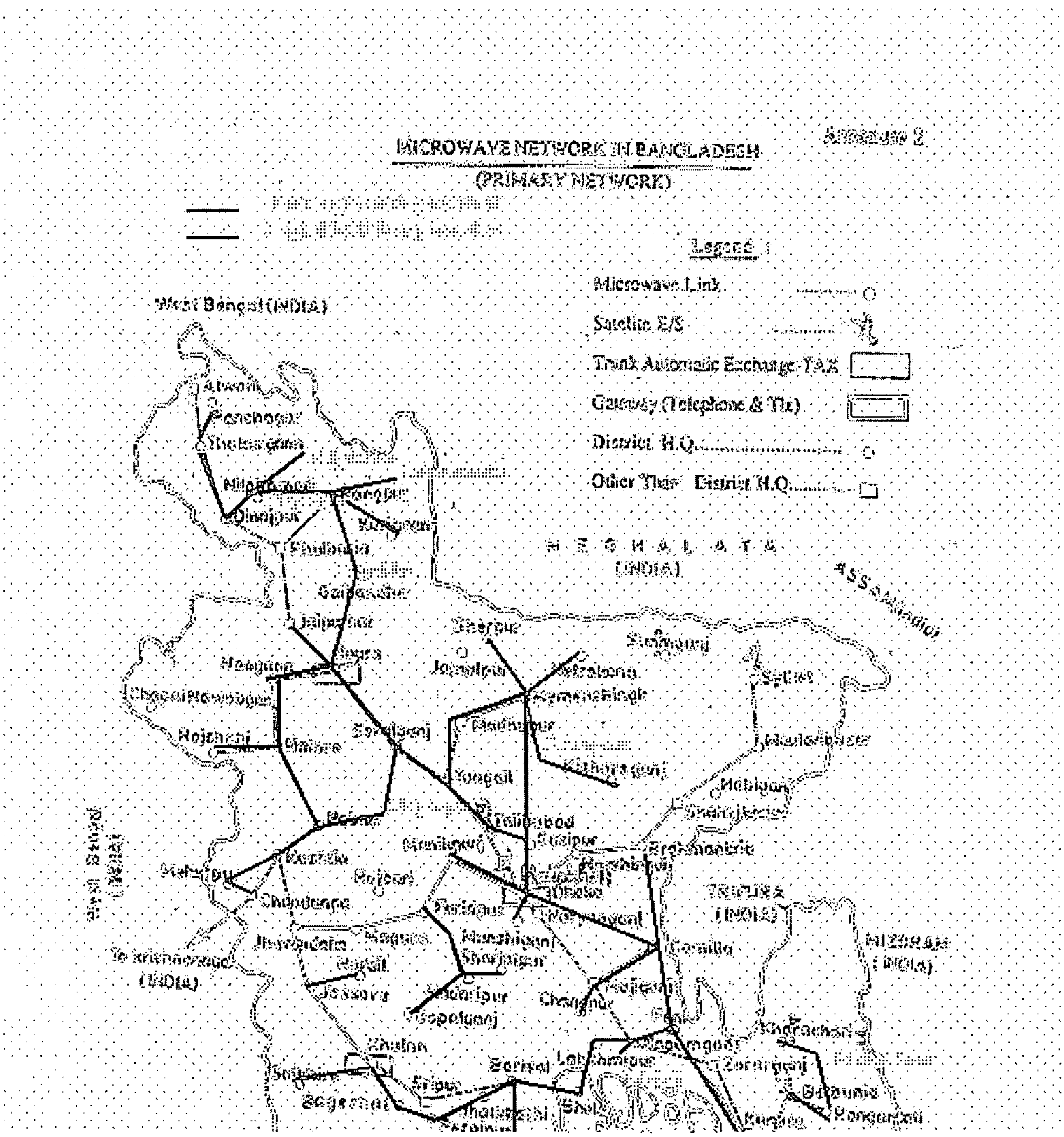
6.2 If an analysis of the difference between the survey statistics of 1990 with that of 1998 of the above noted countries on various parameters is made, it will be evident that the progress made by Bangladesh is quite appreciable. It is apparent that the most significant progress has been achieved in the export market, which is primarily due to phenomenal escalation in the ready-made garment productions. Bangladesh export increased by 120 percent while that of India, Pakistan or Sri Lanka (with the exception of Nepal) is around 30 percent only.

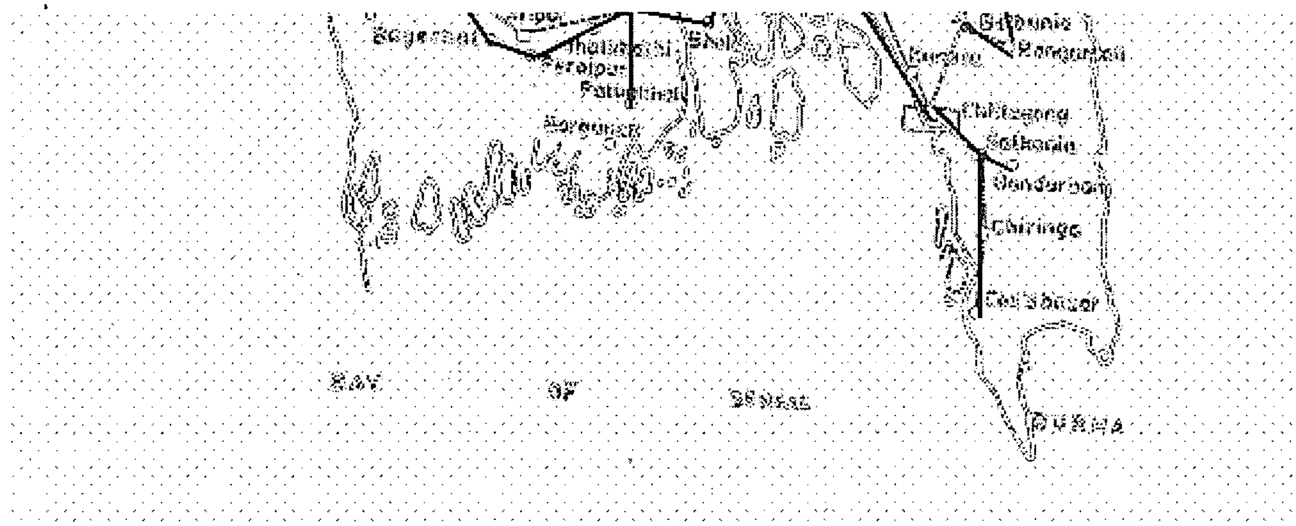
BACKBONE NETWORK AREA OF GRAMEENPHONE





BACKBONE NETWORK OF BTTB





7. TELECOM AND IT SCENARIO OF BANGLADESH

7.1 Notwithstanding the fact that there is comparatively faster growth of telecommunication in Bangladesh during the last decade, the telephone penetration is still around only 7 per thousand populations. The switching systems range from the most modern digital technology to the age-old manual magneto system. There are two private operators having licenses to own and operate telephone services in Upazillas, the smallest units of administration. A third private operator has also been given permission to operate in the capital city. The cellular mobile services are opened exclusively to the private sector and presently there are four operators. There is a private PHS operator also (not yet in Operation) in the field.

7.2 The national long distance network is composed of MW, UHF, VHF and Optical Fiber networks belonging to both the state-owned and private operators. There are both nationwide direct dialing services as well as operator-assisted trunk dialing system. The international traffic is primarily routed via four satellite earth stations. The neighboring countries, namely India and Nepal are also connected with terrestrial microwave. There are three international gateway exchanges. The data communication is established through Packet Switched Data Network. It has eight nodes in the major cities, which support X.25 protocols for national and X.75 for international traffic.

7.3 The performance in revenue earning is comparatively much bright than other service sectors in the country. The gross revenue earning of the state-owned operator increased more than three times during the last decade. The earning per telephone in the year 1995 of the state-owned operator alone was US$ 772 while the same in India and Pakistan stood at US$ 332 and 491 respectively The investment in the telecommunication sector in Bangladesh is much less in the regional perspective. It was only US$ 0.90 per inhabitant in Bangladesh in the year 1995 while the figures in India and Pakistan stood at US$ 1.90 and US$ 4.40 respectively.

7.4 In order to ensure orderly development of telecommunication in the country, to provide service on demand, to assure satisfactory quality of service and to guarantee value for the money of subscribers, appropriate actions are being taken to satisfy the under-serviced demand in existence and the probable one that may be generated. The telecommunications policy objectives have been framed to ensure promotion of national integration, safe-guarding of social and cultural fabric, universal access to cost effective services, creation of an environment of competition, resource mobilization through participation of both public and private entrepreneurs, liberalization of tariff, development of human resources and independence of regulatory functions.

7.5 Legislative actions had been completed to facilitate formation of an independent and autonomous Telecom Regulatory Commission. The formal constitution of it will finally end the domination of the government since 1885. It is expected that this will create a situation where private entrepreneurs, both the domestic and multinationals, will be attracted to make significant investment to conform to the need. The Telecommunication Regulatory Commission will ensure essential ingredients like liberalized environment, pragmatic thinking, cultivation of flexible approach, practical actions and involvement of all the concerned parties for the greater good of the country and its people. It is certainly true that no nation can operate a twenty first century economy without a twenty first century electronic infrastructure.

TABLE 4 TELECOM SCENARIO

Items	June 1990	June 1995	June 2000
Public Switched Telephone	245824	320734	580,000
Cellular Mobile Telephone	0	3000	235,000
International Circuits	397	914	2,302
Digitalization of Switching in %	1.25	29.12	68
Teledensity	0.2235	0.2673	0.6
International Traffic in Paid Minutes	19,400,000*	108,693,136	217,210,516
Revenue Earning in Billion Taka	4.15	8.91	14.01

*approximate value Bangladesh T&T Board Publication, August 2000

7.6 Like many other developing countries, Bangladesh possesses inadequate IT infrastructure. Moreover, the infrastructure constrains make the access to international networks expensive. The cost of hardware and software as well as the insufficiency of trained manpower are the added impediments. Initially, only the private sector was allowed to introduce IT services to which the government operator joined subsequently. The use of IT for education, health care, e-biz etc have been taken into consideration while preparing the Fifth Five Year Plan and the matter like establishment of high capacity fiber-optic network for national as well as international traffic is in progress. The present IT activities are spread over varied dimensions including office automation, desktop publishing, software development and marketing, human resource development, data processing, web-page design, web-enable software, multi media design, program modifications etc. The figures of last year show that in the country the computer penetration is only 1 per 7,000 and the Internet users were only 60,000. This is one twenty fifth of that of India. The size was estimated at around US$ 150 million only. The average annual growth rate is more than 20 percent. There were more than 300,000 IT personnel engaged last year in the industry. The export of software up to last year amounted to only US$ 2.5 million.

8. ROLE OF TELECOM AND IT IN BANGLADESH

8.1. The success in quite a few of the development sectors is the result of concerted efforts on the part of the government as well as the initiative of the people. Telecommunication is one of the infrastructures that acted as a tool for such development. The role played by telecommunication in this regard, against various odds, is quite significant. In the context of Bangladesh, telecommunication is gradually taking the place of a production input from its traditional role of a consumer item. It has proved to the politicians and the policy makers its relevance and importance in the over all effort of national development.

8.2 The intrinsic quality of telecommunication has opened up a comparatively low-cost alternative to other forms of communication and exchange of information for the people, in both urban and rural areas at large. A study made on the impact of a village pay phone indicates that the availability of a telephone near at hand has provided the growers of agricultural products and livestock or poultry breeders a cheaper and faster means of access to the market demand and supply situation, avoiding the cost-rising role of the traditional middle-man.

8.3 Telecommunication provided the growers the opportunities for smoother procurement of inputs like fertilizers and diesel or reduction of mortality rates of chicks. The villagers are extensively using this facility made available to them by telephone in their own village or the one next to their own. They are now in a position to contact a doctor or a clinic or an ambulance much faster than before thereby completely changing their life style.

8.4 The mobile phones in the villages, provided on credit to the womenfolk especially, have made their empowerment more realistic and fast. The women not only have found a telephone a source of her income by allowing others to use it in exchange of a fee but also feels proud and important to possess a telephone that brings even the elites of the villages to them to make international calls to their relatives abroad.

8.5 At the time of the most severe flood of 1998, when two-thirds of the country remained under water for months, the mobile telephone showed its invaluable potentiality of coordinating the relief operations, assuring the health care and providing the emergency social messages in the rural areas This saved hundreds of thousands of life and property, which would otherwise have caused the nation of millions of Takas as it used to be in just a few years back.

8.6 The liberal decision of deregulation of telecommunication services from state monopoly has resulted in improved, faster and less expensive services including access to the Internet to wider section of the people. Moreover, it is playing an increasing role in accelerating economic growth. More international investments are being attracted in telecommunication industry, which in return is resulting in increasingly consequential investments in other sections of economic activities, which are using telecommunication services like banking, manufacturing, farming, trade and commerce.

8.7 On the other hand, IT has opened up numerous avenues initiating large-scale changes in human life of twenty-first century as the industrial revolution of nineteenth century did. Bangladesh has undertaken measures in developing the IT sector faster to ensure a vibrant economy. These include tax-free import of computer hardware, software and its accessories, easier and cheaper use of V-Sat, full exemption of income tax for computer or IT business, special fund for low-tax loans for software industries, loan for working capital from banks at preferential interest rates with no collateral requirement and adequate capacity of international gateway through submarine optical fibers across the oceans. IT Parks are being set up in both public and private sectors. The recent enactment of Copy Right Bill-2000 is a step in right direction. The IT-friendly government has created equity funds for boosting IT-related enterprises. Increasingly greater number of trained professionals is now coming out of universities and institutions. These have already created a stupendous tumult all over the country to reap the enormous prospect. The experts in this field are of the opinion that by the next decade, it is possible for Bangladesh to earn US$ 5 billion through Internet services and US$ 10 billion through export of software.

8.8 IT has provided the much-needed more or less the even field to open up global markets for the products and services generated by a poor country like Bangladesh, which is not possible in the traditional marketing mechanism. The globalization of trade under the WTO initiative, even with the inherent supremacy of the developed world, may provide the breakthrough.

9. DILEMMA FOR BANGLADESH

9.1 Bangladesh has to develop its most important resource - the manpower. Be it education, health, administration, commerce or any economic activity, it can be done most cost-effectively with Information Technology. Telecommunication and Internet access are possible only with large-scale expansion of telecommunication infrastructure. Networking revolution with a view to achieving universal telecommunication services and Internet access in such an environment is a dream.

9.2 Universal Provision of Service demands access of telecommunication by most people living in a country. Development of telecommunications in a developing country like Bangladesh and the challenges it faces for making it available universally and simultaneously making the services affordable to general public are extremely difficult. In the country, 76% of its people live in rural areas and most of them live below the subsistence level. Affordability of telephone by general public in the country is meager. Resource gap demands new strategy to achieve this goal. The strategy, therefore, calls for minimizing the Capital and Operational costs to make the investment feasible for the entrepreneurs and sharing of the cost of services to make them affordable by the subscribers.

10. STRATEGY FOR BANGLADESH

10.1 In order to develop its telecommunication sector, the infrastructure and the tool for further economic emancipation of the country, it is necessary that

(a) Rather than concentrating on raising the Teledensity, the Government of Bangladesh, through its agencies like Bangladesh Telegraph and Telephone Board (BTTB), Bangladesh Railway; Bangladesh Power Development Board concentrate towards building the countrywide MW Radio and Optical Fiber backbone infrastructure,

(b) The Private Cellular Operators concentrate in raising the Subscribers' Base,

(c) Government facilitates the development of Telecommunication and IT Sector with full Tax Relief,

(d) Combined efforts of Government, Non-Government Organizations, and Financial Institutions as well as resources of local people are put to use for making Telecommunication and Information Technology accessible as well as affordable to general people.
Bangladesh challenges Telecommunication networking revolution to provide access to telephone service to its teeming population with mobile cellular telephones.

10.2 Thus to overcome the resource constraint in Bangladesh the following strategy should be adapted for developing Telecommunication Infrastructure, and that will lead to involvement of ICT for the overall development of the country:

(i) BTTB should take the leadership in making available Public Sector Telecom infrastructure (Optical Fiber, MW Radio, Cable Duct etc) for use by all Telecommunication Operators. BTTB's main primary business and revenue source should be leasing of its infrastructure capacity to other Operators. Thus irrespective of whoever uses these public sector infrastructures, the Government (through BTTB) should earn its share of revenue.

(ii) The Private Sector Telecom Operators shall upgrade the capacity of BTTB Telecom infrastructure as necessary for meeting demand of Telephones and extending coverage of service all over the country. Thus Private Sector Telecom Operators shall help in utilizing dormant / partly used Public Sector Infrastructure, - making its use more cost effective and efficient.

(iii) Government should withdraw all sorts of Custom Duty, Royalty etc from Telecom equipment and Telephone handsets; so that investment for developing the infrastructure can be minimized. Instead, Government should look for earning revenue through Value Added Tax (VAT) on its use.

(iv) The Telecommunication Regulatory Commission should create an environment for all the Telecom Operators to develop countrywide "Community Telecentres", so that the entire country get access of ICT facilities within a planned period. The

Government, Non-Government Organizations, Financial Institutions, and the Telecom Operators as well as Local People should be involved for developing these "Telecentres"

11. CONCLUSION

After his visit to Bangladesh, Bill Clinton, the former President of the United States, observed that 'Bangladesh has made some truly impressive progress on development, and in our view, its promotion of democratic values and economic reforms at the grass roots level are essential for maintaining that progress. Economic reforms are never easy, and the returns are not immediate, but future generations will benefit from today's wise economic decisions'. The people and the richness in their spirit and ability impressed him most. He commented after his visit by saying that 'I came away with tremendous admiration for the way in which they've overcome great obstacles in their lives. I came away convinced that no one should believe that poverty is destiny. Meeting them made me believe more strongly than ever that every child in this world should be given the chance to dream and to live those dreams'. Bangladesh look forward to Telecommunication and IT heavily as a tool for graduating to an 'Emerging Tiger'.

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around 878 persons per square kilometer
US $ 1=Taka 39
US $ 1=Taka 55
ITU
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Dhaka Courier, 10 November 2000

back to index

Abstract

Born through a bloody liberation war in 1971 with practically all infrastructures damaged and left with millions of hungry people, having meager clothing and shelter Bangladesh had little hope for survival. Frequent natural calamities like floods, cyclones etc and chronic food shortage made Bangladesh "The Basket Case of the world". However, the tenacity of its people and the resilient determination to overcome catastrophe helped it to survive, and now Bangladesh look forward to a brighter and prosperous future. Today Bangladesh is surplus in food production, reduced population growth to 1.48%; exports garments to USA / Europe; built a countrywide road network that enable anybody to travel to almost any part of the country from capital city of Dhaka within a days drive. Bangladesh is striving for full literacy in 3-4 years period. Bangladesh makes use of cellular phones to provide access to its rural population. Number of Cellular telephones will exceed fixed telephone this year, Bangladesh look forward to ICT heavily as a tool for realizing the dream to be an "Emerging Tiger" for a better future.

back to index

Fazlur Rahman

Fazlur Rahman was born on 1st March 1937. After obtaining Degree in Electrical Engineering from Dhaka University (1958) with First Class, he joined the Electricity Department of the erstwhile Government of East Pakistan. From 1960 to 1971 he worked with the Pakistan Telegraph & Telephone Department in different capacities. Since 1971, he worked with Bangladesh Telegraph and Telephone Department / Board and in February 1995 he retired as the Chairman, Bangladesh Telephone & Telegraph Board (National Telecommunication Operator).

Fazlur Rahman was the architect for setting up of the Telecommunication Manufacturing Industries (Telecommunication Equipment and Cables) in Bangladesh. He pioneered easier access of telecommunication in rural Bangladesh. He worked in the Emirates Telecommunication Corporation, Abu Dhabi, UAE, on deputation as Chief Engineer for 1982 to 1987. Fazlur Rahman had been actively involved in International Telecommunication Union and Asia Pacific Telecommunity affairs on behalf of his country.

He is working as Chairman, South Asia Multi Media, (Independent Telecommunication Consultant of Bangladesh) and worked with organizations like The World Bank, International Telecommunication Union (ITU), Grameen Bank (Bangladesh), Andersen Management International A/S (Denmark), DETECON (Germany), TM [Telecom Malaysia] International Bangladesh (TMIB) etc.

Fazlur Rahman speaks Bangla, Hindi, Urdu and in English. He is married to Shamim Rahman and has two sons and one daughter.

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FQM FAROOQ

F Q M Farooq was born on 24th February in the year 1944. He obtained his degree in Engineering in the year 1964 from Bangladesh University of Engineering and Technology. Immediately after graduation, he worked in a construction engineering company for a period of one and a half year. He joined the Telegraph and Telephone Department of Pakistan in 1966. He underwent extensive training in Telecommunication Technology for two years at the Telecom Staff College, Pakistan. After the liberation of Bangladesh, his services were transferred to Bangladesh T&T Department and he served the organization in various capacities till February 2001. He went on leave preparatory to retirement as Chairman, the chief executive officer, of Telegraph and Telephone Board, the state-owned telecommunication operator.

F Q M Farooq was closely involved in activities related to formulation of National Telecom Policy, enactment of Telecommunication Act 2000 and formation of Bangladesh Telecom Regulatory Commission. He attended number of meetings, conferences and seminars organized by ITU, APT and SAARC. He represented his country in international, regional and bilateral meets. He had a number of publications on policy issues, management matters and development activities related to telecommunications in Bangladesh. He is a Fellow of Institution of Engineers, Bangladesh. He is married and has two children.

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back to index

Technology

Tuesday, 15 January 2002
1100–1230
Coral I

T.1.4 Satellite Delivery

Chair:
TIMOTHY LOGUE, Space & Telecommunica-tions Analyst, Coudert Brothers, *USA*

T.1.4.1 Advanced Broadband Satellite Digital Communication-System for the Emerging Ka-Band Market (View Abstract)

MARK BEVER; DOUGLAS HIXON; KENTON HO; STUART LINSKY; TERENCE SMIGLA AND ERIC WISWELL, TRW Space & Electronics Group, *USA*

Presenter:
ERIC WISWELL, TRW Space & Electronics Group, *USA*

T.1.4.2 Satellite Communications in the Asia Pacific—Opportunities and Constraints (View Abstract)

BRUCE MIDDLETON, Managing Director, Asia Pacific Aerospace Consultants, *Australia*

T.1.4.3 Broadband Data Communications Via Satellite—Networks and Methodology (View Abstract)

BRUCE ELBERT, Managing Director, Application Strategy Consulting, *USA*

T.1.4.4 The Role of Satellites in the Internet: Push, Pull and Last-Mile Delivery (View Abstract)

LESLIE TAYLOR, President, Leslie Taylor Associates Inc., *USA*

back to sessions

Advanced Broadband Satellite Digital Communication System for the Emerging Ka-Band Market

Mark E. Bever, Douglas A. Hixon, Kenton T. Ho, Stuart T. Linsky, Terrence R. Smigla, and Eric R. Wiswell
TRW Space & Electronics, Business Development Division

View Abstract

Introduction

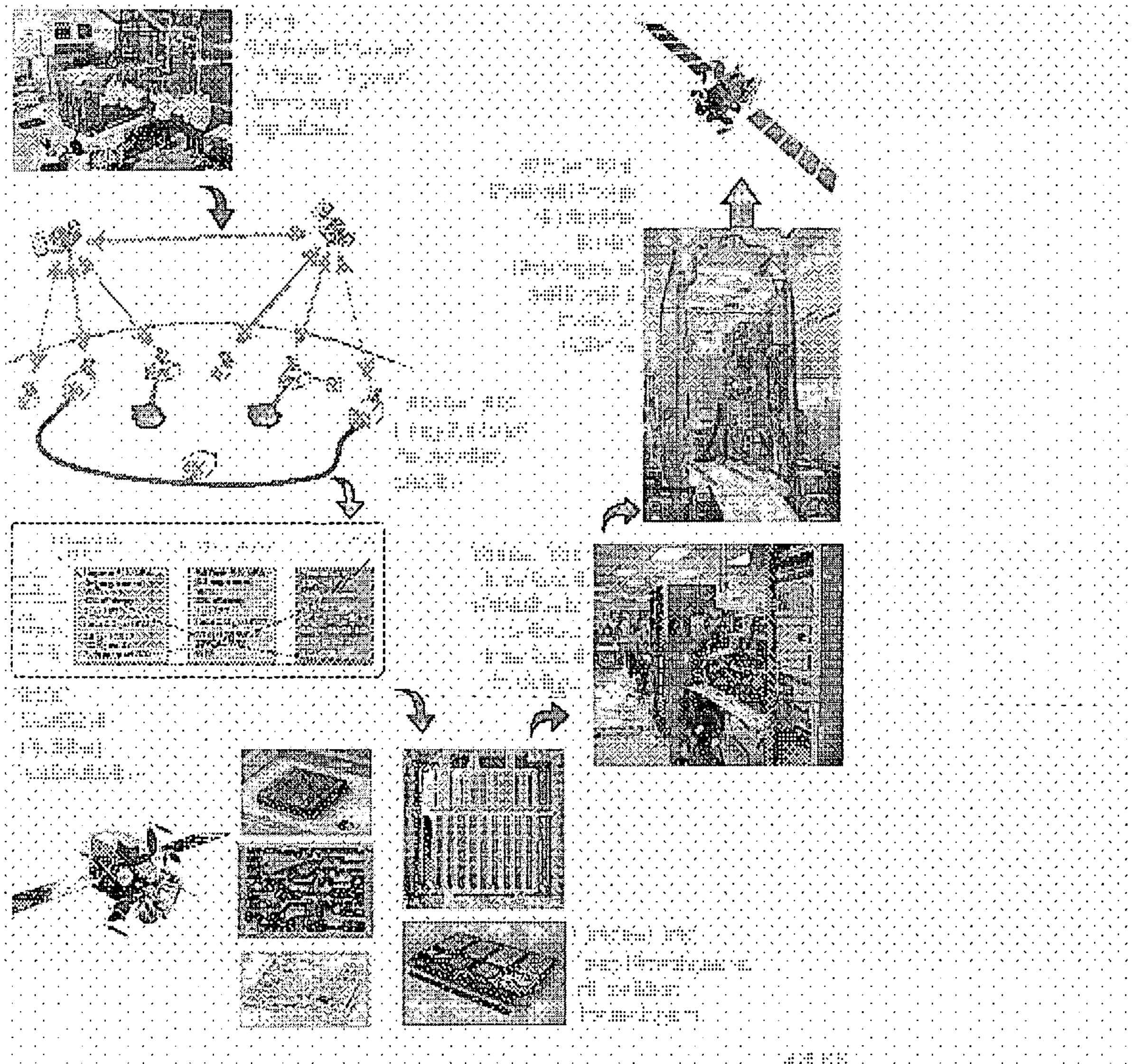
For more than two decades, TRW has been developing complex space communication systems at Ka-band. Figure 1 delineates the evolution of TRW's broadband payload history and development. TRW developed the first onboard-processed, on-demand, multibeam digital communication payload for military satellite payloads in the early 1980s. We then used this experience to develop design processes and the technologies required for an onboard digital-processed payload.

We were developing our third-generation of highly reliable digital processing in space by the mid-1990s. As shown in Figure 1, the Gen*Star payload hardware was directly derived from this third-generation hardware. The goal of commercializing these processes and technologies was realized at that time, and we began a large research and development program as follows:

- We began with a business plan analysis
- We performed system architecture studies
- We identified the high-leverage and enabling technologies

Over the next two years these technologies were successfully developed, including highly efficient digital signal processing algorithms, frequency converters, and high density monolithic microwave integrated circuit (MMIC) low-noise amplifiers (LNAs). We had retired the technology risks involved in broadband digital payloads by the end of 1997. However, we still had to prove that the application of these technologies to a specific design could meet the defined challenges. Thus, we shifted our research and development focus in early 1998 to implement an end-to-end hardware functional prototype (HFP) of the system.

The next step following this successful development was to design the flight payload. Using flight processes that are integrated and in test, we manufactured high fidelity design verification model (DVM) units. Full functional capability, low-risk, path-to-broadband payload solutions, and excellent correlation with performance predictions have been demonstrated, thus validating flight production techniques through this process. Overall cycle time was reduced by incorporating design-for-testability concepts.



In 2001, flight production was initiated. We have completed unit testing the first flight set of payload hardware, integrated it into the payload structure, and have begun payload-level acceptance testing.

Gen*Star Development Effect on Processed Payload Evolution

The Gen*Star payload development progress provides insight to address the following common questions concerning the ability of processed, or regenerative, payloads to be competitive:

- Do processed payloads impose adverse effects to spacecraft power and weight? The processor switch permits multiplexing multiple signals destined for a downlink beam to be multiplexed into a single high-rate data stream. This single-channel-per-carrier signal can be transmitted using a high-efficiency saturated TWTA at a much lower dc power consumption than the equivalent multichannel signal through a TWTA, which is backed off in power. Additionally, this single carrier operation is more bandwidth-efficient (no need for internal guardbands) compensating for the packet overhead. Furthermore, total payload weight can be reduced by designing the digital broadband packet switch processor to multiplex traffic from multiple beams into a single downlink signal that is hopped between multiple beams. The weight efficiency of processed payloads is greatly improved through this sharing of transmit hardware across multiple ground beams.

- Are processed payloads riskier to field? Through modern design practices, digital design has been made faster than analog design, and has enabled a flight-like DVM payload to be built in a time span comparable to bent-pipe payloads. The BIST allows faster and more thorough verification of the design. Being digital, it will perform throughout its life, over temperature, etc., just as it does when new. Reliability and the ability to recover from faults has been enhanced through the integrated fault management systems.
- Are processed payloads more costly and do they take longer to field? The modular design permits easy expansion or customization of the design configuration. Customization permits tailoring coverage and network mappings with minimum effort. The result is lower overall cost and schedule for constellations of more than one satellite, where the coverage and network map varies from one orbital slot to another. By reducing spare satellites and launches required for a constellation, overall life-cycle costs are greatly reduced. The digital design incorporates BIST, which greatly simplifies hardware unit and payload-level integration and test over the analog testing required for an IF switch.
- Are processed payloads less flexible? Although the waveform is fixed, the ability to encapsulate any data over ATM permits efficient transport of voice, data, multi-media, or specific applications yet to be defined. If required, these services can be provided with guaranteed QoS agreements. The digital broadband-packet switch processor permits any network topology, from point to point, hub and spoke, to full mesh connectivity. Furthermore, the topology can be evolved as the business plan changes during the lifetime of the satellite network. This flexibility can also be applied to network backup and restorability of service. A single on-orbit spare can back up multiple orbital slots in case of catastrophic failure. The on-orbit spare can also be used to generate revenue until it is needed in its spare capacity. Although processing can reduce flexibility of the physical layer, it greatly increases flexibility of the network layer. Users care little about which waveforrn their information is traveling over, but care a great deal about what services the network layer can support. Operators also benefit from the restoration of service flexibility afforded by processing, and by the greater deployment flexibility.

Gen*Star Payload Requirement Overview

The categories of payload requirements for the Gen*Star system are

1. Uplink communication
2. Network functionality
3. Downlink communications (see Figure 2)
4. Coverage

The payload can provide coverage to densely packed ground cells located anywhere in the satellite field of view (FOV). The Gen*Star payload has the flexibility to accommodate a wide range of cell locations distributed between user cells and gateway cells. Coverage cells can be packed with four-way frequency reuse. In addition, redundant uplink channels can be activated, providing additional uplink surge capacity in selected regions. After all overhead and coding are met, the total capacity of the payload is up to 12 Gb/s.

The waveform has many features that enable excellent performance in broadband satellite systems. A series of design trades led to the selection of the uplink and downlink waveform for the Gen*Star broadband systems. For uplink communication, the payload must receive user and gateway signals in each ground cell, then channelize, demodulate, and decode the signals.

Asynchronous transfer mode (ATM), which the basic network protocol is based on, permits quality of service (QoS); allows fixed uplink and downlink burst sizes to facilitate bandwidth assignments on the time-division multiple access (TDMA) link; and enables the encapsulation of various other protocols. The ATM protocol also facilitates interconnection with terrestrial networks.

Three burst rates in the frequency-division multiplexing FDM/TDMA uplink structure allow the use of cost-effective terminals appropriate for each application. With a specified receive power for each channel rate, the decoded cell loss rate must be less than 3 x 10 8 to support efficient data transfer. The system design is simplified by using a common user terminal and gateway terminal transmission format.

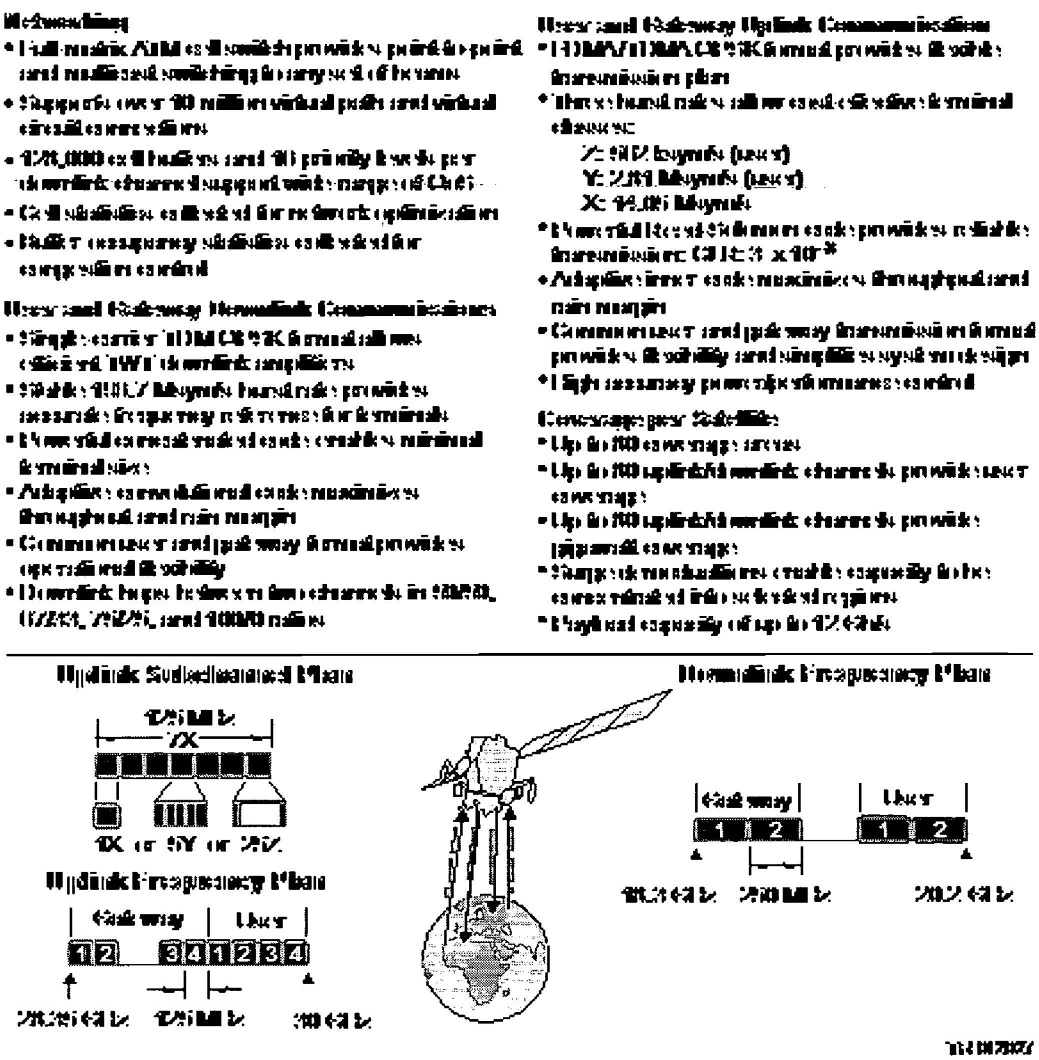


FIGURE 12. GEN*STAR PAYLOAD REQUIREMENTS SUMMARY

To minimize self-interference, the waveform incorporates pulse shaping. In addition, to prevent spectral emission problems with repetitive data, such as idle cell transmission, scrambling is incorporated for both uplink and downlink data. Short four-cell data blocks enable optimal allocation of bandwidth to users in the uplink frame, where traffic is composed of short-duration TDMA bursts from multiple users to the satellite. On the other hand, in the downlink where a single data stream is sent to multiple users, longer data blocks with interleaving between the blocks, are used to maximize code performance. Uplink power and signal-to-noise metrics are necessary to enable terminals to perform uplink power control. Direct feedback from the payload helps minimize uplink interference and provides greater power-control accuracy.

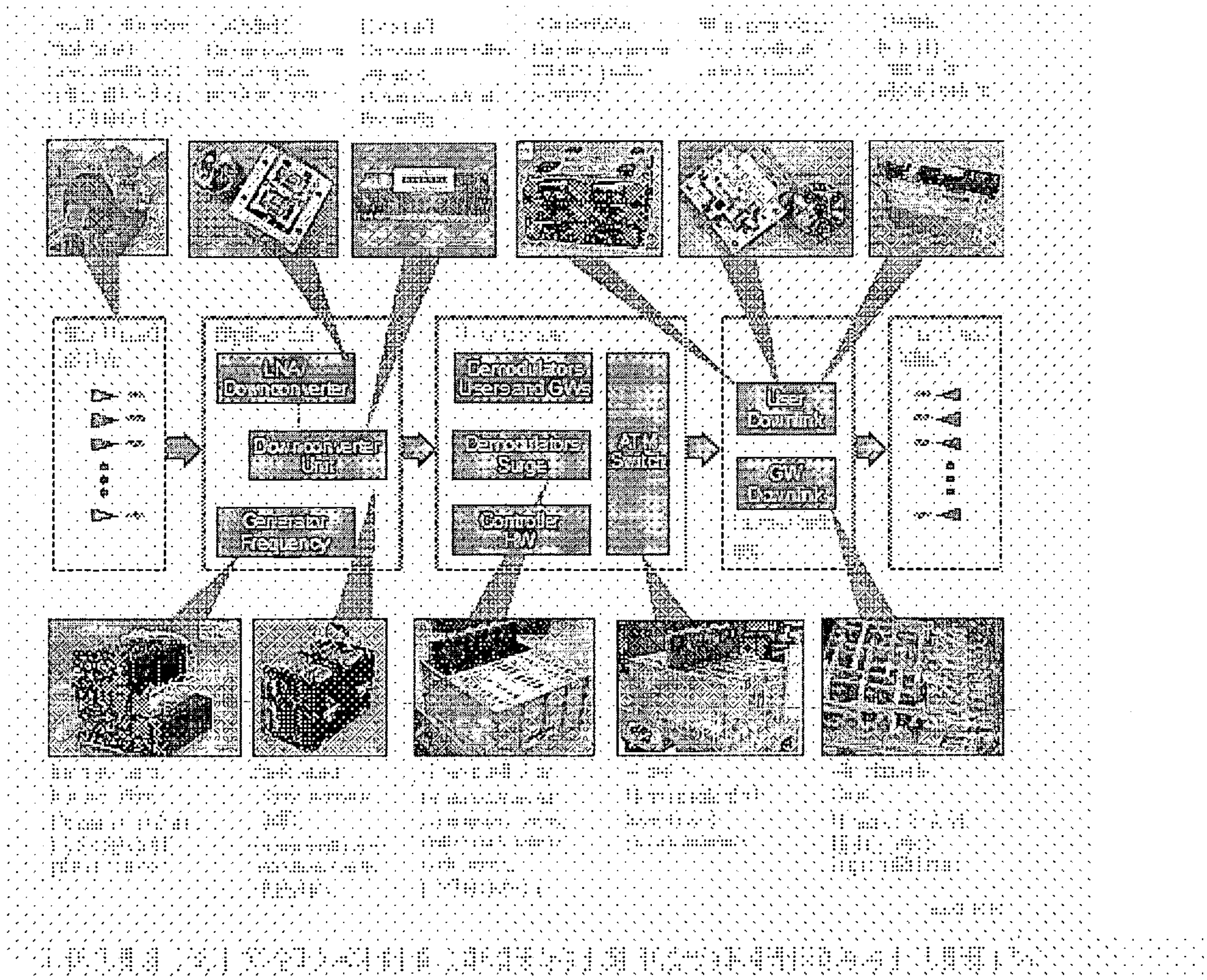
The ATM switch must support over 10 million connections, both virtual circuit and virtual path. It must provide point-to-point as well as multicast connections between any of the cells, users, and gateways. It must also support multiple QoS types, including constant bit rate, real-time variable bit rate, non-real-time variable bit rate, or available bit rate. Statistics are collected for fairness, policing, network optimization, and congestion control.

The payload must encode and modulate each ATM switch output into a single TDMA quadrature phase-shift-keyed (QPSK) signal that is shared by two beams for downlink transmission. This downlink sharing enables capacity to flow dynamically to the location where demand is greatest. The downlink signals must be transmitted at a specified power with strictly limited, beam-to-beam interference.

Gen*Star Payload Signal Flow

Figure 3 shows a top-level payload block diagram. The multibeam antennas (MBAs) receive uplink signals. The unique side-fed dual-reflector Gen*Star antenna configuration enables Ka band spot beam operation with the following performance characteristics:

- Ka-band (30/20 GHz) operation
- Performance using 2.5 GHz of available spectrum
- High-gain, multiple-hopping spot beams
- National, regional, and global coverage
- Global high beam quality
- Low side-lobe and cross-polarization interference
- High degree of flexibility



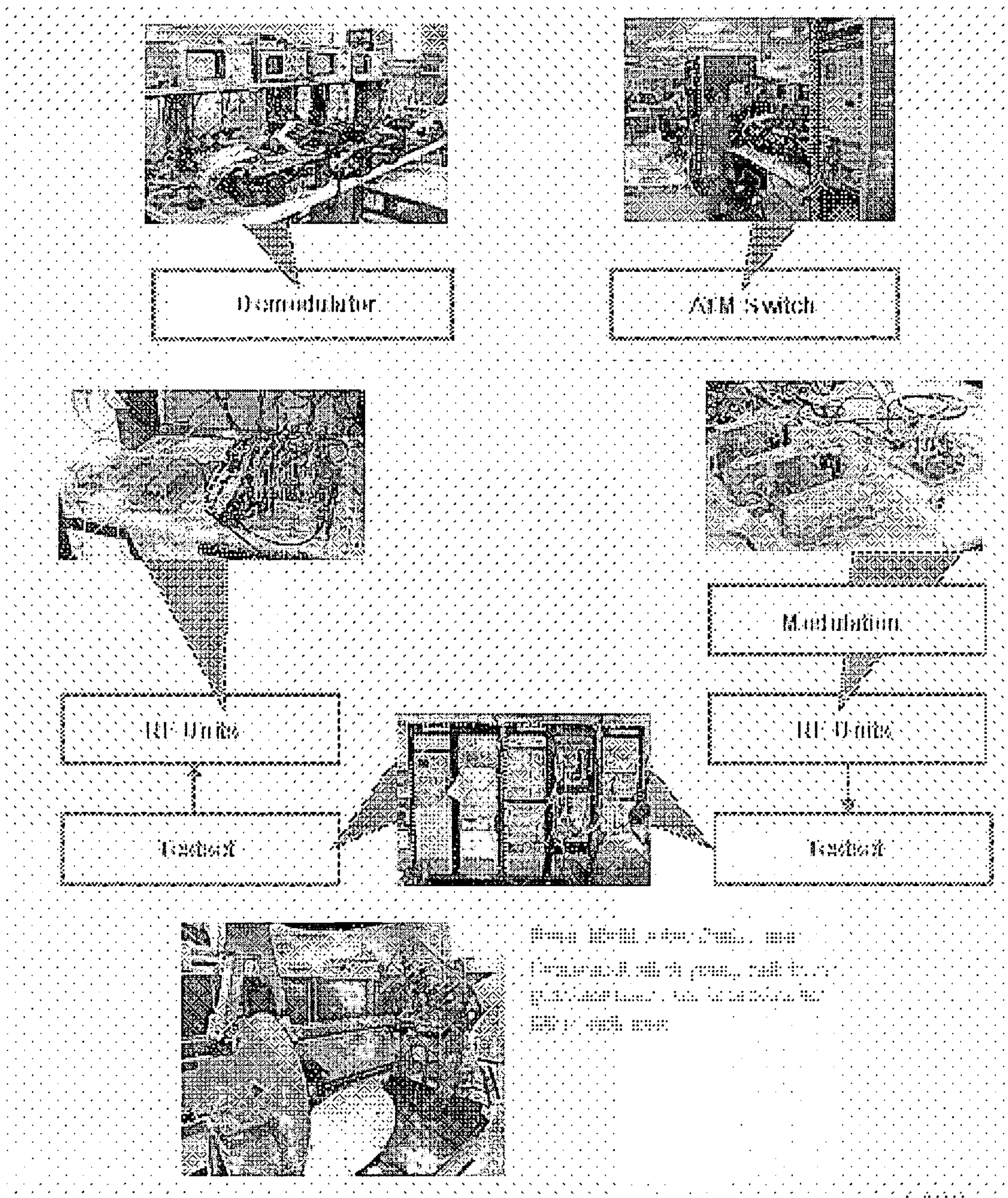
The LNAs and downconverters are MMICs and are packaged in a single integrated microwave assembly (IMA). The IMA is mounted directly to the feeds. This allows a low frequency, low-loss, intermediate frequency (IF) cable interface to the payload module, thus simplifying integration complexity and reducing weight. The IF signal is then downconverted to pseudobaseband by the C-band downconverter. This signal is sent to the demodulator, which immediately converts the signal to digital form. The digital samples are processed to select the three different channel types. Each channel is demodulated and decoded.

The demodulator sends the data formatted into ATM cells for presentation to the broadband packet switch processor. The broadband packet switch processor is composed of an ATM switch and an onboard computer for control. In support of ATM QoS, the switch design includes significant downlink cell buffer capacity and input fairness algorithms. Statistics are generated, packaged into ATM cells, and routed to the network control center to facilitate traffic management. Switch outputs are formatted and encoded for transmission, then modulated with QPSK square-root-raised cosine pulses.

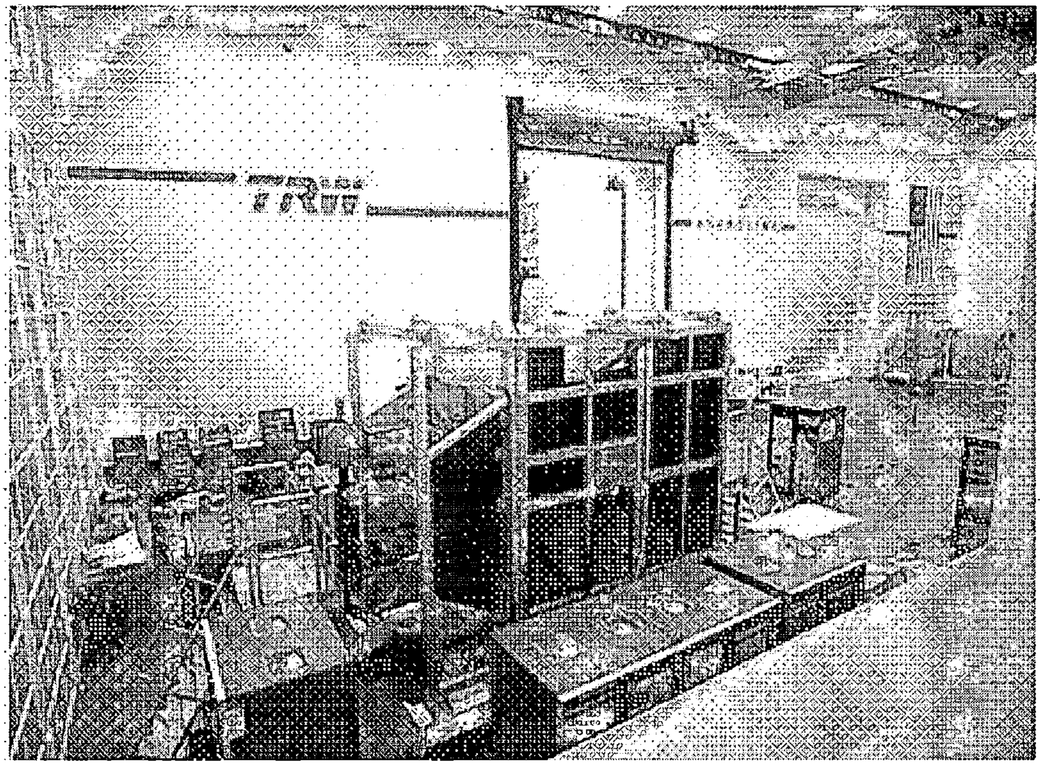
Efficient transmission is achieved through upconversion via a single carrier per traveling wave tube amplifier (TWTA). The carriers are sent to the antenna for transmission. The single carrier downlink signal can be time-shared between two beams, further enhancing efficiency.

Gen*Star Payload Development

Gen*Star system concepts have been validated in several stages. First, we developed and tested a full end-to-end Gen*Star system testbed and the HFP, consisting of two full uplink and downlink channels and terminal emulators (Figure 4). The HFP was implemented hosting flight application-specific integrated circuit (ASIC) logic designs on field programmable gate arrays (FPGAs), thereby facilitating design checkout and integration. The HFP demonstrated payload design functionality and performance, including downlink frame construction, downlink modulation, uplink channelization, demodulation and decoding, cell routing, and nonblocking ATM switch routing. In the HFP environment, we also developed payload test methods.



A brassboard antenna was developed along with this end-to-end electronics prototype. The selected antenna design was based on extensive design trades. Tests of the brassboard antenna show outstanding gain and isolation performance across the entire Earth FOV and correlate well with analytical predictions. We developed the Gen*Star DVM payload after fully validating the electrical design of the system using the HFP (Figure 5). We built DVM units, using flight parts and flight processes (Figure 3), and have completed thorough design verification testing of them, including flight environmental screens.

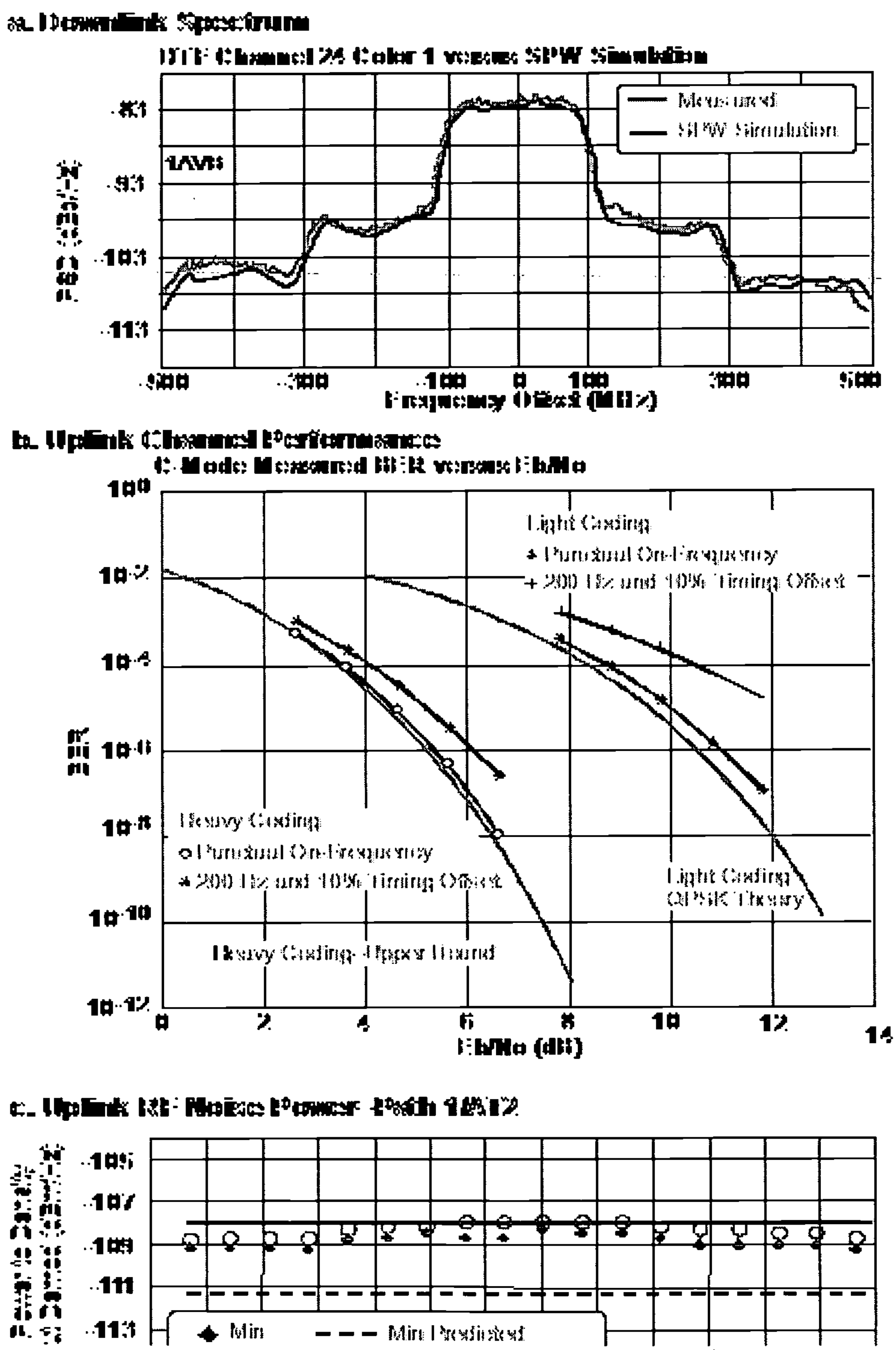


Concurrent engineering has enabled the unit designs to take maximum advantage of design-for-manufacturing and design-for-test practices. The RF MMIC components are manufactured on an automated assembly line and achieve excellent performance without tuning. The digital boards are assembled on an automated line and incorporate extensive boundary scan and logic built-in-self-test (BIST) functions to facilitate checkout and detection of defective parts. Because of the special construction of the processor units, a board can be replaced without disassembly or removal of it from the satellite.

To create a DVM payload, the DVM units were then integrated into a flight-like mechanical facsimile of the satellite structure. The DVM payload includes six full 125 MHz uplink channels and three full 250 MHz downlink channels. Each downlink channel serves two cells. The DVM digital processors were built to full scale to enable unit thermal and vibration qualification. The test equipment for the DVM payload is an extension of the HFP test equipment.

The DVM payload's performance test results matched analytical performance predictions (Figure 6). Functional tests demonstrated successful routing of uplink ATM cells from the testset terminal emulator through all payload processing functions (downconversion, channelization, demodulation decoding at all three uplink subchannel rates, routing through the ATM switch, modulation, upconversion, amplification and routing to the antenna) and back through the terminal emulator. The DVM payload accomplished the following major goals:

- Validation of the functional design of the payload
- Validation of the payload performance
- Validation of the payload manufacturing processes
- Validation of the mechanical design of the payload



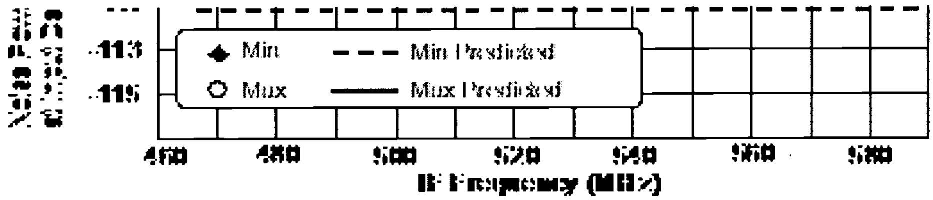
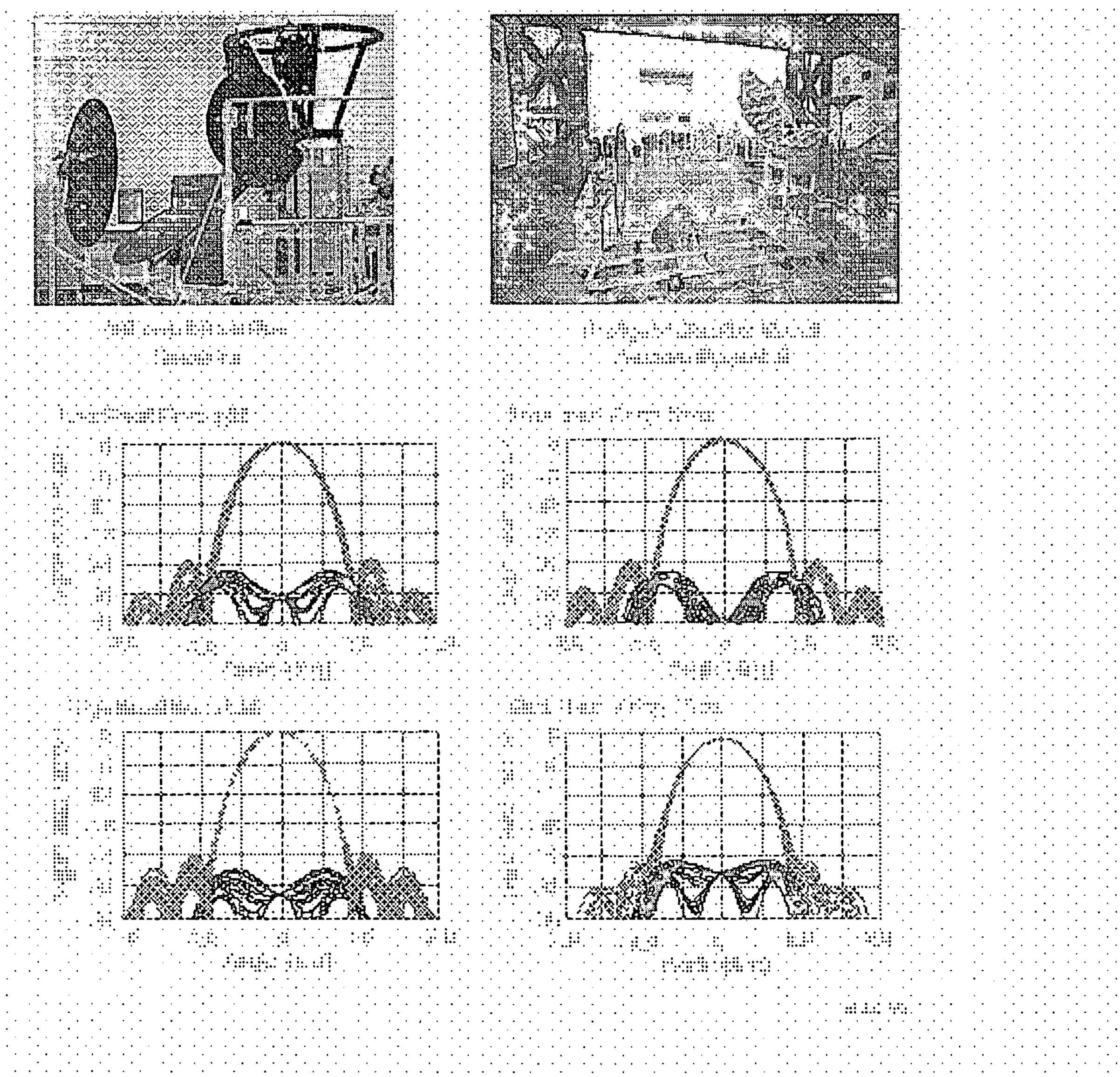


FIGURE 6. DESIGN VERIFICATION MODEL PERFORMANCE

We the excellent gain and side-lobe performance required for constructed the DVM antenna in two phases. First, we upgraded the brassboard antenna with flight horns and reflectors. This DVM antenna was used for complete electrical characterization, and it retired all risk related to the electrical performance of the antenna design. Like the brassboard, test results show a striking correlation with predictions and demonstrate high capacity broadband systems.

We developed an antenna interface simulator to address the mechanical design, including the design of the full suite of four uplink and four downlink apertures, and the interface with the spacecraft bus. The antenna interface simulator consists of the core structure-one complete uplink aperture and one complete downlink aperture (Figure 7). This antenna has retired all risk related to the mechanical design of the antenna, including the structural integrity of the antenna, the pointing, the alignment processes, and the manufacturing processes.



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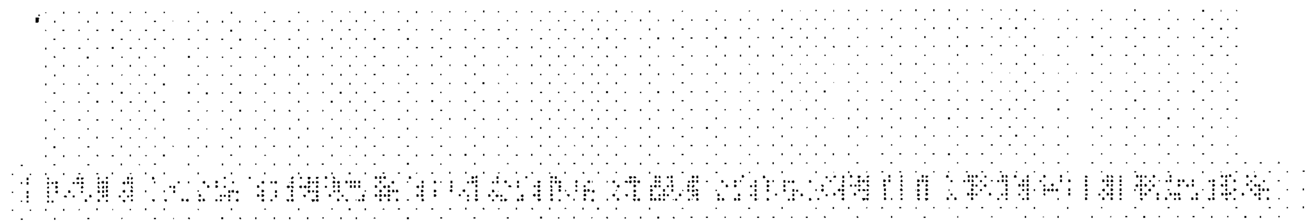

We initiated flight production in early 2001. We have completed production and test of each of the flight units. The units have been integrated onto flight payload panels. The payload has been integrated and is now in acceptance testing. Integration tests that have been run thus far produce performance results comparable to the DVM payload test results. The payload acceptance test is near completion. The first flight antenna is also fully integrated. Following a precise alignment process, the antenna has entered performance testing in a near-field antenna range.

System Advantages of the Gen*Star Antenna

The Gen*Star antenna is designed to deliver the high performance necessary to support multibeam Ka-band systems. In each phase of the design process, the Gen*Star antenna was optimized for performance. The result is the first antenna to offer excellent gain and carrier-to-interference ratio (C/I) performance anywhere in the full Earth FOV.

In many multiple beam systems, interference-rather than noise-limits capacity. The C/I performance becomes the key enabler for maximum capacity. To minimize interference, coverage patterns must be defined so that interference is reduced to acceptable levels. Typically, the coverage pattern is optimized to reduce C/I, forcing more separation between coverage cells and fewer copolarization interfering channels and resulting in a decrease in system capacity. With the Gen*Star design, satellite service providers can densely space coverage cells and optimize the coverage pattern for maximum capacity delivered where it is needed. This translates directly into service revenue and profit for the satellite service provider.

Uniform effective isotropic radiated power (EIRP) and gain/temperature (G/T) for all cells enable standard terminal design. The excellent scan performance of the Gen*Star antenna translates into uniform EIRP and G/T for all coverage cells. To minimize terminal cost and thus increase the affordability of the system to the end user, terminals for the Gen*Star system can be standardized for all coverage cells.

Full Earth FOV minimizes time to global coverage. The ability of the Gen*Star antenna to provide high performance coverage over the full Earth FOV reduces the number of satellites required for global coverage, which allows the service provider to reach global coverage with fewer launches and in less time. The improved time to market and reduced launch costs may translate into improved revenue and profit for the satellite service provider.

Coverage flexibility enables high-value approaches to service rollout, sparing, and service restoration. Homogeneous gain and side-lobe performance over the entire Earth field of regard translates into high levels of coverage flexibility. In addition to regional coverage, the Gen*Star antenna can provide multiregion and multislot coverage, as illustrated in Figure 8. For both types of coverage, the antenna is configured to provide coverage for multiple regions. The multiregion antenna provides coverage from the same slot while the multislot antenna is configured to provide coverage for multiple slots. Upon launch, the beams for the selected slot are activated and the remaining feeds remain dark.

Multiregion and multislot coverage capabilities enable high value approaches to service rollout and sparing. With the capability to cover multiple regions and service multiple slots, the satellite service provider has much more flexibility in deployment. Rather than customizing the satellite for a specific coverage area, the service provider can select multiple coverage options and wait until launch to make the final selection. This additional flexibility permits the service rollout to be based on the latest market data.

Multiregion and multislot coverage also enable high-value sparing and service restoration approaches, as illustrated in Figure 9. Instead of expensive one-for-one sparing, the service provider can configure spares to support multiple regions. Should a failure occur, the spare can be configured to provide the coverage of the failed spacecraft. Sparing requirements can be reduced dramatically, depending on the coverage requirements and available orbital slots. In addition, the spare satellite can be dark or configured to provide additional capacity. Upon failure of another spacecraft, the capacity can be reallocated as necessary.

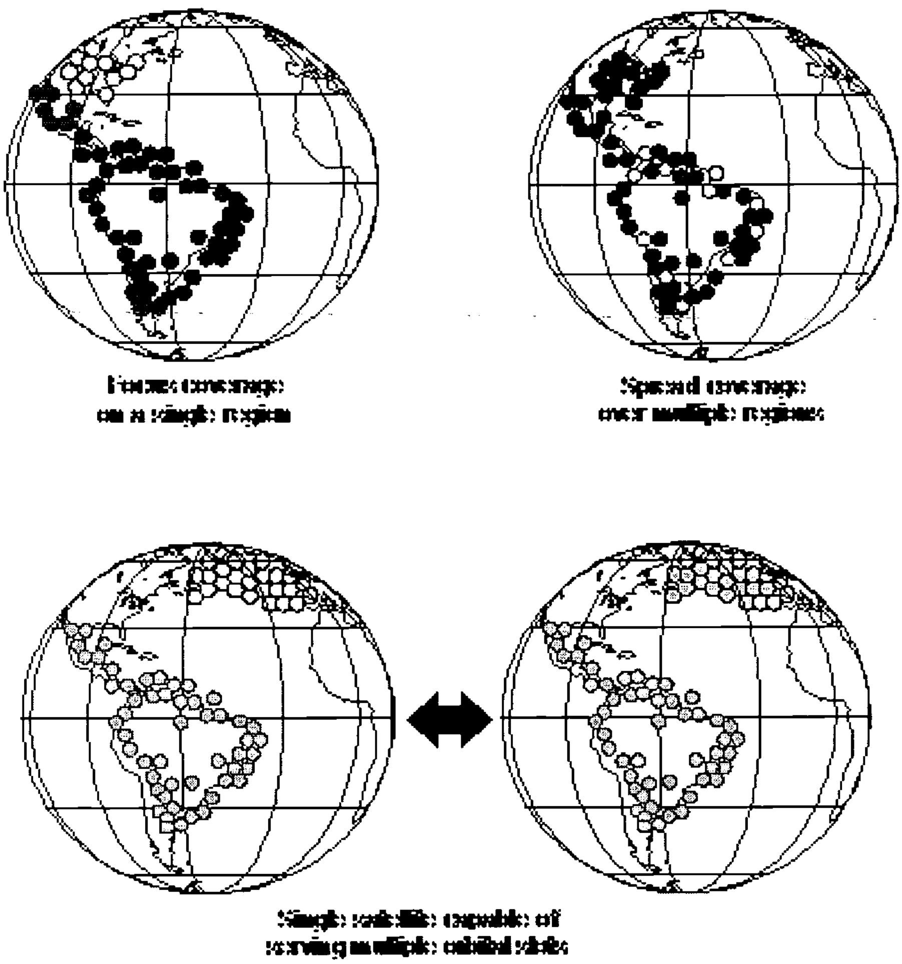

FIGURE 8. COVERAGE FLEXIBILITY ENABLED BY THE GEN*STAR ANTENNA

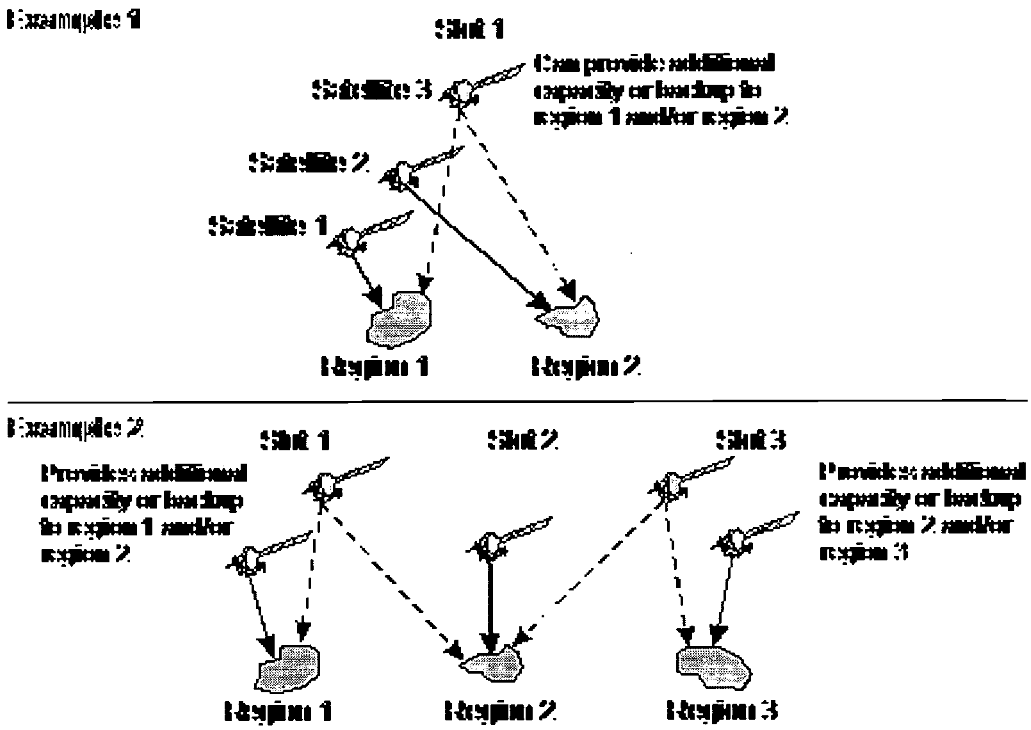

Figure 9. [illegible]

Additional Gen*Star Payload Benefits

The Gen*Star Payload Applies to Bent-Pipe Systems. The TRW Gen*Star payload elements can be configured in high-performance, bent-pipe configuration. The performance advantages of the Gen*Star antenna apply directly to this alternate configuration. The high performance MMIC LNA/downconverter mounted with the antenna feed offers optimum satellite G/T with the benefits of signal routing, filtering, and conditioning at a convenient IF frequency.

Extension to C-Band and Ku-Band Broadband Satellite Networks. Spot-beam antenna coverage and onboard processing benefits can also be applied at C band and Ku band. The same onboard processors used at Ka band can be used in these frequency bands. The spot beam antenna coverage is achieved through multibeam antenna designs adapted to use at C band and Ku band. These advances in satellite coverage can been achieved while supporting legacy networks. The improved technologies add new network capabilities.

Use of multibeam antenna designs to produce spot-beam coverage increases system capacity through frequency reuse, just as in Ka band. Frequency reuse values greater than 10 are possible with this technology, resulting in dramatic increases in revenue-producing capacity. Additionally, satellite power resources are used more efficiently with spot beams by dedicating coverage to the high revenue-producing areas.

Partition of services to provide local content delivery is also obtained through the use of spot beams. Thus, content is only delivered to the revenue-producing customers and not entire regions. Another benefit is that coverage can be tailored to support geopolitical concerns such as regulatory requirements in a straightforward manner. Figure 10 demonstrates the multibeam advantage.

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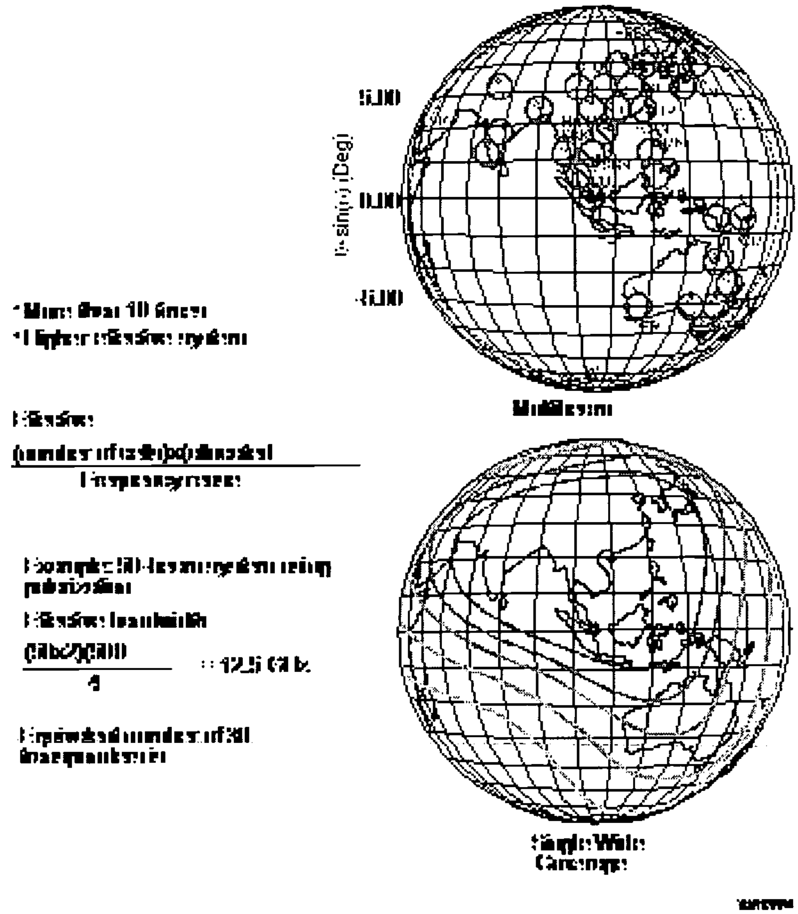


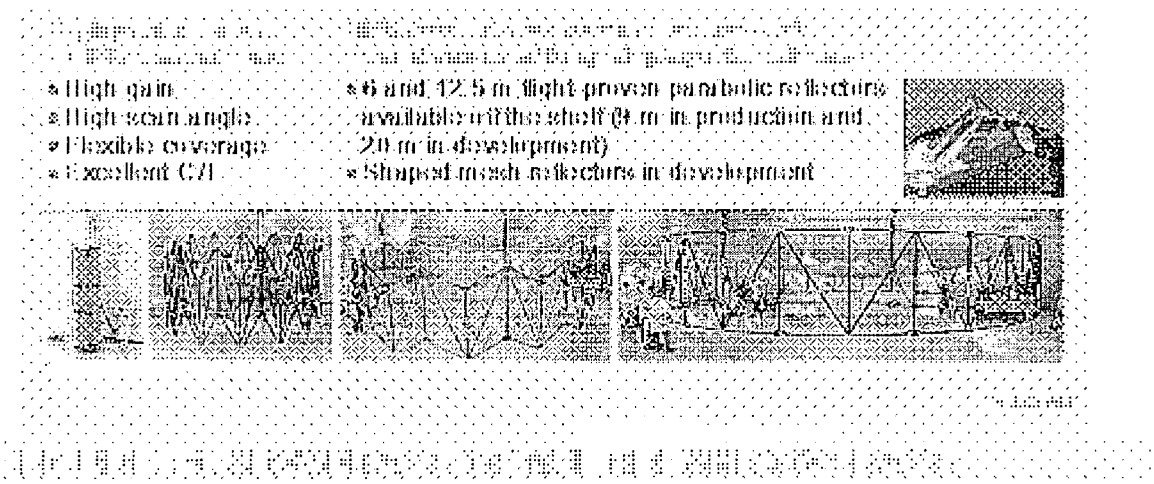
Multibeam antennas used at these frequencies produce several benefits in communication link performance. Use of spot beams implies that the antenna gain is much higher than seen in conventional C-band and Ku-band systems. These means that higher EIRP and G/T can be readily obtained. With higher EIRP and G/T, the satellites can easily support higher data rates. Indeed, downlink data rates greater than 100 Mb/s are easily supported. This truly brings broadband communication capability to these networks.

An additional advantage of the higher gain satellite antennas is that Earth terminals can use smaller antennas and lower transmit powers to achieve higher data rates. For example, a C band Earth terminal with a 1.8 m antenna and a 4 W transmit power can support a 4 Mb/s uplink. Conventional systems would require much larger Earth terminals to provide the same support.

By using these satellite network improvements, multimedia broadband services similar to the developing Ka band systems can be provided at C band and Ku band. These advanced networks are especially well adapted to support both mesh and star network capabilities. With the addition of onboard processing that includes routing, full peer-to-peer (mesh) connectivity is obtained. Thus, fully interconnected broadband multimedia networks can be achieved in regions where propagation conditions-such as those seen in tropical areas with heavy rainfall-prohibit practical deployment of Ka-band systems. In addition, onboard routing enables interconnectivity between cells serviced with different frequency bands.

To bring these critical technologies to fruition, particularly for use in broadband satellite networks, a solid systems engineering competency is required. System engineering used in developing broadband Ka band satellite networks resulted in technologies directly applicable to other frequencies. High performance antennas designed for use at Ka-band and C-band (shown in Figure 11) and onboard processing technologies are critical technologies to the emerging

Ka-band market.



Summary

The construction of the first Gen*Star payload application, is well under way. The Gen*Star payload has demonstrated a high degree of maturity and excellent performance, enabling low-risk, early-service initiation. Successful technology developments in high-density electronics provide high capacity at low risk. The Gen*Star antenna can provide multiregion and multislot coverage over multiple regions. It provides several dimensions of system configuration flexibility that are of significant use to satellite operators. Both the hardware functional prototype and the DVM payload end-to-end design have been validated. The DVM payload is manufactured using full flight processes, validating the high throughput manufacturing techniques needed for these multiple-beam satellite systems. Bent-pipe architectures and systems operating in alternate frequency bands can also benefit from technologies developed for the Gen*Star broadband system.

back to index

Abstract

In response to the demands for broadband satellite systems and services, TRW initiated development of the Gen*Star processing payload. The Gen*Star system development objective of providing profitable broadband connectivity with seamless interfaces to a terrestrial infrastructure implies highly reliable network nodes in space. Robust communication links and sophisticated onboard signal and data processing are required to achieve this objective. Using technologies designed to operate in space for years, the Gen*Star satellite payload provides such communication links and processing functions in a package suitable for launch into space.

In developing the TRW Gen*Star payload, we incorporated business analysis, terminal concepts, payload technologies, network simulation and analysis, and network operations. Since initiating the effort, TRW has completed simulations, a functional hardware prototype of the payload, a complete engineering model payload, and integration of the first flight payload. The end-to-end engineering model of a broadband payload operating at Ka-band features engineering model hardware tested to flight environmental conditions and built to flight production standards.

back to index

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back to index

SATELLITE COMMUNICATIONS IN THE ASIA PACIFIC - OPPORTUNITIES AND CONSTRAINTS

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View Abstract

1. Introduction

The decade from 1990 was a period of strong growth in satellite capacity in the Asia Pacific. During this period no less than ten national satellite communications systems - six regional systems and four global systems - commenced service. Satellite TV, one of the drivers for this growth, did not take off as expected, but the Internet arrived and showed astonishing growth, quickly becoming a major proportion of network traffic.

Strong economic growth that underpinned the satellite business slowed down dramatically from 1997, and the regional satellite communications industry had a tough few years. Then, just as reformed national economies were resuming their former growth rates in 2000, the global economy faltered and Asia Pacific economies followed suit.

Now however we are entering a new era. As the end of the global economic slowdown seems to be in sight, the promise of satellite TV may soon be realized, and broadband services are unleashing new demands for bandwidth with positive implications for the satellite industry.

This paper canvasses some of the opportunities and constraints now facing the satellite communications industry in the Asia Pacific region.

2. The Economic Environment

Prior to 1997, economic growth in the Asia Pacific was strong and per capita incomes were rising. Entrepreneurs and investors embarked on new satellite ventures in a positive business environment. The regional economic crisis that started in 1997 with attacks on the currencies of southeast Asian countries took more than a year to work its way around the region. It eventually impacted north Asia, and reduced growth in countries outside the Asia Pacific region that had substantial trade with Asia.

By late 1999 growth had resumed in all the countries impacted by the crisis, including those worst impacted. Confidence was being rebuilt, with stronger fundamentals underpinning what looked like a relatively vigorous recovery in most countries. Regional economic growth (excluding Japan) was 6% in 1999 and 7% in 2000. The rapid recovery was fuelled by continuing monetary and fiscal stimulus, as well as by external demand supported by a recovery in prices of electronics (Asia is now the world's largest supplier of electronic goods). In October 2000 the International Monetary Fund (IMF) was predicting that growth in Asia would be more than 6.5% in 2001.1

While continuing demand for information technology goods was underpinning the expansion, private domestic demand became a more important driver for regional growth in 2000, particularly in those countries most advanced in recovery where fixed investment was increasing rapidly. This was good news for the satellite industry, for rising private domestic demand meant more demand for satellite TV and broadband services.

In 2001 however the slowdown in the US economy threw predictions aside. Prices for electronics tumbled as demand softened, triggering a drop in confidence across the Asia Pacific region. Stock markets slid, currencies softened, and business activity slowed. Then came the terrorist attacks on the US on 11 September, followed by military action in Afghanistan. As a result, recent IMF growth projections are much more modest. The economies of Japan, Taiwan* and Singapore, all major exporters of electronic goods, are now believed to have contracted during 2001. Hong Kong, which recorded 10.5% growth in 2000, is expected narrowly to have avoided recession in 2001. Malaysia is expected to have fallen from 8.5% economic growth in 2000 to 1.0% in 2001. Korea achieved 8.8% in 2000 but probably achieved only 2.5% in 2001.2

All is not bleak however. There are emerging signs that the global economy may have bottomed, and every economy in the Asia Pacific is expected to achieve stronger growth in 2002 than in 2001, with the single exception of China (where outstanding growth of 7.5% in 2001 is expected to moderate to 7.1% in 2002).

The economies of the Asia Pacific together are expected to achieve a collective growth of 2.4% in 2002 (5.3% excluding Japan) compared with 1.3% in 2001 (3.8% excluding Japan).

3. Deregulation And Satellite Markets

Market deregulation is sweeping across the Asia Pacific with implications for the structure of the satellite services industry. The global trend towards open markets is driving fundamental changes in national markets in Asia. Competition is being introduced into telecoms markets, and government-owned telco monopolies are being corporatised and then privatised. (These two processes pose challenging issues of timing for governments faced with the competing policy objectives of lowering service charges through competition, and maximising the value achieved from the sale of publicly-owned assets).

Some telecoms markets - Australia, Indonesia, New Zealand and Singapore - are now fully open, whereas at the other end of the regulatory spectrum Vietnam is closed and tightly regulated (though perhaps not for much longer). Others are partially deregulated. In some markets, despite some deregulation, the incumbent telco (whether still majority government-owned or not) is still so dominant that the benefits of competition are a long way from being realised. Korea, Malaysia, the Philippines and Taiwan are examples.

China is of special interest because of market size. Already the number of telephone lines in China is 50% larger than in Japan, but teledensity has not yet reached 10% in China whereas in Japan it is nearly 56%.3 After negotiations that started in 1987, China finally joined the World Trade Organisation (WTO) as a full Member in November. Inevitably this will result in an opening of the Chinese telecommunications market to foreign businesses, and some relaxation of rigid controls on broadcasting.

Satellite services markets are following a similar path to telecommunications. Governments around the region have in the past used a range of devices to protect their national satellite operators. Restricted access is one of those devices. In Australia, during an interim period of protected duopoly from 1991 to 1997 it was illegal to both uplink and downlink from the same satellite within the country (without express Ministerial dispensation, which was never granted), except through one of the two licensed full service telcos (Optus and Telstra). In Korea, only facilities-based telecommunication service companies are currently permitted to uplink to foreign satellites, effectively channelling TV broadcasters (which do not require terrestrial infrastructure, or facilities) towards Koreasat.

In Malaysia, Telekom Malaysia (which remains 60% government-owned) is required by its majority shareholder to give Measat first preference for domestic services. Philippines satellite operators are given first refusal to provide space segment capacity to approved telecommunications carriers wishing access to international satellite services. In Thailand, Shin Satellite received an eight-year period of exclusivity when it established the Thaicom satellite system in 1991. Although that period expired in September 1999, the Communications Authority of Thailand still does not licence uplinking other than to Thaicom.

The barriers used to protect these satellite businesses are coming under increasing pressure from the WTO. The growing globalisation of business is adding to that pressure. As protection is reduced, national satellite systems (some of them struggling to achieve commercial viability even in a protected domestic market) are being exposed to competition from regional and international operators. For a regional operator, any national market represents only a fraction of the total potential business. He can defray fixed costs across a bigger market and therefore achieve a lower relative cost base. For a formerly-protected domestic operator, a regional competitor gaining access to the core domestic market represents a threat that cannot be ignored.

In response, domestic operators have little choice but to address the wider regional market as soon as they are technically able. Achieving the necessary footprint is the easy part, even though that can be expensive. Marketing the system's capability within the region, and establishing alliances that support competitiveness, are much harder. As a result there is a growing trend towards strategic partnerships and even mergers and acquisitions. Some involve regional players, others involve regional and global players. More can be expected.

4. Industry Restructuring

Government and commercial factors are driving satellite industry restructuring in the Asia Pacific.

In China, the Ministry of Information Industry (MII) was established in 1998 by amalgamating the former Ministries of Electronics Industry and of Posts and Telecommunications, together with some functions of the former Ministry of Aerospace Industry. One important objective of the new ministry structure was to separate business activities (including provision of telecommunications services) and the entities providing those services from the ministries themselves, leaving the ministries to be responsible only for policy and regulation.

Around the time this initial reorganisation was under way, the Chinese government decided that the People's Liberation Army (PLA) should not be involved in trading companies. In the past the PLA has been a source of investment funds for some satellite operators, so fund raising for new satellite projects must now follow a more commercial path. In consequence it has become more difficult.

China Telecom was divided into four business units in 1999-2000, and its satellite business emerged as one of those. It was then decided to bring both ChinaSat and China Orient (both being linked to China Telecom and the MII) into the satellite group. A new holding company, China Telecommunications Satellite Group Company, commenced operations this month, January 2002. It is the seventh basic telecom operator in China (after China Telecom, China Unicom, China Mobile, China Railcom, China Netcom and Jitong).

In Indonesia it was a condition attached to the IMF rescue package after 1997 that the telecommunications market be opened up, which was accomplished in September 2000. Indosat, the former monopoly international carrier, immediately announced that it intended to become a full service telco. Telkom, which already had a licence for mobile services and equity in (but not control of) the Telkomsel cellular business, moved in the same direction. During 2001 Indosat and Telkom divested cross-shareholdings in each other, in a $1.5b deal. Indosat bought Telkom's 22.5% stake in Satelindo, to which it added Bimagraha Telekomindo's 45% stake, resulting in Indosat owning a controlling 75% share of Satelindo. These changes have implications for the satellite businesses of both Satelindo and Telkom. For Satelindo, the implications include having a financially stronger owner. For Telkom, the new competitive environment compounds the difficulties of solving the problem of non-viable agreements for new terrestrial infrastructure funded by foreign partners.

More restructuring is being driven by commercial factors. As noted earlier, former domestic satellite operators have little choice but to address the wider regional market as soon as they are technically able. As a result of the alliances required for effective marketing, there is a growing trend towards strategic partnerships and mergers and acquisitions. Intelsat has forged new alliances with operators in China and India to share payload and gain access to orbital locations. PanAmSat has talked with most regional operators exploring partnering prospects. One national operator is currently canvassing other operators for investment in a new regional project. There is more, most of it not yet public, and more still is to come.

5. The Impact of Undersea Fibre

Transoceanic fibre is being laid under and around the Pacific Ocean in unprecedented capacity. The current investment commitment to fibre cables in the Pacific exceeds that committed to fibre cables in the Atlantic.4 These new cable systems have three important features of great significance for trans-Pacific satellite services. Two of those features are huge capacity and low per-megabit cost. The northern and southern cables of Global Crossing, for example, have an initial transmission capacity of 80 Gbps, upgradeable to 640 Gbps using DWDM. Satellites cannot compete on capacity or cost to customers.

Equally important is the third feature. With a ring configuration, these cable systems are able to offer redundancy. Global Crossing completed its north Pacific ring to Japan in December 2000. If the northern route of that cable were damaged, Global Crossing would continue to provide high-speed transoceanic service using only the southern route. Redundancy on trans-Pacific links has been one reason customers have remained interested in Asia Pacific satellites with capability to reach the US, whether through Guam, Hawaii or California. With redundancy now available on fibre in the north Pacific at lower price and higher capacity than on satellite, it is likely these transpacific satellite links will become less attractive to this business, and will lose it altogether once fibre redundancy is widely available.

On the other hand, until redundancy exists in the undersea cable infrastructure within Asia, corresponding intra-regional business will remain a significant market for satellites. The demand for capacity for trans-Asian traffic (between Japan, India and other parts of Asia) is increasing and, for the foreseeable future, some of this will be transmitted on satellites. The issue of redundancy will continue to be significant.

The huge capacity of these fibre cables means that data, including Internet content and new interactive multimedia services, can be delivered at unprecedented speeds. Those data have to be delivered from the national gateway to their final destination. In some of Asia, where neither XDSL nor terrestrial fibre cable is available and the copper network is of poor quality (if available at all), satellite is the only viable option to deliver the data at speed. It is not surprising therefore that there have been a number of broadband satellite proposals, though as yet none has reached orbit.

The broadband satellites address two distinct stages in the journey of high-speed data. Most aim to connect the national gateway to either Internet Service Providers (ISPs) or corporate customers. They can be characterised as business-to-business (B2B) solutions. Examples are Malaysia's former DTS proposal and Hong Kong's PCDataStar. The other important link in the network is connecting to the end-user - the "last mile". This business-to-consumer (B2C) market is being addressed by Thailand's iPSTAR.

6. C-Band, Ku-Band and Ka-Band

A regional zoning has developed, in which the three frequency bands are favoured. Near the Equator, especially in Indonesia, C-band is the primary band of interest due to the rainfade issue. The forest of rooftop C-band antennas in Jakarta is testimony to the use of C-band for what passes in Indonesia for DTH television. The Cakrawarta-1 DTH satellite uses the even lower frequency S-band to cater for rainfade in Indonesia.

This preference for the superior performance of C-band in rain extends to the edge of the influence of the Monsoon, though Ku-band is used within much of that region as well. From Singapore and Malaysia north to Japan and Korea, Ku-band is increasingly favoured. However the industry is well aware of the difficulties encountered by Measat in Malaysia with rainfade of TV transmissions during heavy rain, notwithstanding EIRP levels as high as 56 dBW.

While at present there is a surplus of Ku-band capacity in the region, there is an expectation of increased demand for Ku-band in 2002. The broadband services discussed later in this paper are likely to be behind at least some of this increased demand.

Ka-band has been available in north Asia for most of the past decade, though it has not been much used. The Japanese satellites Superbird-B1 (launched February 1992), Superbird-A2 (December 1992), N-Star-A (August 1995), N-Star-B (February 1996) and Superbird-4 (February 2000) all carry Ka-band, as does Koreasat-3 (September 1999). Some of the Japanese Ka-band has been for military use, some for commercial use. However Korea appears at present to be most advanced in implementing commercial Ka-band services.

With the growing demand for broadband services and increased bandwidth, new Ka-band capacity is now being planned. In Korea, Space Broad Band's H-Star is to operate in Ka-band, if sufficient funds can be raised for the project to proceed. Pacific Century Matrix's PCDataStar is to use Ka-band, and others have talked about using Ka-band. (Optus-C1 will have Ka-band, but only in the military payload, and Shin Satellite will use Ka-band for network links.)

Based on current experience and trends, Ka-band can be expected to continue to be more acceptable in northeast Asia than in southeast Asia. Since the biggest demand for broadband services is likely to come from markets like Japan, Korea, China and Taiwan, more demand for Ka-band can be expected.

7. Internet and Broadband Programs

Asia is recording the fastest growth of Internet user numbers of any region in the world. There are expected to be more than 150 million Internet users in Asia by 2003, compared with 76 million in June 2000. Half of the world's top ten Internet user economies are in Asia: Australia, China, Korea, Japan and Taiwan accounted for 51% of the world's total Internet users in January 2000. Surging Internet use is driving demand for high-speed access in Asia.5

Broadband growth is strong in some parts of Asia. Broadband use in Korea is growing at 25% a month. In August 2000 Korea surpassed the US as the leading user of broadband in the world, though Korea has less than one fifth the US population. At that time Korea had 2.6 million broadband subscribers in a population of 47 million. Taiwan expected to have nearly one million broadband customers connected by the end of 2001. Analysts estimate there will be close to a million broadband subscribers in China by 2005.

As noted earlier, where neither XDSL nor terrestrial fibre cable is available and the copper network is of dubious quality if available at all, satellite is the only viable means of delivering data at broadband speeds. Even where broadband is not required, satellite-based Internet access will sometimes be the preferred mode for reliable Internet access.

Satellite operators in the region are implementing broadband strategies on their existing satellites, quite apart from the dedicated broadband satellite projects in the Asia Pacific. Intelsat announced in December 2000 a comprehensive broadband strategy using its existing fleet. The new satellite system is a key element in Intelsat's progressive rollout of managed last-mile access services (B2C business). Beginning in 2001, Intelsat started offering high-speed two-way Internet protocol (IP) access solutions to ISPs on a wholesale basis using existing satellites (ie B2B business).

Shin Satellite started offering broadband service under the iPSTAR name, using its existing Thaicom-3 satellite, in November 2000.6

Broadband is a new market segment, and timing is always critical for success in new markets. There have been several early projects announced in the region, based on dedicated broadband satellites, but they have been a little ahead of their time and have had a difficult time raising funds. Binariang's Data Transmission Satellite project did not proceed, Pacific Century's PCDataStar has not yet made visible progress, Shin Satellite's iPSTAR is still negotiating for funding for construction of the satellite6 (though the ground terminals are in service using Thaicom-3, see above) and Space Broad Band's HStar is still awaiting funding. At least one substantial telco in the region concluded, after a recent pre-feasibility study, that the time was not yet right for a dedicated Ka-band satellite.

8. Emerging IP-Based Multimedia and Interactive Services

The arrival of widely available and affordable broadband services, and the satellite delivery of those services, is spawning new applications that were not feasible with the narrow pipes that preceded broadband. Typically, these services offer both the basic connectivity and value-added services such as multicast entertainment and broadband-enabled corporate broadcast services.

These new services demonstrate another advantage of Internet via satellite, especially for real time video. They deliver connectivity and content free of the "Internet cloud" that slows nominally fast terrestrial connections to unacceptable real rates. It appears that the latency associated with using a geostationary satellite is less of a problem than the random latency introduced by the many links involved in delivering Internet packets over a terrestrial network. Transmitted by satellite, the packets undertake just one hop and are readily reassembled into a smoothly moving picture.

These new services, most less than three years old, seem likely to be the forerunners of a new generation of services that become both practical and affordable with the introduction of broadband. They probably will become very popular, and in consequence will drive even stronger demand for broadband capacity. It can be expected that broadband, and the new services it will enable, will become major drivers for new on-orbit capacity in the Asia Pacific in the next five years.

9. Direct-To-Home Satellite TV

Since the startup of Star-TV in 1991 there has been a focus in the Asia Pacific region on satellite TV. While Star-TV's business was always regional (with particular interest in China and India, potentially the two largest markets), other service providers have focussed on more limited markets. So far, satellite TV has not been highly profitable for anyone in the region, even Star-TV.

China remains out of reach as a satellite TV market, at least for the time being, but China is moving slowly and deliberately towards widespread availability of satellite TV. There have been two satellite TV services run on a trial or demonstration basis in China since 1994:

- East Communications has successfully run a demonstration free-to-air TV service of 45 channels in Ku-band on the Xingnuo-1 satellite since 1994, and
- the state-sanctioned DTH operator CBTV has delivered eight channels of free-to-air satellite TV from China Central TV (CCTV) via SinoSat-1 to communal DTH antennas in 110 rural villages since October 1999.

There are plans to introduce BSS services in China soon. The Commission on Planning and Development (the successor to the former State Planning Commission) has coordinated preparation of a BSS strategy for the four planned Chinese BSS orbital locations. Interlinked with this BSS strategy is a new policy on satellite TV that was developed during 2000 by the Commission on Planning and Development with the MII, and has since been approved by the State Council.

Even with this new policy in place, there is no indication when the Chinese satellite TV market might be fully opened to foreign broadcasters. It seems that the Chinese are unlikely to open this market voluntarily until their domestic broadcasters are well entrenched. It may be that pressure from within the WTO framework might be needed to achieve an earlier breakthrough.

India too is moving. In November 2000 it finally reversed a 1997 ban on DTH TV. There are conditions to this market opening that are not trivial:

- the broadcaster must have 51% local ownership and must be managed by Indians, but can use foreign satellites,
- a $2.1m entry fee is required,
- an $8.4m refundable deposit is also required,
- 10% of annual revenues will be taken by the government as an annual fee,
- uplinking must occur from Indian soil to enable program monitoring.
- uplinking must commence within twelve months of licence issue, and

- broadcasters must comply with local program and advertisement codes.

Despite the conditions, this policy change is recognised as finally opening the Indian satellite TV market.

Other Asian national markets for satellite TV have only recently become accessible. In Hong Kong, home of the regional satellite services AsiaSat and APT Satellite that have long distributed TV programming around Asia, only in 1999 did the regulator first invite bids for BSS services from the Chinese 122o BSS location. AsiaSat-4 will carry the first Hong Kong BSS service after its launch in mid-2002.

DTH TV has been a long time coming in Korea too. Although Koreasat satellites have carried BSS transponders since 1995, only in December 1999 was the United Broadcasting Law (UBL) finally passed by the legislature after five years of consideration. This opened the way for utilisation of the three BSS transponders on Koreasat-2 and six on Koreasat-3. Following enactment of the UBL, the Broadcasting Commission (BC) selected the Korea Digital Broadcasting consortium headed by Korea Telecom in December 2000. Satellite TV will finally launch in Korea in late 2001, but in most cities it will compete with entrenched cable. High capacity cable is already available to a high proportion of subscribers located in 60% of Korea's land area.

10. Conclusion

Despite the difficult times experienced in the Asia Pacific over much of the past four years, the satellite industry has continued to grow. Now the opening of satellite TV and the arrival of broadband services offer prospects for renewed growth. It is likely that the new services enabled by broadband capability, many of which are just emerging, will demand bandwidth beyond the boundaries of current planning. Just as telephone companies were surprised at how quickly IP-based traffic came to dominate voice traffic on their networks, traffic driven by high-speed delivery will quickly become a major element of the business of most satellite operators in the Asia Pacific.

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*Note by PTC
As used throughout this paper, "Taiwan" refers to and is used as an abbreviation for "Taiwan, China."

back to index

Abstract

There are emerging signs that the global economy may have bottomed, and every economy but one in the Asia Pacific is expected to achieve stronger growth in 2002 than in 2001. Market deregulation is sweeping across the region, and the pressure to deregulate satellite services is exposing national operators to competition, forcing tough decisions. Industry restructuring in several countries is adding to the uncertainty. Redundant high-capacity undersea cables are winning the trans-Pacific traffic, but are also opening new opportunities for satellite services within the region. Operators are implementing broadband strategies on their existing satellites, while new dedicated broadband projects (both B2B and B2C) are moving more slowly. Emerging IP-based multimedia and interactive services and new opportunities in satellite TV appear likely to demand bandwidth beyond the boundaries of current planning.

back to index

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back to index

Broadband Data Communications via Satellite - Networks and Methodology

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View Abstract

1. Broadband service - a definition

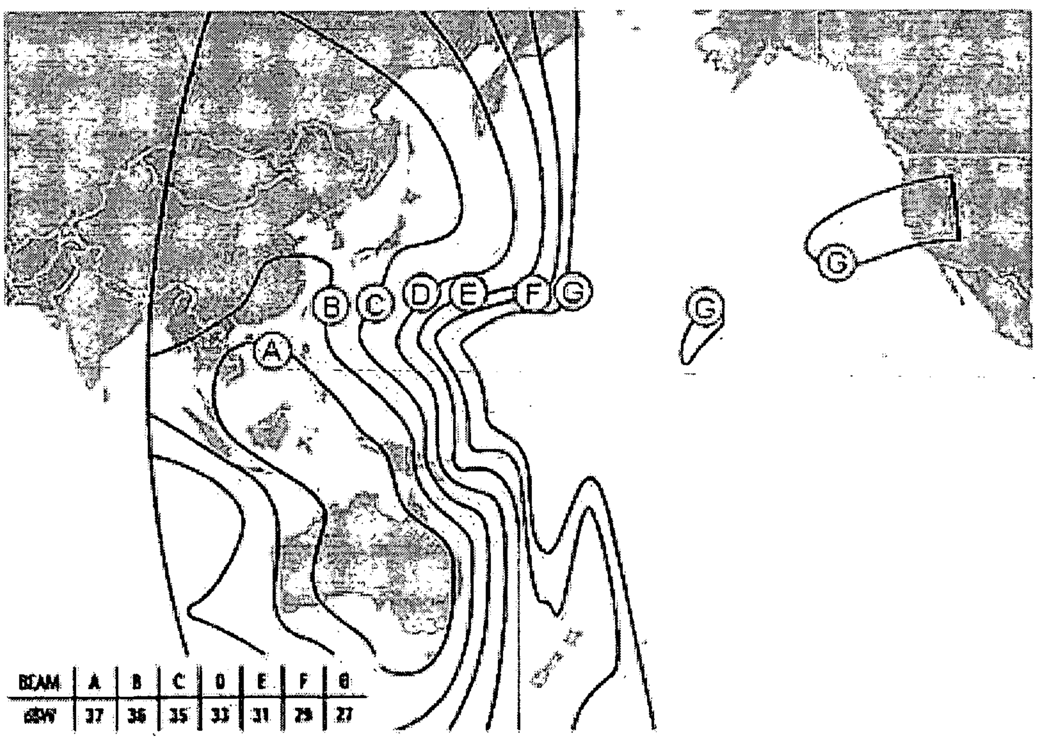
A broadband data communications service is one that requires a transfer rate greater than that afforded by a dial-up telephone line using a V.92 modem. This places the minimum data transfer rate at about 100 kbps, which is typical of current high-speed access (HSA) services from Digital Subscriber Line (DSL) in its many forms, cable modems, and comparable fixed wireless and satellite HSA services. There is also the question of whether the two directions of transmission are of equal speed (symmetrical) or asymmetrical such that the inbound speed from server to user is greater than the outbound speed from user to server. From an IT perspective, broadband service supports standard office applications including email and file transfer, and major software systems like Enterprise Resource Planning and distance education. Organizations are structuring many of their IT applications for use within a standard Web browser, allowing employees and partners to access services within the Intranet and from the external Internet as well. This makes applications seem relatively similar to the network, but the detailed structure cannot be ascertained in general. HSA can provide video distribution, telephony and video conferencing, although these may not be deliverable through a browser since they require specialized user terminal devices or other appliances.

2. Role of Operating GEO satellites

The single most critical element and technology in broadband satellite communications is the satellite itself, since every link within a common footprint must pass through it. Spacecraft designed and constructed in recent years are larger in physical size and mass, and provide substantially more power than their predecessors. This results from improvements in launchers, on-board power systems, high performance components, and radio-frequency high power amplifiers. Other components used within the microwave repeater have improved as well, with benefits showing up in reduced component mass, lower signal loss, and enhancement of transmission quality. A typical satellite weighs almost 5000 kg on top of the launch vehicle, has a lifetime of 15 years, and provides between 50 and 90 channels of wideband transmission (commonly referred to as transponders) with individual power levels of up to 200 RF watts, each. A modern

GEO satellite may serve relatively small antennas throughout a large area such as the entire Euro-Asia continent or the full breath of the Pacific region (illustrated in Figure 1 for the PanAmSat 2 satellite).

FIGURE 1. A TYPICAL SATELLITE TRANSMIT (DOWNLINK) FOOTPRINT OF THE PANAMSAT 2 SATELLITE, LOCATED AT 169° EAST LONGITUDE; SATELLITE RADIATED EIRP VALUES ARE APPROXIMATE (COURTESY PANAMSAT CORP).



Digital communications and GEO satellites have long partnered and in fact innovations such as TDMA, CDMA, digital speech interpolation and video compression were applied to space-ground links well ahead of terrestrial networks. The Digital Video Broadcast (DVB) standard fits tightly to the satellite's natural ability to transmit the same high-quality signal across a wide region, rendering the cost per location to an infinitesimally small number (not including the cost of the dish and set-top box installation). Moving forward, this platform provides broadband data delivery and facilitates return channel service if remote sites are suitably configured. Competition from new entrants like PanAmSat, SES and Loral has impacted satellite operation such that quasi-governmental operators like Intelsat and Eutelsat have become commercial enterprises. Suitable GEO satellite capacity is now available throughout Asia-Pacific for networks that serve most any location.

3. Application Interface Standards

A summary of applications and interface standards is provided in Table 1. For digitized content, quality is set at the source encoder and transmission only introduces time delay. For a satellite hop, this delay is small compared to that of compression/decompression. The terrestrial interface concerned with DVB and digital TV in general is called ASI, a high speed serial connection used primarily on the uplink side. Telephone service is usually delivered on an analog basis (2-wire or 4-wire). A properly engineered satellite voice circuit meets the currently accepted standard of 400 ms total delay, including the added delay for speech processing (e.g., compression and decompression, if applied), routing and switching. Importantly, such a satellite circuit will sound better to subscribers than casual Voice over IP connections through the Internet.

TABLE 1. USER APPLICATIONS AND THEIR INTERFACE STANDARDS APPLIED IN SATELLITE COMMUNICATION NETWORKS.

User application	Network	Technology
Internet access (one user; small group; remote site)	High speed access to Internet backbone; TCP/IP	One way over satellite; terrestrial return
		Two way over satellite; broadcast outbound with multiple access inbound
Remote access to corporate Intranet (LAN extension)	High speed access to private network infrastructure; web-based applications; TCP/IP	One way over satellite; terrestrial return
		Two way over satellite; broadcast outbound with multiple access inbound
Remote access to corporate business applications	Medium to high speed access to private network infrastructure; applications employ client/server or mainframe style; may employ proprietary protocol	Two-way over satellite; broadcast outbound with multiple access inbound
		Two way over satellite; point-to-point circuit, either pre-assigned or demand assigned

Content distribution	Multi-cast uplink for wide area distribution to PCs and content caching servers; UDP/IP and Multicast Transport Protocol (MYP)	One way over satellite; verification of 100% reception via terrestrial or satellite return
Video teleconferencing	High speed access to private network infrastructure or public ISDN; H.320 or H.323 standards	Two-way over satellite; broadcast outbound with multiple access inbound
		Two way over satellite; point-to-point circuit, either pre-assigned or demand assigned
Telephone	Low to medium speed access to private network infrastructure or PSTN; POTS or VoIP standards	Two-way over satellite; broadcast outbound with multiple access inbound; echo cancellation
		Two way over satellite; point-to-point circuit, either pre-assigned or demand assigned; echo cancellation
Leased line	Medium to high speed connection; T1/E1	Two way over satellite; point-to-point circuit, pre-assigned

4. Internet Protocol

The Internet itself is the last and probably most important interface in the context of data communications. Organizations in the private and public sector have either converted their data communications over to the Internet Protocol, or are in the process of doing so. The interface that is growing to dominate the data world is the simple RJ-45 modular jack associated with the Ethernet standards, 10baseT and 100baseT. Higher rates than 100 Mbps demand Gigabit Ethernet or the optical speeds of the Synchronous Digital Hierarchy (e.g., OC-3, OC-48 and the like). Such speeds are presently beyond a practical HSA service from currently operating C and Ku band GEO satellites. This could be the domain of the coming generation of broadband satellites employing Ka band spot beams and on-board processing.

4.1 Broadcast, Multicast and Unicast

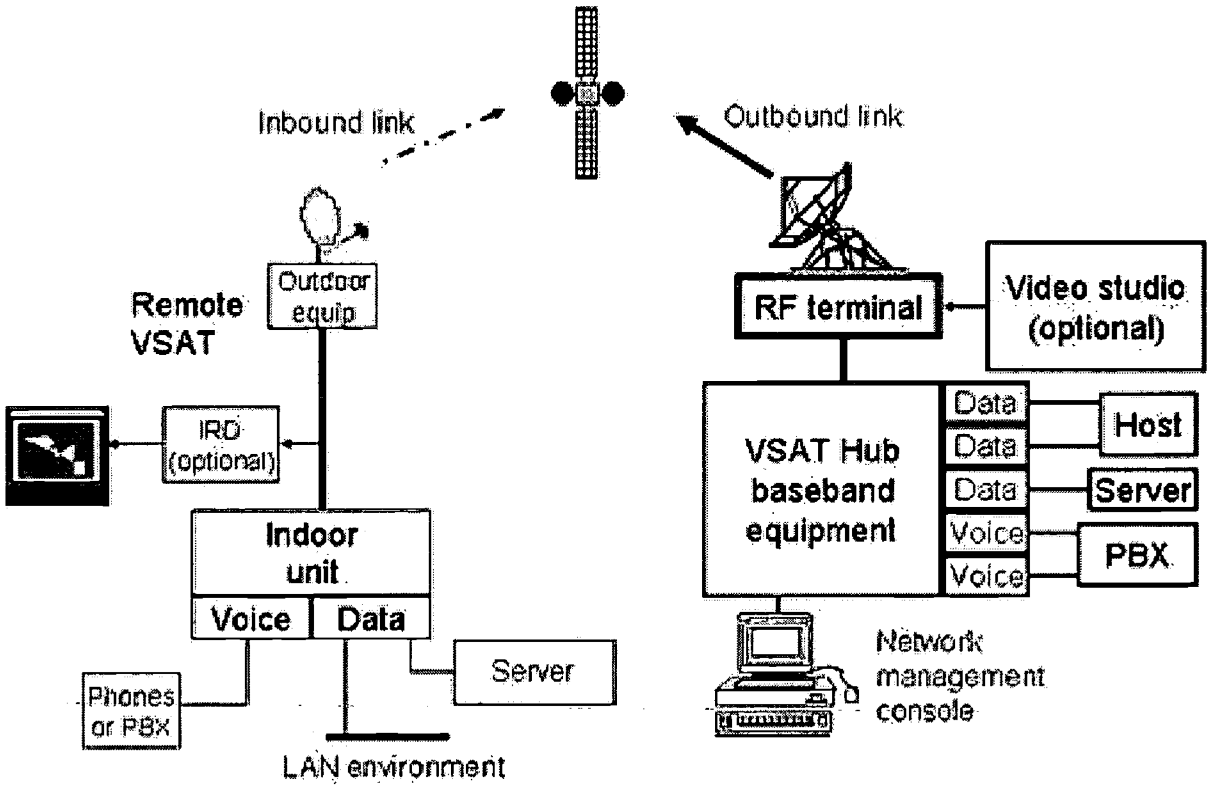
Terrestrial networks, including the Internet, are effective for point-to-point transfer of digital media and content. Multicast service over the Internet must employ several point-to-point links to emulate a broadcast system, and therefore has difficulty assuring timely delivery of content to all receivers. A broadcasting station from a local radio tower or GEO satellite affords timely delivery of content with a consistent bandwidth. Guaranteeing delivery is usually less of a problem because receivers are designed to directly play the content (a local recording device can allow later playback, if desired).

Included in the DVB standard is a data transfer capability called Internet Protocol Encapsulation (IPE). This allows a single broadcast carrier to transfer both television programming and Internet content on the same transport stream. At the subscriber end, the carrier is detected by an integrated receiver decoder (IRD) that extracts the data and delivers it a local PC or LAN. This vehicle allows satellite broadcasters to introduce broadband data into their multiplexed transmissions. The data that rides the MPEG stream may be encrypted along with the digital video and audio, or can be processed with its own unique encryption system. To this may be added a terrestrial return channel for bi-directional service to the desktop or other computational device. Many applications can be supported in this asymmetrical manner since the greater demand is for megabit per second transfer over the satellite in the outbound direction. One must not neglect the potential of this mode for reaching locations that cannot transmit directly over the satellite. Provision of a satellite return channel, in the inbound direction, is discussed next.

4.2 Interactive bi-directional data

Interactive data communications are the foundation of must corporate and government uses of telecommunications. These needs can be addressed by properly engineered bi-directional satellite links that involve multiple transmitting earth stations. The Very Small Aperture Terminals (VSATs) used by fueling stations and discount department store chains in the Americas, Europe and parts of Asia demonstrate that such networks are practical (e.g., easy to install and centrally manage), reliable (e.g., 99.9% availability) and cost/effective (e.g., saving users as much as 20% over what an equivalent terrestrial network would cost). The architecture of a typical VSAT network employing a star topology (e.g., all communications through a central hub) is illustrated in Figure 2.

FIGURE 2. ARCHITECTURE FOR A TYPICAL VSAT NETWORK EMPLOYING A COMMON HUB AND STAR TOPOLOGY.



In 2002, VSATs are becoming attractive to smaller enterprises and for big organizations that wish to push the use of satellite communication down further in their operation. The cost of equipment per site has dropped from over US$10,000 in 1998 to around US$2000 in 2002. Consumer versions that provide HSA to the Internet are offered in the US for under $500.

5 Review of equipment and network suppliers in the marketplace

The market for satellite communications ground equipment as introduced above is served by specialist manufacturers and systems integrators. A partial listing is provided in Table 2. Several have been in business for more than a decade; however, some of the more interesting technology is offered by relatively new companies that didn't exist prior to 1998. This can make it more challenging to convert architecture into a real network, but the methodology reviewed here should make the task less formidable.

TABLE 2. SUPPLIERS OF TECHNOLOGY FOR BROADBAND SATELLITE COMMUNICATIONS.

Service	Provider	Approach	Product	Base	Experience
One -way	BroadLogic	Receivers and IRDs		DVB-S	PC cards and IRDs

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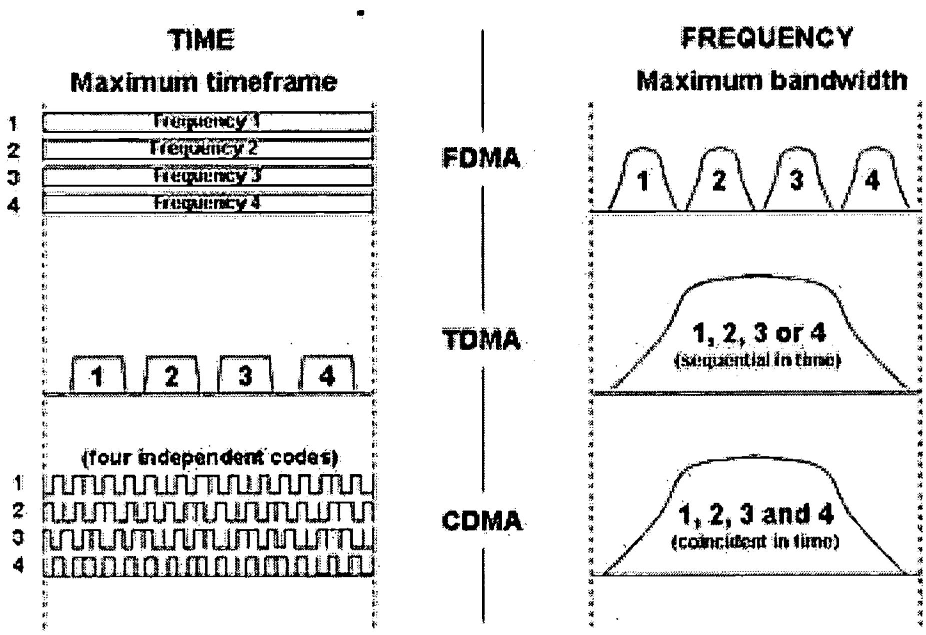
	ViaCast	Encapsulators, receivers, IRDs		DVB-S	Supplier to many CDNs
	SkyStream	Encapsulators and IRDs	Satellite Media Router	DVB-S	Originator of opportunistic encapsulation
	Logic Innovations	Encapsulators		DVB-S	Supplier to integrators
	International Datacasting	Encapsulators and IRDs		DVB-S and others	Experienced supplier and integrator
	Global Telemann	Receivers and IRDs		DVB-S	Distributor of products for data distribution and access
	Helius	Receiver and router		DVB-S	Stand-alone remote site receiver/router
Two-way	Hughes Network Systems	Full range of VSAT and wireless products	PES, TES	Proprietary, TDMA	Leading supplier to the global market
	Gilat Satellite	Full range of VSAT and wireless products	SkyStar Advantage, SkyBlaster	Proprietary and DVB, TDMA	Leading supplier to the global market
	ViaSat	VSAT products	LinkStar, ArcLight	Proprietary and DVB, TDMA and CDMA	Growing supplier to commercial and gov. markets
	STM Wireless	Full range of VSAT and wireless products		Proprietary and DVB, TDMA	Supplier to global market
	Shiron	Interactive VSAT product line	InterSKY	Proprietary and DVB, FDMA	Field proven DVB-S product line

	iDirect	Interactive VSAT product line	Netmodem II	Proprietary, IP-based	High-speed IP networking over satellites
Integrator	Bit Central	Distributor and integrator for private networks		DVB	Experienced integrator
	Alcatel	Major telecom manufacturer/integrator, satellite experience		Proprietary and DVB, uses products from STM and others	Leading telecom equipment supplier, also active in satellite communications

5.1 Basic multiple access and modulation schemes

Effective and efficient satellite communications depends on the type of modulation and multiple access used by transmitting user terminals and earth stations. The staunch support by suppliers of their particular approach often produces interesting and confusing debate within the technical community. Mirroring the dialog of the digital mobile (cellular) standards, satellite multiple access techniques run the gamut of time division, frequency division and code division approaches. Figure 3 shows how these techniques occupy the two key dimensions of satellite capacity: frequency spectrum and time. The suppliers of two-way products in Table 2 each have chosen a scheme for reasons of experience and capability. Evaluation of these systems is ongoing, and each can demonstrate satisfactory operation in a live network. Any of the three can be made to work; however, it is likely that one or two may be superior for a specific defined application. Beyond the theory, it is the product design and protocol operation that matter as to how well the multiple access system delivers information in an effective and manageable way.

FIGURE 3. ILLUSTRATION OF THE TIME AND FREQUENCY UTILIZATION OF BASIC MULTIPLE ACCESS TECHNIQUES, INDICATING HOW FOUR EARTH STATIONS WOULD SHARE THE OVERALL CHANNEL BANDWIDTH.



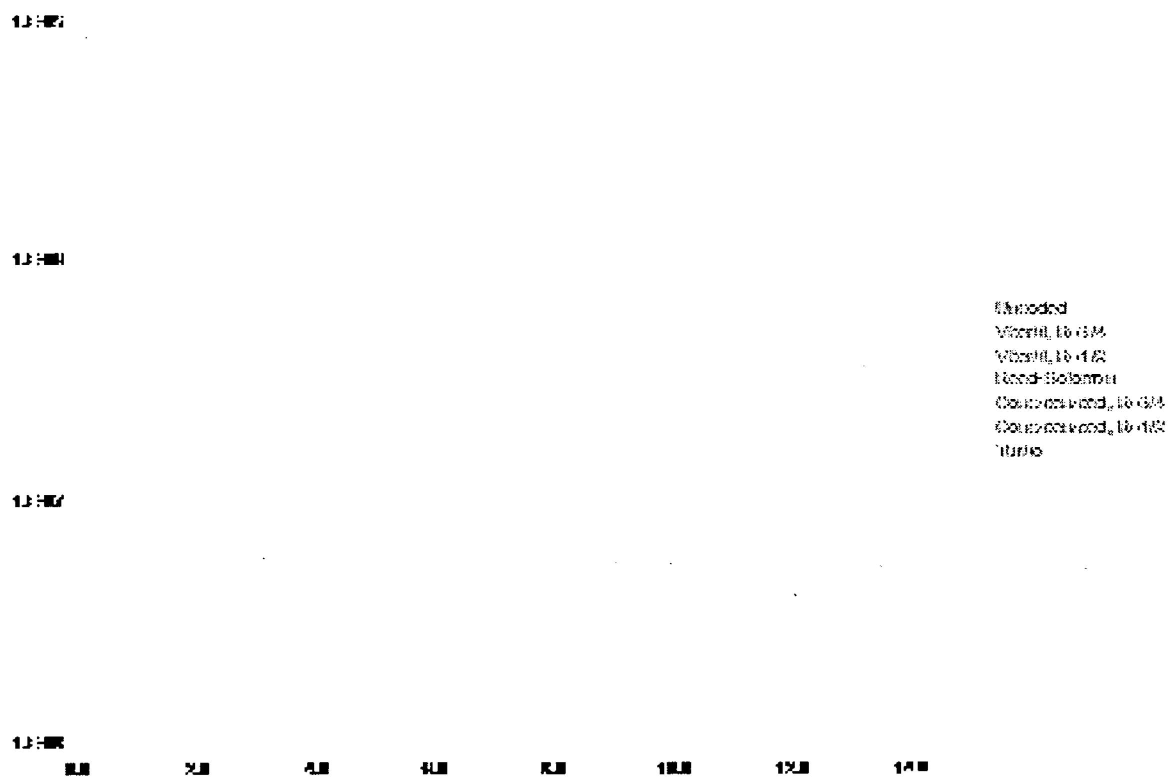
The primary modulation method in use over satellites is phase shift keying (PSK). Adopted by satellite engineers in the 1960s, PSK has found its way into all wireless systems as it is nearly optimum with regard to the use of bandwidth and power. Variants like minimum shift keying (MSK) and Gaussian MSK (GMSK) that are applied in different situations, and some have gained in popularity due to increased importance of using low-power transmitters on the ground.

The key FEC techniques employed by current VSAT equipment include:

- Convolutional encoding with Viterbi decoding, long a favorite in satellite and terrestrial wireless communications, is available in coding rates (R) between 7/8 (minimum gain) and 1/2 (maximum gain);
- Reed-Solomon (R-S) code, a block coding scheme with excellent properties and popularized by DIRECTV;
- Concatenated (combined in a serial manner) convolutional and R-S, provided by the DIRECTV Satellite System (DSS) and the Digital Video Broadcast (DVB) system; very effective for all services, particularly digital TV using MPEG 2 and Internet data transfer;
- Turbo Product Code (TPC), similar in concept to the concatenated code but based on combining two like encoding mechanisms that employ feedback and iterations to boost FEC performance..

A comparison of typical implementations of these FEC techniques is provided in Figure 4. Plotted on the X axis is the ratio (in dB) of the ratio of energy per bit to the noise density; the Y axis indicates the estimated probability of bit error, which approximates the bit error rate (BER) delivered at the receiver. It is clear from these data that TPC is to be favored on performance alone; however, its computational complexity limits data rate to about 10 Mbps, appropriate for inbound service. Modems to support concatenated coding, particularly within the DVB standard, are available up to about 100 Mbps, making this system desirable for high speed outbound transmission from the hub and for the broadcast of both digital video and Internet content.

FIGURE 4. PERFORMANCE CHARACTERISTICS OF CURRENT FORWARD ERROR CORRECTION TECHNIQUES, PROVIDED FOR COMPARISON PURPOSES ONLY.



5.2 Comparing Technical Performance

A global comparison of technology and its implementation by developers and manufacturers is probably impractical. However, if the basic requirements for the network are known, it is possible to narrow the possibilities and make choices of equipment and operating parameters. Most generalized comparisons resort to the basic linear equations for the wireless line-of-sight path, e.g.,

$$C = P_t G_t G_r \left(\frac{\lambda}{4\pi R_0} \right)^2$$

where C is the received carrier power, Pt is the transmitter output power, Gt is the transmit gain, Gr is the receive gain, and R0 is the range from the transmitting antenna to the receiving antenna. From the basic geometry of the geostationary orbit, the line-of-site path length (R0) can be estimated from:

where is the latitude and is the longitude of the earth station relative to that of the satellite. The measure of link performance, C/N, is computed as the ratio of C to the noise (N) in the signal RF bandwidth (B). For pure thermal noise as produced within the receiving earth station, $N = kTB$ where k is Boltzmann's constant and T is the equivalent noise temperature of the receiving system (composed of contributions from the antenna, coupling loss and low noise amplifier). Conversion to Eb/N0 amounts to multiplying the C/N by the ratio of the information bit rate to the bandwidth, B.

$$R_0 = 42643.4 \times 10^3 \; 1 - 0.2957 / \cos\varphi \cos\delta$$

This simple calculation is not sufficient to account for a variety of other noise sources and impairments that significantly affect the satellite channel. These include:

- Uplink noise, which is computed in the same manner as above;
- Propagation effects due to the various layers of the atmosphere, particularly absorption by clear air and rain (which introduces substantial power loss at frequencies above about 10 GHz), and scintillation fading due to the troposphere and ionosphere;
- Transponder intermodulation distortion, which may add noise products into the spectrum of the carrier;
- Interference from cross polarized signals on the same satellite (XPOL) and from adjacent satellites (ASI)
- Direct distortion to the signal as it passes through the uplink earth station, satellite transponder, and receiving earth station; the principal impact is called intersymbol interference (ISI), an impairment which causes the required Eb/No to increase for the same probability of bit error.

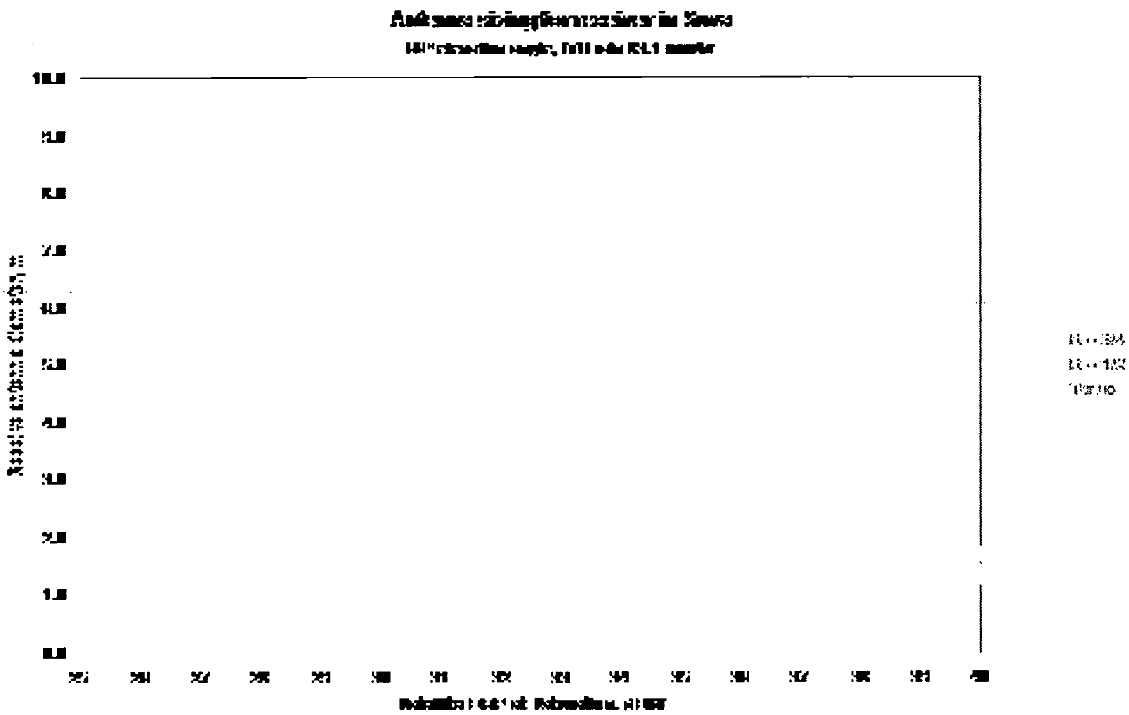
Satellite communications engineers most often use the link budget to identify and combine the various gains, losses and margins in the uplink and downlink path. The practice of link budget formulation involves both science and art. Individuals who routinely compile them have their own unique formats, typically embodied in personalized Microsoft Excel spreadsheets. There are a myriad of calculations and assumptions for individual entries, and engineers typically include margins anywhere in the range of 0.5 to 3 dB to cover factors not known with sufficient accuracy.

The following is an example of the type of analysis that would be performed in studying the properties of a particular network, considering the candidate satellite and techniques for multiple access, modulation and forward error correction. This is for illustrative purposes and not to derive conclusions applicable to a different network design.

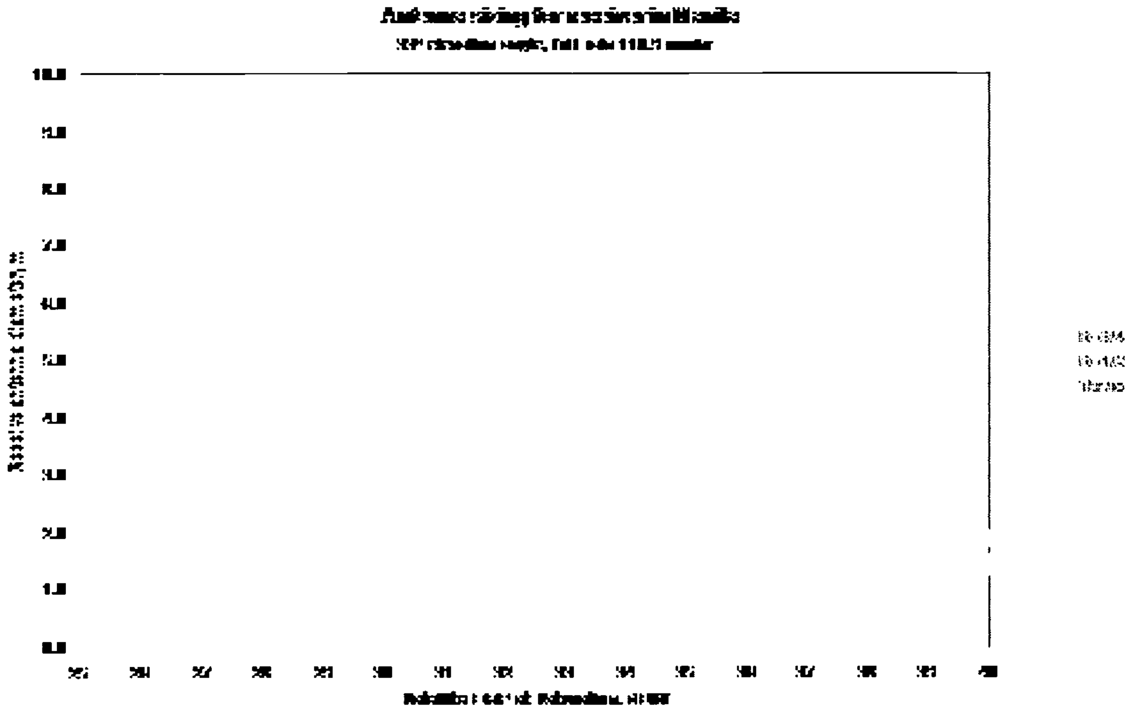
Fixed in this analysis is the satellite, assumed to be at 169° EL and operating at C-band (e.g., PAS 2) with the uplink emanating from San Francisco, CA; the receiving earth stations are located at Suva, Fiji, Manila, Philippines, and Palembang, Indonesia. The cities where chosen to measure the impact of different local climate situations and geometry to the satellite, where Suva is the most favorable in terms of elevation angle and rainfall; Palembang is the least favorable, having the lowest angle and being situated in a region of intense tropical rainfall, and Manila being about in the middle in terms of these issues. While PAS 2 provides a fixed coverage to these locations, we have chosen to make the downlink effective isotropic radiated power (EIRP) an independent variable in the range of 25 to 40 dBW. The bit error probability at the receiver, including all impacts on the uplink and downlink, is held constant at 10-8 at 99.9% availability. The results of the analysis in terms of receive antenna diameter are shown in Figures 5 a, b and c, for Suva, Manila and Palembang, respectively. The separation between each set of curves reflects the required Eb/N0 for the particular FEC technique, i.e., concatenated R-S with R=3/4 or R=1/2 convolutional, and TPC. Also factored into the analysis are realistic values for XPOL, ACI and ICI.

FIGURE 5. RECEIVE ANTENNA DIAMETER FOR THE HYPOTHETICAL VIDEO DISTRIBUTION NETWORK CONSISTING OF AN UPLINK FROM SAN FRANCISCO AND DOWNLINKS TO (A) SUVA, FIJI, (B) MANILA, PHILIPPINES, AND (C) PALEMBANG, INDONESIA, VERSUS SATELLITE EIRP AND FORWARD ERROR CORRECTION TECHNOLOGY - RATE 3/4 AND 1/2 CONVOLUTIONAL CONCATENATED WITH R-S (204,188), AND TURBO PRODUCT CODE.

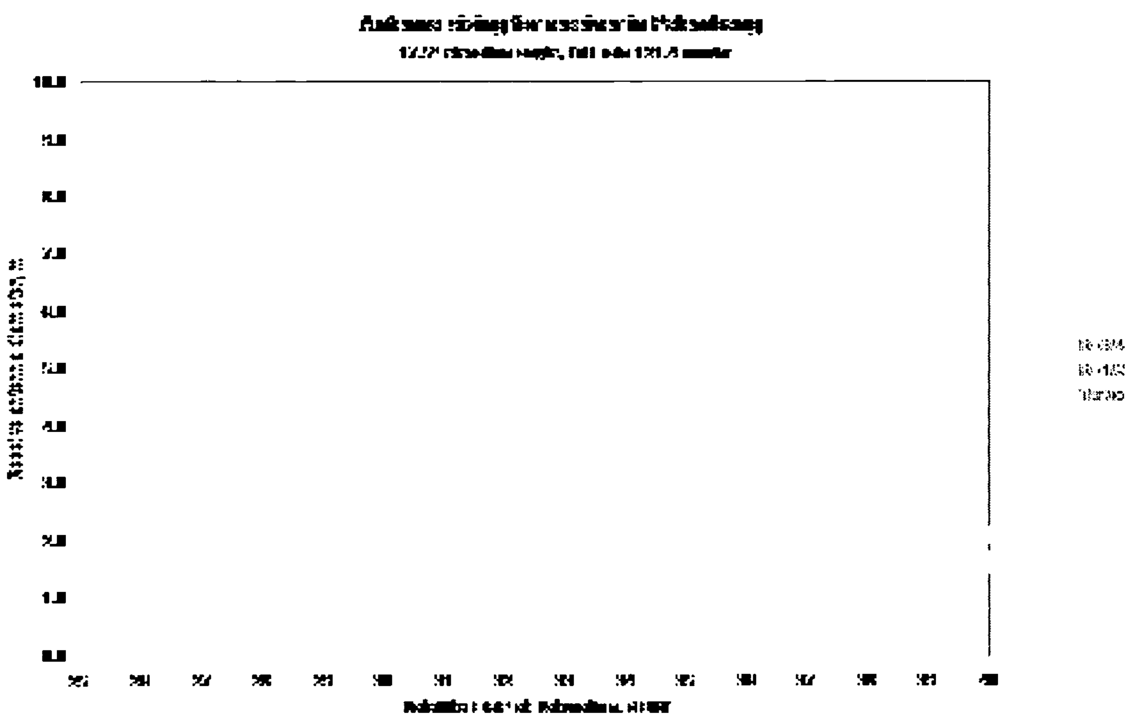
(a) Suva, Fiji



(b) Manila, Philippines



(c) Palembang, Indonesia



The curves reveal some interesting aspects of this evaluation:

- A 2.8 meter antenna at Suva would require 35 dBW using concatenated R-S and R=3/4 convolutional coding, while about 3 dB less EIRP would suffice using TPC;

- For 35 dBW at Manila, antenna diameters range from 3 meters for R=3/4 concatenated coding to 2.2 meters for TPC
- EIRP values of up to 2 dB greater are required at Palembang to use antenna sizes similar to Manila and Suva; a larger diameter would therefore be recommended for use in the same network.

The analysis was extended to include uplinking from these sites to create a star VSAT network back to a hub located in San Francisco, CA. The assumed antenna sizes of 2.8 meters for Suva and Manila, and 4.8 meters for Palembang were determined both by the outbound downlink requirements and inbound transmit needs. Table 3 presents the results of this evaluation, assuming the actual satellite uplink characteristics for these three locations in Asia Pacific. For an information transfer rate of 256 kbps for the inbound link, we see significant improvement from the application of TPC as compared to convolutional FEC (at the time of this writing, concatenated convolutional with R-S was not available on the market for the inbound channel). In addition to the antenna, the other critical VSAT design parameter is the solid state power amplifier (SSPA) power output. We see that this power is held to a reasonable value (under 4 watts) for both Palembang and Manila, resulting from the satellite providing good uplink performance. On the other hand, the Suva location happens to be situated in an unfavorable part of the PAS 2 uplink pattern for the Vertical uplink beam, which causes the transmitter requirement to balloon to tens of watts.

TABLE 3. EXCEL SPREADSHEET CONTAINING PARAMETERS FOR VSAT INBOUND LINK EVALUATION

Paramter	**Units**			
Data rate	kbps	256		
Eb/No	dB			
R=1/2 (without R-S)		6.4		
Turbo		4.5		
Transponder capacity	channels			
R=1/2 (without R-S)		161		
Turbo		225		
		Suva, Fiji	Manila, Phil	Palembang, Indon
SFD	dBW/m2	-80.0	-90.0	-88.9
G/T	dB/K	-12.0	-1.6	-2.9
Elevation angle	degrees	66.1	33.1	17.5
Rain rate at 99%	mm/hr	83.1	110.9	121.4

Uplink fade (rain + tropo)	dB	0.6	1.3	3.8
Dish size	meters	2.8	2.8	4.8
SSPA power	Watts			
R=1/2		30.7	3.6	3.0
Turbo		22.0	2.6	1.9

A study of this type can be quite involved as there are potentially many links, different modulation and FEC methods, and a variety of satellite coverage options to consider. The difficulty one faces in this type of effort is that there are almost always more equations than known; therefore, a unique solution cannot be obtained. Many important factors, such as ASI and ISI, can only be estimated and then budgeted in the link budget in terms of additional margin. It is always a good practice to test the proposed solution using a comparable satellite link and equipment of the proposed design. Also, satellite performance should be based on high-quality measurements taken from calibrated earth stations at critical points of the coverage. The best source of this type of data is the appropriate manufacturer or operator; however, the network developer may need to perform some of this work themselves.

6 Conclusion

We have identified and reviewed many topics that are central to the development of cutting-edge satellite broadband networks. New configurations and applications using interactive satellite networks are being devised to address a hungry market for communications and information applications; some will succeed and, unfortunately, some will fail. One can only increase the probably of success by considering a sufficiently wide range of technologies and their providers. However, gaining a firm base in the technical performance of the different options is a key to developing a satellite network that satisfies users.

Endnotes

Much of the analysis was performed using software developed by Derek Stephenson, who heads Arrowe Technical Services of the UK.

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Abstract

This paper provides a review and assessment of satellite technologies for providing broadband data communications. In this context, "broadband" means that the application requires a data transfer rate greater than 100 kbps and should allow broadcast, multi- and uni-cast, and interactive bi-directional services to fixed locations worldwide. The applications considered are: Internet access over satellite, digital content distribution, wide area network (WAN) connectivity, video teleconferencing, distance learning, and telephony. The systems examined include digital broadcasting (e.g., DVB) with IP encapsulation, and bi-directional VSAT star networks. Detailed comparisons of various transmission parameters are provided to help evaluate currently available satellite and ground equipment capabilities. It is observed that improved forward correction is desirable, namely the turbo product codes now being introduced widely in satellite ground equipment.

back to index

The Role of Satellites in the Internet: Push, Pull and Last-Mile Delivery

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View Abstract

Introduction - Why the Sky Isn't Falling

In the economic climate in the latter part of 2001, the market for satellite communications goods and services appeared to have reached a plateau, along with the market for telecommunications goods and services of all types. Moreover, the seemingly abrupt slowdown in the rapid expansion of Internet activity also is affecting the market for satellite communications. During the 1990s, the satellite industry benefited from the rapid growth of the Internet, as Internet traffic required bandwidth of all types (wired and wireless) to transport content to distant sites, to transmit and fulfill requests for Internet content and to distribute Internet content directly to end users. Internet Protocol (IP) communications flourished.

The unique characteristics of satellites brought them a key role in transport of Internet content. Multicasting capability, large coverage areas, distance-insensitive costs, ability to support high-data rate transmission, and ability to provide connectivity to end users are strengths of satellite communications particularly applicable to supporting Internet communications. While extensive fiber networks within and between continents continue to be deployed at a fierce pace, satellites nevertheless retain advantages for broadband backhaul as well as service to the enormous population outside the areas populated sufficiently densely to justify fiber installation.

Despite the current economic slowdown, there is no doubt that the Internet is here to stay and that satellite communications will continue to play an important role in transmitting Internet content. While it may appear that the Internet is taking a breather, in reality more and more entities are integrating web use into their daily business: internal communications, external communications, and to support increasingly web-based activity with suppliers and customers. Despite, or at times even because of, this slowdown, more and more organizations are realizing the benefits of organizing internally generated content into web format to facilitate more efficient internal functioning as well as to facilitate sales and customer support.

In addition, the delivery of high-data rate multimedia content through the Internet is just in its infancy. The MP3[1] battle over distribution of audio is continuing but it is clear that electronic access to such content is not going to end. The realization of this is most evident in the recent announcement by key Hollywood interests that they, too, will be distributing video content directly to users over the web. These interests have recognized that the content is desired, security measures can be implemented, and that the content providers will be able to reap profits by using the Internet as a distribution channel.

So, during this "breather" in the Internet explosion and in growth in demand for communications services, satellite manufacturers, service providers and resellers have a great opportunity to refocus their efforts on the next great era in transmission requirements. Development of seamless approaches to reprovisioning content, thoughtful integration of terrestrial facilities with satellite networks, careful development of consumer-focused delivery of both direct-broadcast satellite as well as interactive Internet access, should occur during this period. With these efforts the satellite industry will be well positioned to capitalize on the enormous demand for content transport which will occur when the current economic environment changes, as it inevitably will.

After the events of September 11, 2001, another area of communications promises to provide substantial stimulus to the satellite communications market. This is surveillance, generally in the form of transmission of video and data content from aircraft and other fixed and mobile sites requiring monitoring on a real-time basis. Needless to say, the range of possible surveillance needs includes nuclear power plants, utility and water facilities, dams, border crossings, airports and other transportation areas, etc. Satellites are well-positioned to provide the bandwidth for such services since the uplink facilities are relatively easy and fast to deploy and the transmission capacity, for the most part, is already deployed in space.

I. Setting the Context: The Internet is Here to Stay

Because this paper focuses on the role of satellites in Internet delivery, it is useful to provide some recent statistics on Internet use as well as projections for broadband connectivity. The growth in business and consumer broadband connectivity is critical for satellite communications, not only because satellites have a role to play in delivering content to users, but because growth in end-user broadband connectivity will stimulate demand for Internet content, also promoting the need for satellites as transport media.

According to a recent report, 459 million people worldwide have access to the Internet.[2] This report is based on surveys in 30 countries, which include Chinese Taipei and Australia. Other data reports that 22 percent of the population of the Asia-Pacific region are online and that there is substantial interest in broadband connectivity. For example, in Hong Kong 14.7 percent of Internet users have broadband access.[3] In Singapore, 50 percent of households are online according to the Infocomm Development Authority of Singapore. Projections in growth of broadband access in the Asia-Pacific Region, excluding Japan, are 37.8 million users by 2005, up from 11.4 million with broadband access in 2001.[4]

The leaders in connectivity, at the end of the first quarter, 2001, are South Korea, Chinese Taipei, Hong Kong, Singapore and Australia. The breakdown in technologies used for this connectivity is: cable - 7%; DSL - 4%;other - 2 % and dial-up - 87%.[5] To compare with the U.S., Internet users total in the range of 150 million in 2001. Home broadband connectivity in the U.S. is projected to be, over the next few years, as follows:

Connection Type	2001	2002	2003	2004
Cable	6.1	8.5	10.19	13.9
DSL	4.1	6.4	9.2	12.3
Wireless (including satellite)	.35	.785	1.9	4.3
Totals	**10.55**	**15.68**	**21.29**	**30.5**

* figures are in millions; source: Parks Associates, 2001

Thus, while there might be somewhat slower uptake than hoped for in additional broadband connections over the next 18 months, it is evident that many consumers want to upgrade connectivity to allow for easier and more efficient Internet use. Once consumer broadband connectivity reaches a certain level (say, 15% of users), multimedia content will expand and web use will start growing rapidly again.

By 2004, many users will utilize the Internet to obtain movies, to engage in interactivity (videophone and games), and for many, many other activities.

Satellites are well-positioned to play an increasing role in transport of Internet content. The following table summarizes the varying roles of satellites to be discussed in the remainder of this paper.

Role of Satellites in Internet Delivery

Category	Description	Example Providers	Niche/Benefits
Internet Backhaul (Pull)	Transport Internet Traffic from ISP to requesting ISP	Intelsat, Panamsat, Eutelsat, New Skies, Skynet, Shin Satellite, J-SAT, AsiaSat, NetSat Express	Alternative or supplement to terrestrial backbone (fiber, cable)
Deliver of high-bandwidth content to ISP point-of-presence (Push)	Internet content transmitted to ISPs and cached	Same as above plus Cidera	Broadcasting capability of satellites; gets content closer to users

Broadband Internet Access (last mile)	End-user/last mile Access to Internet to fixed locations	Gilat, Hughes, Spaceway, Astrolink, SES Astra, WildBlue; NGSOs: SkyBridge, ICO	Where good terrestrial alternatives (cable, fiber, DSL) not available; synergy with DBS
IP VSAT networks	IP connectivity for VSATs; combine voice, video, broadband; data networks	Gilat, Hughes Network Systems; iDirect; Shin; AsiaSat	Upgrade of current VSAT networks to provide high-data rate access for corporate networks

Source: Leslie Taylor Associates, Inc.

II. Satellites are playing an important role in carrying Internet traffic (Pull)

Satellites already are playing an important role in carrying Internet traffic. As many Internet sites are located in the U.S. (although this is changing), ISPs throughout the world must transmit requests to U.S. sites for content. The asymmetric nature of this traffic has resulted in cost-effective use of multiple types of communications facilities: cable, satellite. For example, the lower data content inquiry can be sent via terrestrial facilities and the return higher-data rate content can be sent via satellite, or through the most cost-effective transmission media.

Satellites are well-positioned to obtain this traffic because they already provide excellent worldwide coverage, have high bandwidth, are digital, and have an established reputation as being a reliable delivery mechanism for broadband, e.g., video communications. Teleports are widely available and if necessary, satellite earth stations can be deployed relatively quickly. Moreover, satellite transmissions support "scaleability," e.g., the ability to accommodate a very small or a very large traffic stream. Pricing according to usage also has been utilized for a number of years in the satellite industry.

Fortunately, the satellite industry has ably demonstrated that satellite technology can operate smoothly with TCP/IP.[6] The early concerns about satellite's ability in this regard have long been dispelled by the experience of users in practice.

Traditionally, for satellite system operators, transmission of video content has been their bread and butter. Growth in demand for capacity leasing has been in the 7 percent range, largely as a result of increased video, telephony and data requirements. At the beginning of 2000, there were approximately 200 geostationary satellites providing fixed-satellite service (FSS) with the equivalent of 6,000 36 MHz transponders, with about a fill rate in the range of 75- 80 percent. Because of the introduction of a number of new satellites over the last year, and the downturn in the world economic climate, this fill rate currently stands in the range of 65-75 percent. However, the upturn in demand for global video transmissions following the September 11, 2001 terrorist attacks on New York City and Washington, D.C. shows no signs of abating.

Hybrid connections for hauling ISP traffic are often chosen by ISPs to reflect the Internet's asymmetric flow of data. The hybrid approach is more for routes which also have extensive fiber connectivity. Emerging markets may prefer (or need) to utilize a satellite-only approach because of the unavailability of fiber.

Satellite systems, in addition to transporting the Internet content on their own facilities, have been adding high-speed fiber connections and points-of-presence at network access points which allow customers to access the Internet backbone networks.

Entities providing satellite ISP backhaul service include not only the satellite system operators, but teleport operators, telecommunications administrations and companies which use a variety of communications media, and others. Key players in this market are Intelsat, Panamsat, AsiaSat, Shin Satellite, Eutelsat and others.

III. Satellites are playing an important role in moving Internet content closer to the users (Push) and in Reprovisioning Content for the Internet

A more recent role for satellites in delivering Internet content relates to the desire of content providers to ensure that the user has the best possible experience in viewing the material on their websites. To improve this experience, satellites have developed services called "multicasting and caching" which takes the Internet content from the content provider, uploads this to the satellite(s) and broadcasts the content, and updates, to ISPs and their points of presence. The ISPs have servers located in dispersed locations which store the content and make it available to the web user.

In the early days of the web, carriers and service providers made extensive investments to increase Internet bandwidth. Unfortunately, adding bandwidth alone could not address latency (delay) or increase the speed of servers at content points of origination. Websites suffered from overwhelming demand and users could not even access the websites, let alone, the information. Users also experienced unpredictable performance. Obviously, improving user experience is key to obtaining loyalty to a website, product or service.

The following provides the contrast between web accessing with and without use of multicasting and caching:

(1) old way: user types in web address, transmission is relayed to the server where the content resides, multiple back and forth transmissions occur between the user, the ISP and the content provider's server, and the user can wait for the download, sometimes for minutes on a dial-up connection. This method is obviously inefficient from many perspectives. As one article puts it, it "is the equivalent of having everyone fly to Hollywood to see the latest movie."[7]

(2) new way: user types in web address, transmission goes to ISP which checks for closest location of content from website (hopefully near the user), and content moves expeditiously from the nearby server to the user. Even with a dial-up connection, this approach can result in a much better user experience, especially for websites with high-data rate content.

One of the expressions used to describe this approach to improving the web experience is "moving the content to the edge of the Web."

Satellites are ideally suited to provide this service as the uplink earth stations can be located near the content provider and receive-only earth stations at the ISP points of presence. The networks can be quickly deployed, since, generally, satellite capacity will be available over most geographic areas. Satellites can bypass congestion on the terrestrial Internet, especially during peak request times. Multicasting and caching is particularly useful in delivering dynamic, streaming content through satellite point-to-multipoint streaming networks. In addition, this type of service also supports:

- live event webcasting including sporting events and concerts
- training, including distance learning
- corporate websites to dispersed locations
- large file downloads such as software, games and databases

One difficulty in developing this business has been identifying the party who is willing to pay for the multicasting and caching. The original concept was to seek compensation from the content provider from the perspective that it had the most to benefit from this approach. Of course, corporate uses and others who are interested in delivering streaming content, training, and webcasting events will pay for such service. However, the value proposition for large numbers of websites may be there but is not yet widely recognized by the content providers.

A variation of this business has been the growth of content management networks. Satellite operators, teleports and resellers all are involved in developing these end-to-end services for customers. Content management is helping users identify, organize and digitize corporate content for transmission and use to others, including other parts of the organization, customers, or prospective customers. One way of describing this is "webifying" the content developed within an organization. Much of this content can be useful to others inside or outside the organization if the content is developed and managed in a way that it can be accessed over the Internet, including through corporate intranets and extranets. In a sense, this is part of the Internet's impact of moving organizations towards new ways of working. It takes time because of long-established patterns of work, information management and storage. And, to succeed, organizations have to overcome their fear of sharing information, both internally and externally. For many hierarchical organizations, this can be very threatening to the status quo, even though distribution of information can save and make money for the organization.

Through helping organizations "reprovision" content, and transmit it to users, satellite entities can build more demand for their services.

IV. Satellites Also Have a Key Role to Play in Providing Broadband Capability to the End User

Finally, satellites also have a role in providing broadband access directly to users. This can be in the form of advanced VSAT networks aimed at corporate customers, many of whom have been using VSAT networks for years, or in the form of two-way earth stations which enable consumers to have broadband access to the Internet.

The advanced VSAT networks are developing a new area for the satellite industry, with advanced IP modems and interfaces which allow organizations to use the satellite system for high-speed Internet access, data transmission, video and voice. Generally, these systems are deployed in a star network, e.g., with a central hub and many remote sites. While many service providers utilize proprietary software and hardware, others are using equipment based on the DVB (digital video broadcast) standard which can reduce the costs of chipsets and ultimately, lower the cost of mass-produced VSAT terminals. Of course, the temptation to use proprietary solutions is great as it increase the difficulty for customers to move from one service provider to another.

The two-way broadband services for consumers are also being implemented, although generally, they complement, rather than compete with cable modems, DSL or fiber. In general, the satellite solutions are utilized in areas where these other technologies are not available. Introduced more than three years ago by Hughes (DirecPC), the service has had slow uptake. Installation of the customer premise equipment can be time-consuming and the cost of equipment out of reach of many users. Nevertheless, this service is steadily obtaining new customers as the cost of equipment decreases, as demand for broadband connectivity increases, and as consumers realize they are unlikely to be served by DSL, cable modems, or fiber.

It is more likely that the two-way broadband services to end users will move forward more rapidly as they are integrated into DTH service offerings. Particularly if the same earth station can be utilized for both the receive-only and the two-way service, this will be more attractive to consumers. Also, the market for this service is similar to that for DTH, e.g., areas where other alternatives, such as cable television, is not available. This hybrid approach is being deployed by EchoStar, DirecTV, and SES Astra. This service also may be particularly appropriate for widely dispersed areas, such as in the Asia-Pacific region, where other broadband choices may not exist. Operators in that region, including Shin Satellite, are introducing such service.

V. Conclusion

This paper has provided an overview of various roles of satellite systems in the Internet. Satellites will maintain their traditional role of moving content from location to location, whether that content is video distribution, data, or Internet content. Satellite service providers also have an excellent opportunity to use their systems as platforms to market integrated content management and delivery solutions. Increasingly, satellite VSAT networks will upgrade to higher functioning and more flexible IP networks. Finally, satellite networks will have a role, albeit a niche one, in provision of two-way broadband service to the end user.

Endnotes

[1] MP3 is a term for digitized music content based upon the standard developed by the Motion Picture Experts Group (MPEG).

[2] Nielsen/NetRatings, Global Internet Trends Report, July, 2001.

[3] NetValue Report, September 3, 2001.

[4] Dataquest, September, 2001.

[5] Id.

[6] TCP/IP is transmission control protocol/Internet protocol and is the basic common language of the Internet, allowing differing networks to communicate with each other. Loral CyberStar provides an excellent discussion of TCP/IP Performance over Satellite Links, available through its website, WWW.CYBERSTAR.COM.

[7] "Caching for Improved Internet Delivery," INTEL White Paper, 2000.

back to index

Abstract

Traditionally, satellites have been used for long-haul communications, linking heavy traffic areas and providing critical thin-route access. With the growing use of the Internet, the role of satellites has changed dramatically. In addition to their traditional role of delivering video content and providing thin-route telephony access, satellites are garnering an important role in transporting Internet traffic from ISP points to Internet nodes, in transporting Internet content to ISPs, and in providing users direct broadband access to the Internet.

The explosion in use of the Internet has resulted in increased demands for telecommunications transport of all kinds: fixed, mobile and satellite. Every request for a website requires use of telecommunications facilities. Delivering the content to the user similarly requires use of telecommunications facilities. Thus far, the majority of web content resides in the United States and Western Europe. Consequently, when a web user outside of these areas "requests" a site located in these areas, transmissions must occur from the user's local ISP to other points on the web where the request can be fulfilled. This has resulted in the need for ISPs around the world to utilize more and more inter-exchange and international telecommunications networks. For long-haul traffic, satellites are a particularly efficient means of delivering such content globally.

A second use of satellites stimulated by the growth in the Internet has resulted from the growing interest in high-data rate content, e.g., music, video, etc. Because the content providers have a strong incentive to ensure that the user has a satisfactory experience with this content, they are starting to utilize satellite systems to "push" Internet content directly to the edge of the Internet, to ISPs close to the users. This enables the efficient aspects of satellite communications - broadcast of the same content to multiple sites at the same time --to be harnessed. Another use of satellites is in integrated content management systems, whereby developers of media content, whether text, audio or video, can develop content, save in a digital format, and transmit through a satellite system to other locations where the content can be further manipulated or utilized.

Finally, satellites are also attaining a place in the provision of last mile broadband Internet access, particularly in geographic regions which are large and/or less densely populated. Many areas of the world will never be attractive economically to providers of fiber optic access, DSL or cable modems. These areas, which include major portions of Asia and the Pacific Ocean region, are very well suited for provision of last-mile broadband Internet access through the use of satellite systems.

This paper will examine the current systems providing these varied services related to delivery of Internet content, provide an overview of the system architectures and address the prospects for the growth of such systems, particularly in the Asia-Pacific Region.

Leslie A. Taylor

Leslie A. Taylor is president of Leslie Taylor Associates, Inc., a telecommunications legal, engineering and consulting firm, specializing in international and satellite strategy, regulation and policy, including spectrum allocation matters. LTA also provides engineering services, including cost-effective solutions to complex interference situations. Past projects and capabilities include:

- identifying strategic opportunities in the satellite or wireless business and facilitating strategic relationships.
- identifying solutions for communications requirements; RFP development; interface with communications providers and vendors; contract negotiation and procurement.
- obtaining frequency allocations for new services and necessary ITU regulations; coordination between satellite systems and between satellites and other users of the spectrum
- identifying opportunities based on international and national satellite system filings and developing and executing strategies to support new systems.
- preparing, filing and prosecuting satellite, earth station and Section 214 applications for the provision of international telecommunications services.

Specific accomplishments include: obtaining an FCC license for the Globalstar "Big LEO" satellite system and obtaining access to feeder link spectrum; obtaining an FCC license for the E-SAT "Little LEO" mobile satellite system operating below 1 GHz and negotiation of agreement for exchange of ownership; participation in FCC auction proceedings; negotiation of leveraged lease financing arrangements and many others.

FCC proceedings in which Leslie Taylor has participated include: development of rules and policies for operation of Fixed-Satellite (FSS), Direct Broadcast Satellite (DBS), Mobile Satellite (MSS) and Digital Audio Radio Satellite (DARS) systems. In addition, Leslie Taylor has represented clients before the Federal Communications Commission with regard to all of these types of satellite systems, obtained licenses, and participated in proceedings relating to licensees of these services.

Prior to founding Leslie Taylor Associates in 1989, Leslie Taylor was Director, Government Affairs, at GTE Spacenet Corporation. While at GTE Spacenet she managed the licensing process for the GTE domestic satellite system, obtained numerous FSS authorizations and earth station licenses for the company and developed and negotiated customer and vendor agreements. During 10 years of government service at the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration she served as Chief of the International and Satellite Branch, Legal Advisor to Commissioner Mimi Weyforth Dawson and Advisor to Ambassador Abbott Washburn for the 1983 Region 2 Broadcasting Satellite Conference. The Region 2 BSS Conference allocated frequencies and orbital locations for the systems which now provide Direct Broadcast Satellite (DBS) service in the U.S., Canada and Latin America.

Leslie Taylor has a law degree from George Washington University and is a member of the District of Columbia, Maryland and Supreme Court Bars. She also holds a B.A. with honors in English and journalism from the University of South Florida.

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back to index

Technology

Tuesday, 15 January 2002
1430–1600
Coral I

T.2.4 Future Networking

Chair:
YASUHIKO KAWASUMI, General Manager, Japan Telecom Co., Ltd, *Japan*

T.2.4.1 Terrestrial and Submarine Integrated System for Global Mesh Network (View Abstract)

SHINYA KUKITA, Senior Manager and TERUYUKI NAKAJIMA, Assistant Manager, Optical Network Product Marketing Division, NEC Corporation, *Japan*

T.2.4.2 A Framework for Optimized Content Delivery Over the Internet (View Abstract)

JINGSHA HE, Senior Member of Research Staff and TAKAFUMI CHUJO, Manager, Fujitsu Laboratories of America, Inc., *USA*

back to sessions

Yasuhiko Kawasumi

He started his business carrier at the Japanese overseas telecommunication operator KDD in 1961 after graduated from Electrical Engineering Faculty of KEIO University. His experiences cover the works for the construction of Transpacific Submarine Cable No.1, the maintenance and operation of submarine cable systems and Intelsat satellite systems at the international gateway station of the company, engineering of network management systems, telephone traffic management. He stationed in Geneva 1972-1976 as the company's representative. He attended CCITT, CCIR Plenary Assembly Meetings, World Administrative Radio Conferences (WARC), and Plenipotentiary Conferences (Nice and Minneapolis) as a member of Japanese delegation. He contributed to the standardization of G3 facsimile machine in CCITT in late 1970s, 32KbpsADPCM Speech Codec etc. He participated in Maitland Commission meetings in Arusha (Tanzania) and Bali (Indonesia) in 1984 and the Advisory Board meetings of Center for Telecommunication Development of ITU as expert. After taking the position of director of the international affairs department of KDD, he took the posts of secretary general of ITU Association of Japan, Executive Vice President of Kokusai Telecommunication Installation Co. and Secretary General of International Communication Foundation (ICF). He moved to Japan Telecom Co., Ltd. in 1997 taking present position since then. He was appointed as rapporteur of Focus Group on topic 7 "Development of New Rural Communication Technology" of ITU-D Study Group 2 in 1999 and submitted the final report on "New Technologies for Rural Applications" to the Study Group 2 of ITU-D and Telecommunication Development Advisory Group (TDAG) of ITU-D. He is one of Vice-Chairmen of TDAG (2000-2001) in charge of Rural Communications Development.

back to index

Terrestrial and Submarine Integrated System for Global Mesh Network

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Japan

View Abstract

1. Submarine network in Global data network

Today's commercial activities are executed on a global scale. Data networking is quickly expanding to support the ever-growing global communication needs. While voice communication growth is roughly proportionate to world's population growth, the demand for data communication is growing exponentially. As a result, data traffic now exceeds voice traffic in many countries and others are quickly following this trend. In the voice communication age, international traffic was limited. Language barriers and time differences impaired open, real time international communications. But now, written text communication like e-mail lowers the language barrier and buffers time differences. Graphics, recorded sounds and videos are exchanged easier than real time voice.

Much of today's business is conducted by multi-national companies (MNC). Everyday, these MNCs exchange information between locations spread all over the world. Their dependence on timely, accurate information makes them the largest consumer of the data communication capacity.

Because of the speed of today's business operations, MNCs need to deploy branch, sales, and temporary offices, complete with voice and data communications channels quickly. Quick deployment means earlier time to market. Communication service providers need to provision network services quickly to meet these demands. Intervals need to decrease from months and days to minutes and seconds. But today's international network architecture is not fit to support these kinds of demands. Provisioning is complicated and time consuming.

Besides the MNC's network, today's Internet demand poses similar issues. Internet traffic demand is generated across the globe. Today's communication service providers must provide robust data communications network to meet the demands of the MNCs, small business, and residential markets. A transoceanic DWDM submarine system, which is the subject of this paper, is an integral part of global data network.

2. Evolution of Transoceanic Submarine Systems

The protection scheme of Transoceanic Submarine Systems has evolved over the past decades.

Submarine systems used to provide unprotected point-to-point connections. In the case of failure, traffic was sent through other backup networks, such as satellite systems. This scheme does not work in today's network. The satellite network capacity does not match the submarine network capacity.

Point-to-point with redundancy switching schemes is the simplest way to provide protection. Although it provides protection against component failures, it does not provide protection against cable cuts.

Duplicated cables placed with route diversity provide superior protection. This configuration also allows cable maintenance activities without causing system failure.

Many of the newly installed or planned submarine systems are configured in Ring to provide network flexibility and security. Ring network is ideal when the traffic loads are distributed evenly along the ring, but is inefficient if the traffic is unbalanced because the busiest segment governs the systems capacity.

3. Global Mesh Network

SONET/SDH Ring is the dominant network architecture in the terrestrial network. While ring based networks provide reliable services through fast protection capability, it is not the most efficient architecture.

3.1 Mesh network benefits

Bandwidth efficiency of Ring architecture never exceeds 50%. Mesh architecture allows many working paths to share a single protection path. This results in higher bandwidth utilization. Subsequently, it leads to a significant reduction of capital expenditure. By putting preemptable traffic on protection bandwidth, the utilization ratio can be even larger.

Mesh architecture supports Class of Service (CoS) by differentiating restoration speed and/or reliability. Ring network might have provided one unified performance for one kind of service: voice. The CoS capability of the mesh network creates a potential for differentiated services for different types of data communication.

Control plane software, rapidly evolving in standards communities, is essential to realize rapid provisioning and quick restoration in mesh network. By this, mesh networks obtain supreme scalability and flexibility compared to ring-based networks.

3.2 Global extension of mesh network

It is quite natural to try to expand this mesh architecture on a global scale, including a transoceanic span. However, consortiums build most of the transoceanic submarine systems. Typically individual participants do not have full control over the choice of architectures, protection capability, and other features.

It is considered a bottleneck when there is only one cable system connecting two territories. Two mesh networks are isolated and managed independently, even if the submarine system provides supreme reliability through Ring protection under water. Such a network cannot provide the full potential of mesh architecture on a global scale.

Currently a number of service providers are constructing various Submarine systems. Some are competing with each other in close proximity, but many of them can complement with each other. Two terrestrial mesh networks can be connected by more than one submarine system across the ocean. We call this network "Global Mesh Network".

3.3 Global Mesh Network architecture

To materialize a "Global Mesh Network", we propose to introduce cross-connect equipment at the demarcation point, namely the City-POP. Please refer to Figure 1.

Typically cross-connect equipment provides various networking functions, such as Wavelength Provisioning, Service Grooming and Restoration. Because we assume submarine systems have been put in service in sequence before combined in a Global Mesh Network, all the networking functions have been allocated and implemented in either the terrestrial or submarine portion of the network. Primary functions of the newly inserted cross-connect equipment are providing flexibility of network configuration for unbalanced traffic loads and restoration in case of catastrophic failures. Because grooming capability is already provided in the terrestrial network, the granularity of cross-connect equipment should be line-rate. The size of the cross-connect matrix is relatively small. These requirements perfectly match the characteristics of the initial releases of evolving, all-optical, cross-connect equipment.

The total capacity or throughput of the network might be different. The number of nodes might be different. Still the mesh architecture makes good sense for many service providers. We feel the Global Mesh Network will become the default network architecture for global communication service providers.

4. Terrestrial and Submarine Integrated System

Once this becomes a reality, new submarine systems should utilize the capability of Global Mesh Network to its maximum extent. Please refer to Figure 2.

With control plane software in place, mesh protection in the Global Mesh Network will replace the ring protection mechanism in submarine systems.

Grooming capability is not required in submarine systems. Still, wavelength-provisioning capability might be required because wavelengths used in submarine systems could be different from those used in terrestrial systems.

We have compared three (3) cases as described in Figure 3:

- Option A: Conventional layout
- Option B: 3R repeater at landing station
- Option C: 1R repeater at landing station

Because Option A requires a backhaul system between a landing station and City-POP, the amount of equipment installed in a landing station is large.

Option B and Option C are available with Global Mesh Network.

Option C effectively eliminates landing stations. The physical size of equipments in City-POP becomes large because submarine transmission is terminated at City-POP. The ultra-longhaul transmission requires large dispersion compensation materials and, most likely, per-wavelength adjustment function. If the distance between a landing station and City-POP is large, several issues, listed below, become critical and almost impractical to implement.

- Ultra-longhaul performance limit
- High voltage in the cable

Option B can be considered as a generic solution to accommodate various geographical conditions. One side of 3R repeater terminates ultra-longhaul submarine transmission, while other side supports terrestrial interface. The distance between a landing station and City-POP does not affect the above listed issues because they are solved at a landing station. This equipment may provide Wavelength-provisioning function upon necessity as well.

In a sense, 3R repeaters integrate submarine and terrestrial systems. We call it "Terrestrial and Submarine Integrated System". Thanks to Global Mesh Network, the space requirement will be reduced as much as 25% by comparing Option B and A. The reduction of power consumption is even greater.

5. Conclusion

We presented the benefit of Global Mesh Network and proposed the architecture. We also presented that Terrestrial and Submarine Integration is best discussed in conjunction with Global Mesh Network. Integration by 3R repeater at Landing Station is our recommendation.

6. Emerging technologies

There is the inherent space limitation of the submergible unit in submarine network. To meet the ever-increasing capacity demand, we cannot count on the new band utilization or fiber pair increment.

This is why the challenge towards 10Tb/s would be to squeeze more and more wavelengths within the available bandwidth.

Most of the initially deployed DWDM submarine systems were four (4) fiber-pairs, where each pair of fibers carried eight (8) 2.5G channels. It computes to an 80Gb/s cable system. Since then, the number has increased to six (6) fiber-pairs. Bit rates have increased to 10Gb/s. The number of DWDM channels has increased to 64. Total capacity is now 3.84Tb/s, close to 4Tb/s. Typically, the strategy for the next step would be to narrow the wavelength interval from the currently deployed 50GHz spacing to 33GHz spacing using polarized wave multiplexing. The number of fiber pairs would also be increased to eight (8) pairs. This enables total capacity of 7.68Tb/s. The next and most challenging step is to further narrow the wavelength interval as tight as 25GHz, enabling 10.24Tb/s in total capacity.

An approach to further increasing the total capacity is to upgrade the bit rate that is carried by each wavelength to 40Gb/s. This causes a qualitative change in the structure of transmission systems, especially long-haul transmission such as submarine systems.

6.1 Dispersion Managed Fiber

The primary issue for the 40G-based system is that it becomes tremendously difficult to secure the dispersion flatness along the transmission line. To overcome this issue, fiber and systems vendors are seeking sophisticated dispersion management solutions. Each repeater span is designed as a combination of multiple types of fiber that have different dispersion characteristics. Unlike the conventional monolithic fiber solution, dispersion compensation is applied along the transmission line. Typically the multiple types of fiber consist of the following:

- Large core fiber in order to minimize the non-linearity caused by high power density
- Dispersion Compensating Fiber to compensate both the dispersion and the dispersion slope of the overall span.

In general, deploying dispersion-managed fiber will cause maintenance problems because of the fiber polarity. It also limits the upgrade flexibility of the network using the same fiber as initially deployed. For those reasons, adopting a dispersion management solution in the terrestrial network, where the system must be upgraded without deploying new fiber and cable cuts occur much more frequently than submarine network, is unrealistic. However, this solution is still valid for the submarine network, which is more of a network optimized to the deployed system configuration.

6.2 Optical Regenerator

The 40 Gb/s systems would initially be available with 16 or 32 channels for short-haul applications in year 2003 to 2004. To apply 40 Gb/s systems for transoceanic route, it would probably require intermediate regeneration to remove accumulated signal impairments.

Recently, studies of all-optical transmission technology have gained the industry's attention. The application of this technology is mainly targeted at 80G and beyond, where signals cannot be processed electrically. All-optical regeneration for DWDM systems was not originally in the scope of this application, because per wavelength regeneration cannot functionally replace in-line amplifiers. However, once we admit the need of intermediate regeneration for 40G transoceanic submarine systems, there maybe an opportunity for all-optical transmission technology to be applied to 40G all optical regenerator. Whether this technology is useful for 40G regenerator or not will fully be dependent on the benchmarking result with 40G electrical regenerator in terms of power consumption, space, and cost.

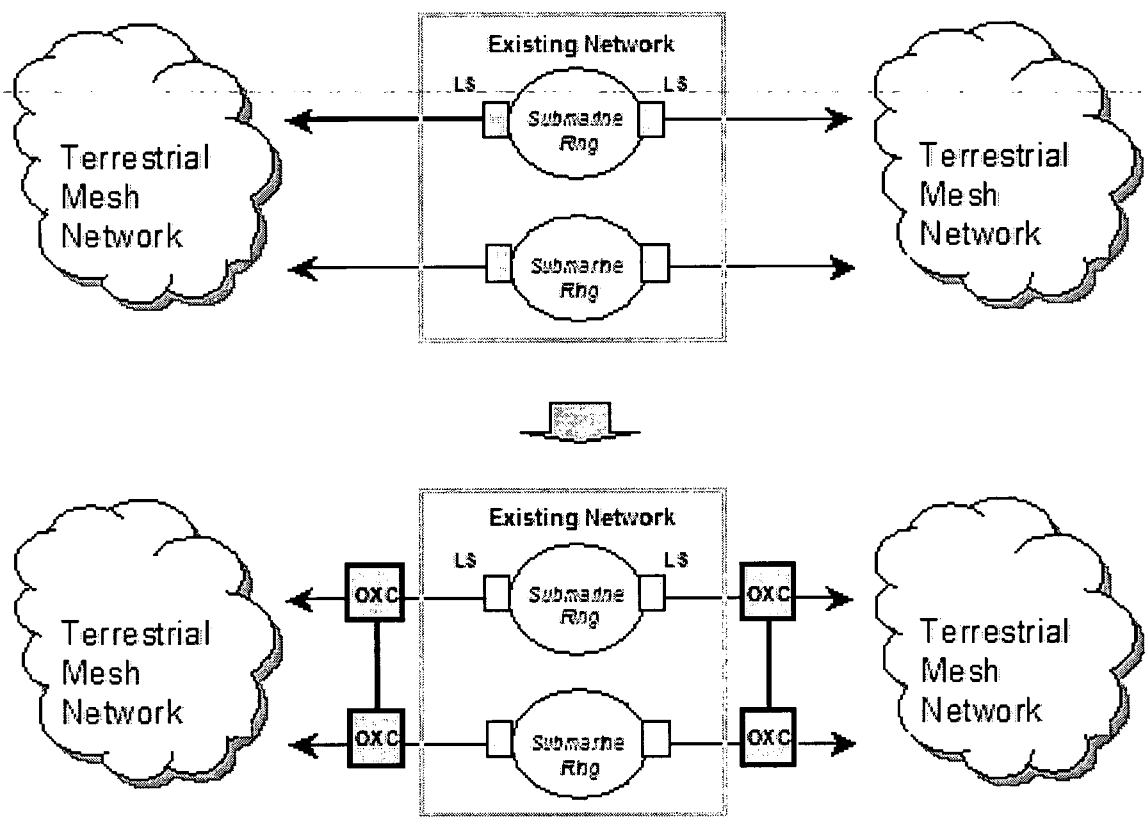

FIGURE 1 GLOBAL MESH NETWORK

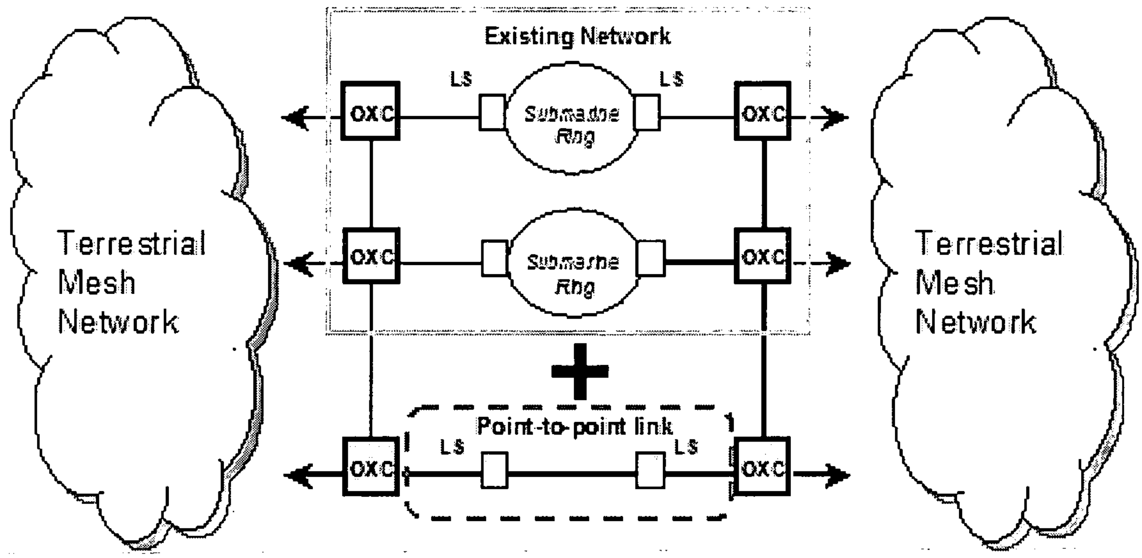

FIGURE 2 NEW SUBMARINE LINK

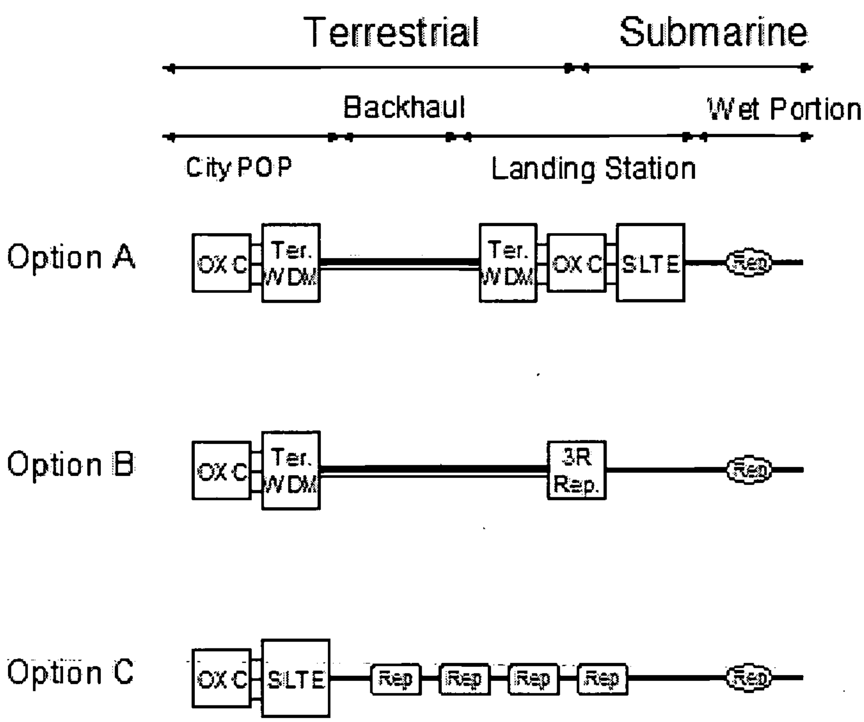

FIGURE 3 TERRESTRIAL AND SUBMARINE INTEGRATION

back to index

Abstract

We will first review the evolutional building steps towards Global Mesh Network and its enabling technologies. Then we will discuss new Terrestrial and Submarine Integrated System, which will be added as a new part of Global Mesh Network in parallel with existing and under-construction DWDM submarine systems. We will describe how Global Mesh Network contributes towards the optimization of Terrestrial and Submarine Integrated System.

back to index

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back to index

A Framework for Optimized Content Delivery over the Internet

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View abstract

1. Introduction

The growth of the Internet has significantly increased its commercial applications for video, audio and other multimedia applications that require quality of service guarantee in the delivery of the contents and in providing the best user experience. Meanwhile, content and service providers are faced with the challenges of optimizing network resource utilization. To meet the above needs, various mechanisms and technologies have been developed over the past few years to address these requirements. Among the mechanisms commonly used today are content delivery networking, load balancing, bandwidth management, web caching, and peer-to-peer networking. Together with effective network measurement technologies, resource utilization and performance of content delivery can be provided to a great extent. However, each of the above approaches has its benefits and limitations. For example, content delivery networking based on content caching cannot deal effectively with dynamic and personalized contents. Although improvements have been made in this area, the overall performance of the mechanism will be greatly compromised due to the complexity of the management of the dynamic and personalized contents as well as the timely distribution of the contents to the edge of the network through the content delivery network. Consequently, relying solely on the current content delivery networking technology may not be suitable for an increasing percentage of the contents created, which are characterized more and more by the nature of fast changing and personalization as the commercialization of the Internet continues. Furthermore, such a blind reliance on the content delivery networking technologies could degrade the overall performance and worsen user experience because the user requests may be misrouted through the content delivery network that could not deliver the requested contents. Since each approach has its advantages and limitations, combining the multiple approaches and taking advantage of the benefits while avoiding the limitations will provide the greatest potential of optimizing resource utilization and maximizing the benefits of the various content delivery technologies.

We propose a framework for integrated content delivery in this paper. The framework is based on the building of another layer of control and management on the top of the existing mechanisms and technologies and would accommodate any emerging new technologies. Consequently, the individual mechanisms will no longer function alone as they do today but will work together in a coherent way such that any specific requests for content access can be handled and delivered by the most effective and efficient mechanism. The decision as to which one is the best delivery mechanism depends on a number of factors, among which are the types of the requests, the origination of the requests, the destinations where the content are stored and managed, the availability of the requested contents that are accessible to the different mechanisms. Such a coherent way of integrating the many different content delivery mechanisms will greatly improve the effectiveness of the functionality as well as the efficiency of the delivery system as a whole.

Another main element in the framework is the network measurement capabilities. The measurement modules will continuously monitor the health of the network and gather network traffic information and initiate measurement activities whenever necessary to compute the available network resources. The measurement results will be supplied to the decision making process in the control and management component to be used for matching up the available resources with the resource requirements for the different requests and contents with quality of service requirements. Therefore, it immediately becomes known to the control and management component where to best route the requests when there are more than one option to choose and whether the requested contents can be delivered at all.

The advantage of the proposed framework for integrated content delivery over the current practices where individual mechanisms are loosely put together and no global knowledge is employed in the process of content delivery is that it can immediately serve the user requests by using the best mechanisms instead of trial-and-error or by unnecessary going through the wrong part of the delivery network that would negatively impact the performance of the delivery and the utilization of network resources. Since the framework seeks to leverage on the current mechanisms and technologies and, at the same time, to accommodate future new technologies, it would provide the best way of building the next generation of network infrastructure for handling the rapidly increasing needs of effectively and efficiently delivering contents involving video, audio as well as other types of multimedia contents.

The rest of the paper is organized as follows. In the next section, we describe the framework for integrated content delivery in which we concentrate on the integrated content delivery (ICD) architecture and the network measurement capabilities. In Section 3, we describe an example application that can take advantage of the benefits of the framework. Finally, we conclude this paper in Section 4.

2. The Framework for Content Delivery

In the framework for integrated content delivery, we introduce two components into the present content delivery paradigm: the control and management capability and the network measurement capability. The layering of the components inside the present network is illustrated in FIG. 1.

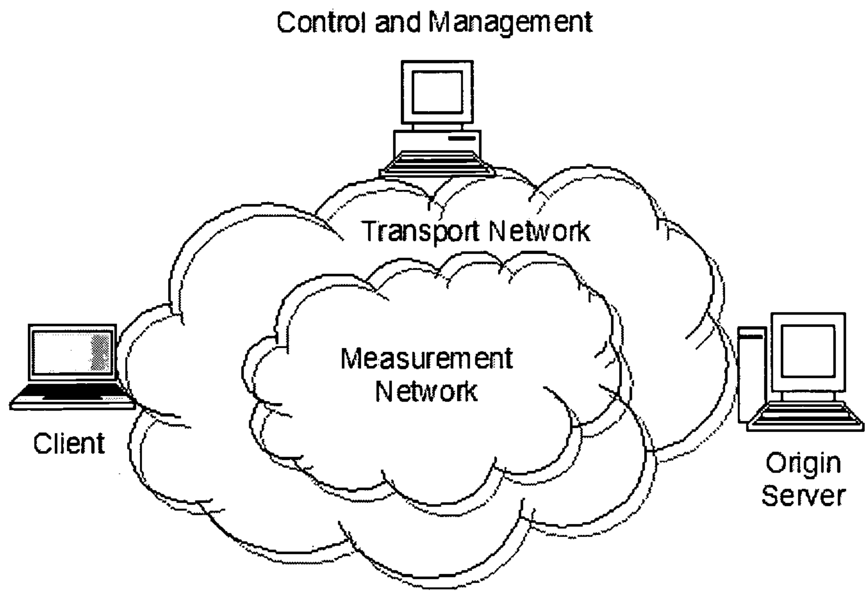

FIG. 1. INTEGRATED CONTENT DELIVERY

The control and management capability is accomplished through the use of the control and management element that acts on behalf of the user to examine and direct user requests to the part of the delivery network that would provide the best service in terms of resource utilization and user experience. The measurement capability is accomplished through a measurement network, as illustrated in FIG. 1. The measurement network could rely on the same transport network that delivers the contents between the client and the server. The measurement network just implements some necessary functions to facilitate the measurement services it provides to the control and management component and, consequently, to the user applications. FIG. 2 illustrates the framework for integrated content delivery. We now describe the two components of our framework, i.e., the control and management capability and the network measurement capability in the remainder of this section.

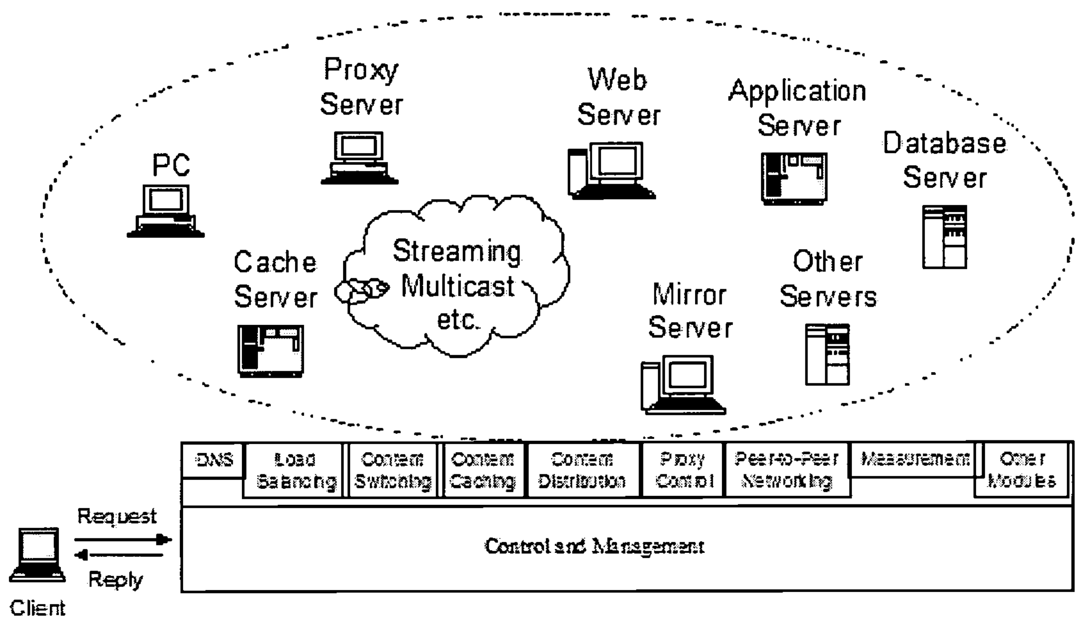

FIG. 2. FRAMEWORK FOR INTEGRATED CONTENT DELIVERY

2.1 Control and Management Capability

First of all, the Internet is comprised of a number of different servers for the storage and caching of contents. These servers are introduced to provide the necessary processing power to serve user requests. They could also be part of the consideration for redundant architecture to improve the reliability and availability of the service. Furthermore, they could be part of a content delivery mechanism that is introduced into the network to achieve the specific objectives of content delivery. For example, content delivery networking would introduce a number of cache servers at the edge of the network so that the contents can be cached and brought closer to the user. The objective would be to serve user requests directly from the contents out of the cache servers. This would greatly improve the user response time and save network bandwidth by avoiding the sending of the user requests to the origin servers. As more such techniques and mechanisms are used for improving content delivery, the number of various types of servers increases in the network, which may contain the same contents simultaneously. Due to the lack of coherence among the different mechanisms, many resources are wasted and the contents may not be provided from the best server in the network in terms of resource utilization and user response time.

The control and management component consists of one or more control servers throughout the network each of which administer and enforce the various policies related to content delivery for a group of users. They also direct actual user requests to the best servers or networks to access the requested contents based on the analysis of the requests, the health of the servers and networks and the availability of the contents. For ease of description, we will directly use the term control and management server in the following discussions. Thus, the control and management server adds the following capabilities into the effective and efficient delivery of contents:

1. Routing policy configuration and management. The routing policies are used to specify the general routing decisions for directing user requests to the specific servers or networks. These policies are specified for different types of contents that are requested, e.g., html, cgi, asp, jsp, etc. They also specify which servers or networks to send the user requests based on their origination addresses or networks. Furthermore, the policies could specify routing based on the health of the content servers or the resource levels of the servers because such phenomenon could significantly impact the performance of the delivery of the contents. This is especially important in the situation that there are more than one content servers or networks that could deliver the same requested contents. The specification of the routing policies based on the many different factors is essential in achieving the claimed benefits of the framework for integrated content delivery and in maintaining the robustness and resilience of the delivery of the contents in the case of server and/or network failure.

2. Server and network health and resource availability information gathering. The control and management server needs to gather information about the health of the servers and networks that are requested to deliver the contents. It also needs to collect information about the resource levels on a periodic basis so that the best server or network can be selected to provide the best user experience in content delivery and to optimize the utilization of the network resources. Such information can be updated periodically through the interaction with the network measurement component or can be obtained when certain status information is needed for the control and management server to make a decision for a user request. The advantage of the first approach is the instantaneous availability of the health and resource information at the time when a decision has to be made, while that of the second approach is the lower overhead in the maintenance of the information. Depending on the scope of using the policies in the routing decision, one approach could be more advantageous over the other. For example, if the control and management server is widely used by users and applications for content delivery, the first approach would make more sense because the information is frequently needed and, therefore, the overhead becomes comparable to that of the second approach. In the beginning of the deployment of the implementation of the framework where fewer users and applications use the integrated content delivery mechanism, if overhead is a primary concern, the second approach may be more practical provided that the delay for getting the health and resource information can be tolerated.

3. Routing decision-making. When a user request reaches the control and management server regarding the availability and delivery of contents, the control and management server will gather the necessary information about the health and resource of servers and networks that can provide the requested contents and decide where to send the request based on the policies. Based on the policies and the server/network information, the request is sent to the right destination that the control and management server decides that best content delivery can be provided. If the policies are flexible, the control and management server may have to use some heuristics or just make some random decision as to how to handle the request.

With the above functionalities in the control and management server, we can see that the server becomes the resource policy management and enforcement point in handling user requests and content delivery. This is because all the user requests will go through the control and management server, directly or indirectly, for all content delivery decisions. This is also because the control and management server keeps track of all the health and resource information about the servers and the networks that can provide the requested contents.

FIG. 3 illustrates the control and management server component and its interactions with other components in the framework for integrated content delivery.

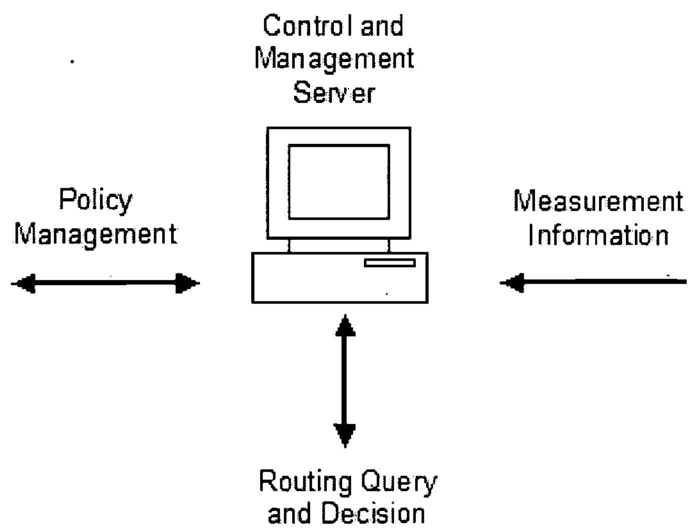

FIG. 3. CONTROL AND MANAGEMENT SERVER COMPONENT

2.2 Network Measurement Capability

Network measurement is an important component in the framework because it makes it possible for the control and management component to make resource management and routing decisions regarding content access and delivery. The network measurement component checks the health of servers and networks and keeps track of the resource utilization information by regularly measuring the various metrics related to the performance and characteristics of the network. Among the most commonly used measurement metrics are one-way traffic delay, round-trip traffic delay, traffic loss ratio, bottleneck and available bandwidth between servers and networks, etc. Therefore, specific technologies and techniques are needed to measure the different metrics. The measurement can be performed by multiple measurement agents against other networks and nodes and the individual results have to be combined to provide a network view regarding the health and performance in order for the results to be useful for the upper layer services or applications such as the control and management servers in the framework. Therefore, we propose a two-layer architecture for the network measurement capability. The lower layer is called the measurement layer and the upper layer the information aggregation layer as shown in FIG. 4.

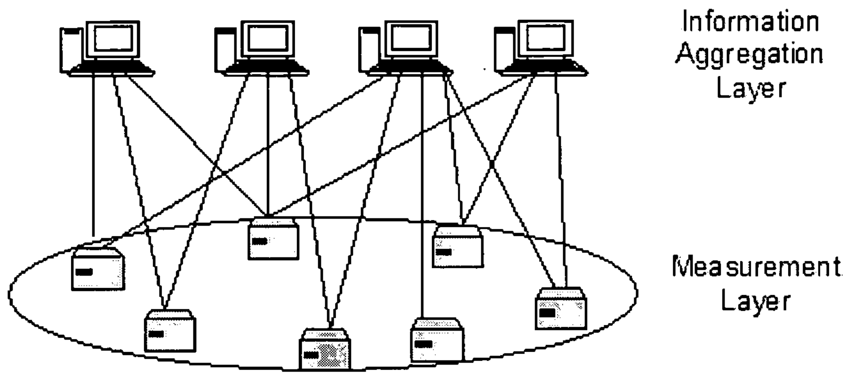

FIG. 4. NETWORK MEASUREMENT COMPONENT

In the measurement layer, there are a number of devices that conduct regular measurement among them. These devices are located inside the network and along the edge of the network. Each of them performs the measurement representing a part of the network or a group of nodes at the higher layers of the network. Therefore, the number and location of these devices determine the accuracy of the measurement because the more of them there are, the smaller the part of the network that each has to represent. In addition, these devices should be evenly located in the network so that the network measurement results can be available from everywhere in the network although the specific measurement technologies and the kind of measurement they perform are not the main subject of this paper. Furthermore, it is advantageous to separate the architecture of the measurement from the particular measurement techniques so that any available technologies can be easily installed and integrated in the measurement devices to perform the necessary network measurement functions as the need arises.

In the information aggregation layer, the measurement results from the measurement devices are combined together for use by the upper layer services or applications. The aggregation can be tailored to suit particular needs, i.e., the aggregation servers can be configured to obtain the measurement results from a subset of the measurement devices. The configuration can be dynamic that new measurement devices and results are connected to an aggregation server when it is the first time that an upper layer service or application requests such measurement results. After the connection is established, the aggregation server will start to include the new devices in the list of measurement devices from which it can regularly obtain measurement results. A connection with a measurement device can also be dynamically dropped if the measurement results from the device are not requested by any upper layer services and applications for a finite amount of time because the aggregation server can assume that such results are not useful for the services and applications. Even the measurement devices can be made to dynamically start and stop certain measurement based on the demand for such measurement from the aggregation servers. Such a dynamic algorithm keeps the overhead of the network measurement component low while providing useful measurement results to the upper layer services and applications.

2.3 Integration

With the control and management and the network measurement capabilities in the framework integrated into the existing content delivery paradigm, requirements for the optimization of network resource utilization and of content delivery can be better served and the performance greatly improved. FIG. 5 shows the integration of the two new components in the framework into the network.

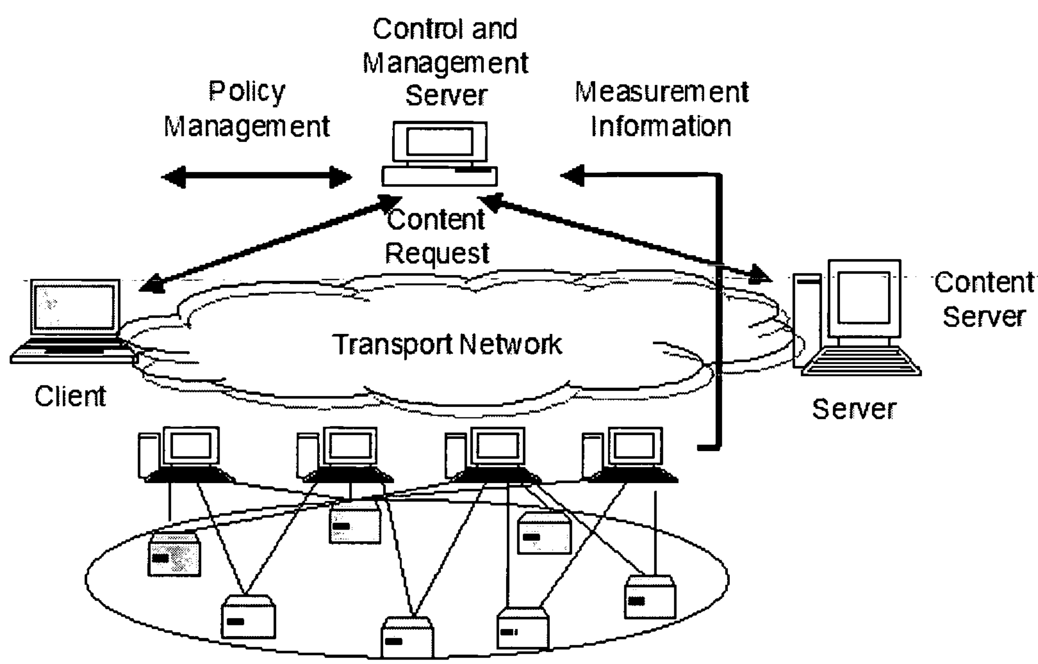

FIG. 5. CONTENT DELIVERY INTEGRATION

It is therefore obvious that the different components and their functionalities in the framework for integrated content delivery can be naturally put together to provide requested contents more efficiently. The advantages of such architecture are as follows:

1. It can improve the performance of content delivery. This is in contrast to the current practice in which the different mechanisms are used loosely without any coherence. Therefore, either some of the different mechanisms are overlapping in functionalities because they provide essentially the same benefits without any aggregated effects, or they are used in a less optimized way such that the potential of the combined benefits cannot be easily realized. By looking at them at the same time, the best delivery mechanism can be identified and the most efficient routing can be achieved to optimize the resource utilization and maximize the benefits of the integrated content delivery network.

2. It can scale well with the needs of the control and management for content delivery. This is because the measurement component will dynamically start and stop certain measurement following the instructions and the needs of the upper layer control and management component. This is also because the measurement architecture in the framework is separated from the specific measurement techniques so that measurement algorithms and procedures can be added into the measurement devices as the need arises. The implication of the scalability is the lower overhead with the maximum benefit while achieving optimized content delivery.

3. It can be made totally transparent to the users and applications that request the delivery of contents. This can be achieved if the integration of the framework into the existing content delivery network is done in such a way that content requests are not required to go through the control and management servers. One such a way is the integration of the framework into the procedure of service identification or domain name resolution. Consequently, the requests would go through the normal procedure for the identification of the content locations without any knowledge of the existence of the two new components in the network. The content location procedure, before providing a response, would consult the respective control and management servers about the availability and the best location of the requested contents.

It is therefore very obvious that the proposed framework for integrated content delivery can provide many benefits with very low overhead to the existing content delivery network. The framework is also suitable for both public service applications and virtual private networking applications with different administrative arrangement of the control and management servers and the network measurement capabilities.

3. An Example Application

The framework that we have proposed and described in this paper is very general and, therefore, suitable for any situations where requested contents can be obtained from multiple servers or networks. The different requirements for the different scenarios and environments are reflected in the configuration and management of policies in the control and management component and in the measurement functions in the network measurement component. In the following, we describe an example application that can take advantage of the framework for integrated content delivery to provide the best user experience.

FIG. 6 illustrates an application in which requested contents may be present in multiple servers and in multiple networks. There are two issues in the delivery of requested contents. The first is that a particular piece of contents may not exist in all the servers and networks although multiple servers have it. The second is that the traffic load situation may be different at a given time for different servers and different networks. Both of these factors are of the dynamic nature. That is, different pieces of contents may exist in different sets of servers and networks at any given time and the load on each server and in each network may change over time. The control and management server solves the first issue in which it determines the appropriate servers and networks that are able to deliver the requested contents. The decision is based on the policies and on the analysis of the requests. It could also be based on the dynamic movement of the contents inside and across the networks, e.g., when the contents are temporarily cached in the CDN. Other heuristics based on prior access history could also play a role in the determination or selection of the best destination for content access and delivery. The last, but not the least, strategy is to rank the possible destinations so that the requests could be sent to alternate destinations simultaneously or sequentially upon timeout of previous attempts. In summary, the control and management server plays the central role in the routing of the content requests and in the accomplishment of the integrated content delivery in the framework to realize the maximum benefits of the network for content access and for user experience.

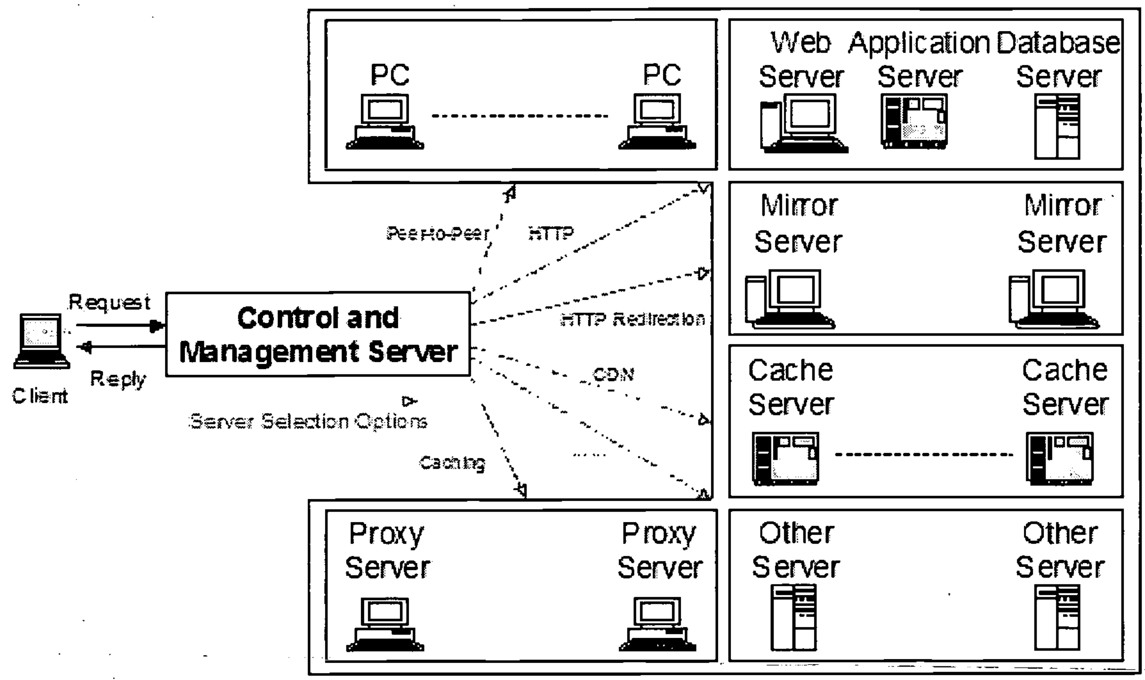

FIG. 6. AN EXAMPLE APPLICATION

Note that, although not shown explicitly in FIG. 6, the network measurement component is an integral part of the solution to realize the benefits of the integrated content delivery in the framework. This is because it helps the control and management server to select the best destination when multiple choices are available. Under such circumstances, the health of the servers and the networks as well as the available capacities determines where the access and delivery should be targeted. Therefore, the control and management server must utilize an existing network measurement service similar to that described in the framework to optimize the output of the server and network selection.

4. Conclusion

We presented a framework for integrated content delivery in this paper in which we introduced control and management capabilities and network measurement capabilities to improve the effectiveness and efficiency of content access and delivery. We showed the architecture, the functionality and the benefits of both components and demonstrated the importance of them for playing the critical roles in the development of a robust and scalable framework and architecture for the next generation of content delivery networks. We also gave an example application that can use and benefit from the proposed framework and the different ways of achieving their respective objectives for optimizing network resource utilization, content delivery and user experience. Other applications for content delivery that are similar to the one that we described can be easily constructed and shown to improve the effectiveness and efficiency of content delivery using the current approaches and technologies that lack coherence in their operation.

Since the development of content delivery technologies and that of the network measurement is actively being pursued by vendors with products and services being announced to the public all the times, the challenge is to integrate all the viable technologies together to support the new framework presented in this paper. Consequently, we don't see much difficulty in the development of architecture that incorporates the capabilities of content delivery and network measurement to improve the performance of content delivery, the utilization and network resources and the user online experience.

back to index

Abstract

We propose a framework for integrated content delivery in this paper. The framework is built on the top of the current mechanisms and technologies for the facilitation of content delivery over the Internet, which includes, but are not limited to, content delivery networking, web caching, load balancing, bandwidth management, peer-to-peer networking. That is, we add another layer of control to more effectively and efficiently utilize the current mechanisms while accommodating future technologies. In addition, network measurement is an integral part of the framework to achieve the objectives of optimizing network resource utilization, maximizing benefits of content delivery and providing the best user experience. The framework leverages on the existing technologies and further improves the performance of content delivery that could not be achieved by each individual technology alone. The control mechanisms in the framework will then take advantage of the multiple approaches and make use of the best or the most appropriate one to benefit the most out of the multiple technologies. This framework could become the foundation for the development of the next stage of Internet infrastructure for improving content delivery and user experience.

back to index

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back to index

Policy / Regulatory

Tuesday, 15 January 2002
1100–1230
Coral II

T.1.5 Universal Service

Chair:
ROBERT GUILD, Economic Infrastructure Adviser, Pacific Islands Forum Secretariat, *Fiji*

T.1.5.1 An Overview of State and Federal Universal Service / Access Support Mechanisms and Administration in the United States (View Abstract)

STEVEN HAAS, Director, Business Development, Marketing for International/State Telecom Programs and Telecom Applications, NECA Services, Inc., *USA*

T.1.5.2 Use of Satellite in Achieving Universal Service Objectives in Underserved and Remote Areas (View Abstract)

ANDREW D'UVA, Vice President & Associate General Counsel, New Skies Satellite N.V. , *Netherlands*

T.1.5.3 Contrasting Universal Service Arrangements- Recent Developments in Australia and New Zealand (View Abstract) (View Update)

CAROLINE LOVELL, Senior Associate, Clayton Utz Lawyers, *Australia*

T.1.5.4 An Update on Universal Service Arrangements in Hong Kong

RICHARD FAWCETT, Partner, Bird & Bird, *Hong Kong SAR*, *China*

back to sessions

An Overview of State and Federal Universal Service/Access Support Mechanisms and Administration in the United States

Steven W. Haas
NECA Services, Inc.
United States

View Abstract

1. Evolution of Federal Universal Service Support Mechanisms

With a monopoly providing both long distance service and local service (AT&T and its subsidiary twenty-three Bell Telephone Companies), rates for local service were kept artificially low through cross-subsidization via implicit subsidies inherent in rates. Higher long distance charges and higher local service charges to urban and business customers as well as higher charges for vertical services compared to basic services were used to offset the high cost of providing telecommunications service to residential subscribers in high cost rural areas.

In many rural areas, independently owned local telephone companies were formed and interconnected to the Bell System network. These companies participated in a Division of Revenues process with AT&T and the Bell Companies. AT&T, through a process of intra-company settlements, paid the local Bell companies from its long distance revenues to complete long distance calls over their local networks. The Bell companies in turn settled with these independent (non-Bell) companies for calls originated or terminated on their networks. The process worked well in the then existing monopoly environment.

Prior to the divestiture of the Bell Operating Companies in 1984, local telephone companies assigned their non-traffic sensitive NTS local loop costs of connecting to the long distance network to the interstate jurisdiction based on a Subscriber Plant Factor (SPF) which, for rural subscribers, assigned additional costs to the interstate jurisdiction for recovery, thereby keeping the prices they paid for local service low. That is, for telephone companies serving high cost areas, this factor produced an assignment of costs to the interstate jurisdiction that was higher than the usage based allocation of cost for providing the interstate connection. In effect it allowed local service rates, the price the "end-user" customers paid for local telephone service, to be kept artificially low in high cost areas since they were subsidized by AT&T's long distance charges through the Division of Revenues process. In 1982, local companies were required to "freeze" their SPF at its 1981 level.

In January 1984, as a consequence of the Consent Decree that AT&T signed to resolve pending U.S. Department of Justice antitrust litigation, AT&T divested its holdings in the Bell Operating companies. As a result, the Division of Revenues process, which had been supported solely by AT&T, was replaced by a series of access charges that AT&T and any other long distance service provider would be required to pay local telephone companies to complete long distance calls over the local network. Recognizing the need for all providers of interstate service (e.g., the Interexchange Carriers ê IXCs) to share in the costs the local telephone companies incurred for providing the local connection, the Federal Communications Commission (FCC) established interstate access charges. The FCC also created the National Exchange Carrier Association, Inc. (NECA) shortly before the divestiture to develop the access charge tariffs for the local carriers and to administer a nationwide cost and revenue pooling mechanism. [Note: Until 1989, all Local Exchange Carriers (LECs) were required to participate in NECA's Common Line Pooling process (access charge and revenue distribution process for the local loop costs assigned to the interstate jurisdiction). All companies, regardless of cost, charged an identical rate - the Carrier Common Line (CCL) rate - to recover the costs assigned to interstate Common Line.]

In 1985, the FCC simplified the process for allocating costs to the interstate jurisdiction by mandating that local companies begin to transition (over an eight-year period) their assignment of non-traffic sensitive costs for providing the local loop to the interstate jurisdiction from the level determined using the "frozen" SPF to a flat twenty-five percent of total NTS costs. While the change to such a Gross Allocator greatly simplified the cost allocation process, it also removed a mechanism that had kept rural carriers' costs affordable. The impact of this change was estimated to shift over $1 Billion in costs from the interstate to state jurisdictions for recovery.

Recognizing this interdependency on the cost allocation process and the need to continue to fulfill the universal service policy objective of the Communications Act of 1934, the FCC created the (federal) Universal Service Fund (USF), designed to supplement the new cost allocation mechanism. As mentioned previously, the change in jurisdictional assignment resulted in a reduction in the allocation of costs to the interstate jurisdiction for most high cost local companies. Without some "special treatment", customers of such companies would have experienced significant increases in their intrastate costs and corresponding local rates. The federal USF permitted local carriers whose actual average cost to provide a telephone line to a customer's premises exceeded the national average cost of all carriers to provide such a line by more than fifteen percent to assign an additional portion of that cost to the interstate jurisdiction for recovery, thereby reducing the costs left to be recovered from local subscribers. This mechanism began its phase-in to full funding in 1986, paralleling the transition of the Subscriber Plant Factor to the 25% gross allocator. The funding required by the new Universal Service program was included in the rates developed by NECA and assessed to each of the long distance service providers as part of their Common Line access charges.

In 1987 as part of an industry agreement to modify the access charge plan, the FCC adopted modifications to the access charge pooling process as well as proposed changes to the Universal Service Fund. As a result of the changes to the USF, rural carriers whose costs exceeded the 115% threshold would be permitted to assign a higher percentage of those costs, while the larger carriers (i.e., those having more than 200,000 customers) would not be permitted to assign as much cost to interstate as had previously been permitted. This change to the USF was predicated on the assumption that small companies have more need for assistance than larger LECs, which were believed to have greater flexibility in how they recovered above-average costs. In addition, the larger local exchange carriers would be permitted to leave the pooling process and file Common Line access charges tariffs based on their own costs rather than the cost of all local carriers nationwide. These changes became effective January 1, 1988 and April 1, 1989, respectively. To reduce disparities in CCL rates among LECs after companies were permitted to withdraw from the NECA pool, the FCC instituted the Long Term Support (LTS) program to provide additional support to high-cost local companies, who remained in the NECA pool, to enable them to continue to charge IXCs only a nationwide average CCL access rate, thereby helping to ensure the continuation of nationwide average pricing for interstate toll charges. When originally established, LTS was entirely funded by those larger LECs who elected to exit the pool.

While the local carriers all benefited from these changes, they necessitated revisions to the methodology for determining who would contribute to the federal Universal Service Fund and how much they would be assessed. Instead of the USF funding being included in the Carrier Common Line charges assessed by all local telephone companies, separate access charges to recover these costs were developed by NECA and billed to all long distance carriers having more than five one-hundredths of one percent of the nation's customers pre-subscribed to their long distance service. In addition to the USF high cost fund, this recovery mechanism also supported the federal programs to assist low income consumers in obtaining and maintaining telephone service. The new funding mechanism was instituted on April 1, 1989.

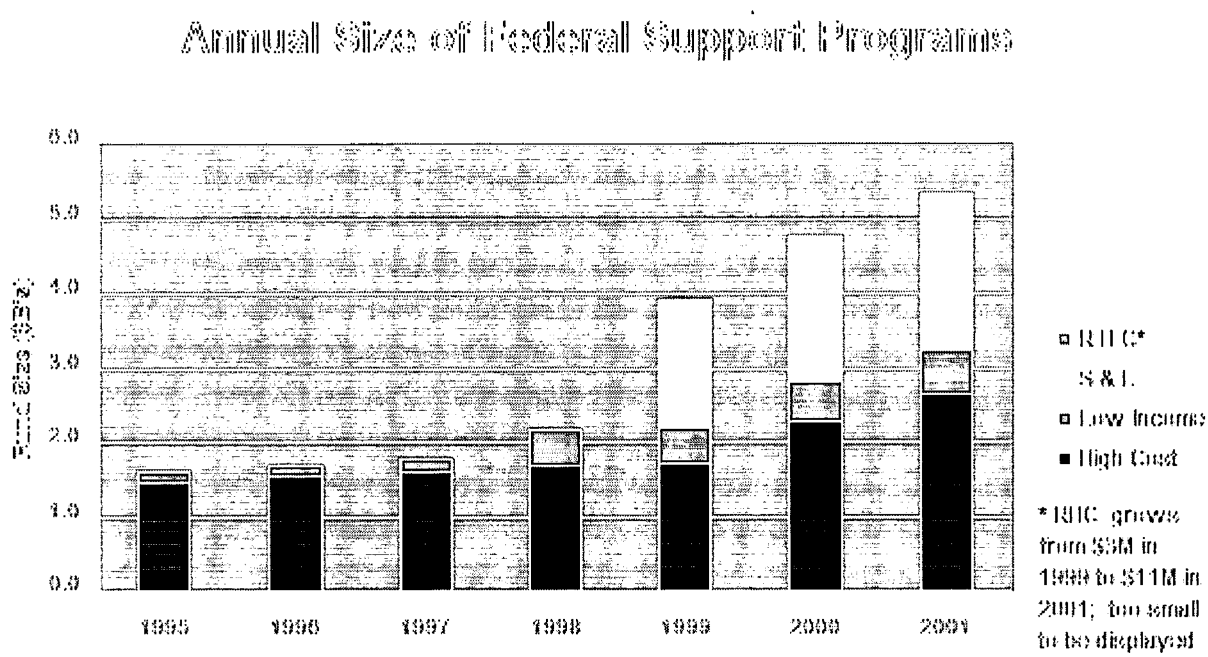
The Telecommunications Act of 1996 (TA-96) expanded the scope of universal service and stimulated the provision of nationwide access to advance telecommunications and information services. When Congress passed this Act, it directed that the FCC "...base policies for the preservation and advancement of universal service" consistent with a set of Universal Service principles, set forth in the Act, which are to promote the availability of quality services at just, reasonable, and affordable rates; provide access to advanced telecommunications services throughout the Nation; ensure the availability of such services to all consumers, including those in low income, rural, insular, and high cost areas at rates that are reasonably comparable to those charged in urban areas. In addition, the 1996 Act requires that all providers of telecommunications services contribute to federal universal service in some equitable and nondiscriminatory manner; there should be specific, predictable, and sufficient Federal and State mechanisms to preserve and advance universal service; all schools, classrooms, health care providers, and libraries should, generally, have access to advanced telecommunications services; and finally, that the Federal-State Joint Board and the FCC should determine any other principles that, consistent with the 1996 Act, are necessary to protect the public interest.

1.1 Federal Universal Service Support Mechanisms - post-1996 Telecommunications Act

To help promote telecommunications service nationwide, the FCC, as directed by Congress in the 1996 Act, expanded the Federal Universal Service Fund (USF). The four main programs of the Federal Universal Service Fund, to be explained in the following sections, are:

1. Low Income
2. High Cost
3. Schools and Libraries
4. Rural Health Care

The sizes of each of these programs from 1995 through the current year are illustrated on the chart shown below. As elaborated upon in program descriptions that follow this chart, the Schools and Libraries and Rural Health Care programs were only funded beginning in 1998 with disbursements effectively beginning in 1999.



1.1.1 Low-Income: Using Federal Universal Service funds, the telephone company provides discounts on telephone installation and monthly telephone service to qualifying low-income consumers for whom the cost of activating and maintaining such service may be prohibitively expensive. The Lifeline and LinkUp programs (summarized below) are available in every state, territory, and commonwealth. In order for a local telephone company to be designated as an Eligible Telecommunications Carrier (ETC), a prerequisite for it to qualify for support from the federal USF, it must make Lifeline service available to its customers. Qualifications for participation in the Low-Income programs vary by state. States having their own Lifeline program have their own criteria. In states that rely solely on the Federal Low-Income program, the named subscriber must participate in one of the following programs: Medicaid, food stamps, Social Security Income (SSI), federal public housing assistance, or Low-Income Home Energy Assistance Program (LIHEAP). Total Federal Universal funds dedicated to the Low Income program is projected to be approximately $570 million in 2001. The following provides additional information regarding the program's benefits and operation:

Benefits available under the Low-Income program:

- LinkUp America helps qualified low-income consumers pay the initial costs for commencing service by offsetting one-half of the initial hook-up fee, up to $30.00. The program also encourages local telephone companies to offer low-income telephone subscribers a deferred payment schedule for these charges.
- The Lifeline Assistance Program provides discounts on monthly service for qualified telephone subscribers. These amounts range from $5.25 to $8.50 per month, depending upon the applicable state provisions.
- Residents of Native American Indian and Alaska Native tribal communities may qualify for enhanced Lifeline support (up to an additional $25.00 in support beyond the levels indicated above) and expanded LinkUp support (up to $70.00 in additional support beyond the levels indicated above).

1.1.2 High-Cost: This program provides financial support to Eligible Telecommunications Carriers (ETCs) that provide basic "core" telephone service to customers in areas of the country that are relatively more costly to serve. The high-cost support mechanisms enable areas with higher costs to recover some of these costs from the Universal Service Fund, leaving a smaller remainder of these costs to be recovered through a combination of end-user rates and supplemental support from state universal service programs. There are currently four components to the federal high-cost support mechanism: (1) High Cost Loop (HCL) support (the primary high-cost support mechanism), (2) Long Term Support (LTS), (3) Local Switching Support (LSS), and (4) Interstate Access Support.

- The High Cost Loop (HCL) fund is the largest of the high-cost support mechanisms (projected at $1.18 billion for 2001) since it deals with the non-traffic sensitive (NTS) loop costs, alluded to earlier, that often represent more than one-half of a local telephone company's investment. HCL is divided between support for the rural ETCs, serving the more costly rural areas of the country, and the non-rural ETCs. In each case the companies must first calculate their cost per line, using an approved methodology - non-rural companies must utilize a designated "forward-looking" cost model. The costs so developed are then used to determine individual statewide and national average costs that are then used to establish "benchmarks" - e.g., threshold levels. Only companies whose costs per line exceed the appropriate benchmark qualify for support from the fund.
- Long-Term Support (LTS) is related to interstate non-traffic sensitive costs and, as mentioned earlier, provides support to ETCs that participate in the National Exchange Carrier Association, Inc. Common Line Pool, allowing them to charge interexchange carriers (IXCs) a uniform nationwide average CCL access rate, thereby fostering the continuation of nationwide average pricing. In effect, LTS helps ensure that IXCs do not need to pay higher CCL rates for reaching high-cost rural locations and alleviates the pressures on IXCs to charge higher rates for calls to or from those locations, or, by the same reasoning, to charge lower rates for calls to or from low-cost areas. LTS is estimated to be approximately $487 million in 2001.
- Local Switching Support (LSS) is available to Local Exchange Carriers (LECs) with 50,000 or fewer access lines to offsets the high fixed costs in traffic-sensitive switching when there are relatively few telephone lines over which to spread those high costs. It recognizes that switching costs in small central offices are relatively higher than those in larger offices. LSS will be about $391 million for 2001.
- Interstate Access Support (IAS) is a new (May 2000) mechanism that provides explicit support for price cap carriers (or competitive carriers serving in the service area of a price cap carrier) to ensure reasonably affordable interstate rates. It replaces implicit support previously collected through interstate access charges. Currently, support is fixed at an aggregate annual amount of $650 million.

Projected Federal support for the entire High Cost program for 2001 is estimated at $2.6 to $2.7 billion.

1.1.3 Schools and Libraries: This program, also called "E-Rate," makes technology such as phone service and the Internet affordable for schools and libraries in America. In 1996 Congress mandated that the FCC implement a support mechanism to provide support to carriers that serve eligible schools and libraries. This program, which was incorporated into the FCC's Federal Universal Service Fund, helps ensure that the nation's classrooms and libraries receive access to the vast array of educational resources that are accessible through the telecommunications network.

Benefits available under the Schools and Libraries (S&L) program:

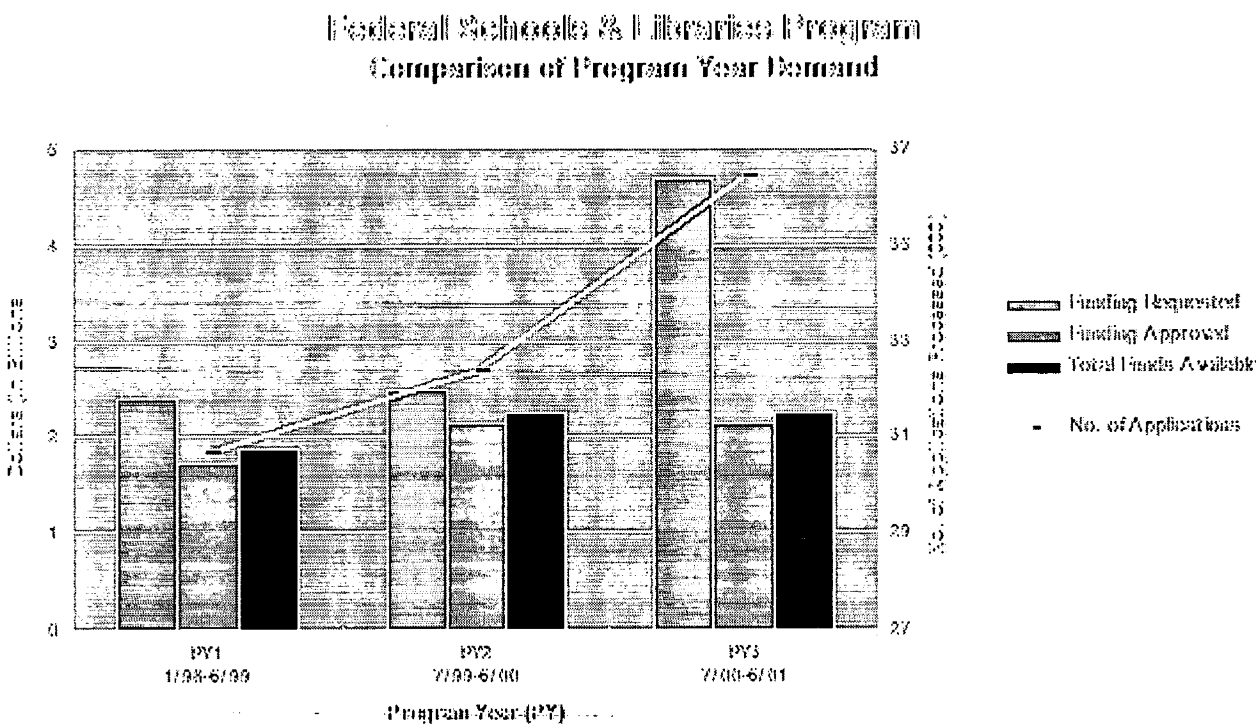
- Eligible schools and libraries receive discounts on telephone service, Internet access, and internal connections (i.e., network wiring) within school and library buildings.
- The discounts range from 20% to 90%, depending on the household income level of students in the community and whether or not the school or library is located in an urban or rural area.

Operation of the Schools and Libraries program:

- Schools and libraries must develop an approved technology plan that demonstrates the relationship between the information technology to be supported and the curriculum or library objectives. A school or library applying for support first solicits bids from vendors for the services it desires. After identifying an appropriate vendor and following review and approval of its application by the S&L fund administrator, the applicant receives a funding commitment from the S&L program. If the demand for support exceeds available funds, then these funds are allocated first to the schools and libraries in those communities requiring the most support (e.g., where the discounts are largest).
- Using Federal Universal Service funds, vendors are reimbursed for the approved discounts they provide on the services they furnish to schools or libraries.

Largely as a result of the FCC's Schools and Libraries program, more than 98 percent of public schools had been connected to the Internet by the end of 2000, up from 65 percent in 1996, just prior to the Telecommunications Act of 1996.

A graphical illustration of this program's success is shown in the following chart. During the first three years of the S&L program, the number of applications for support from schools and libraries has increased by nearly 19% while requested funding has escalated by more that 95%. The "blue bar" represents the total annual funds of $1.925 billion for year one and $2.25 billion thereafter, as stipulated by Congress for this program.



1.1.4 Rural Health Care: The Rural Health Care (RHC) program ensures that health care providers serving rural communities pay no more than their urban counterparts for telecommunications services necessary for the provision of health care. It helps link health care providers located in rural areas to urban medical centers so that patients living in rural America will have access to the same advanced diagnostic and other medical services that are enjoyed in urban communities. The RHC program is also part of the Federal Universal Service Fund and is funded in the same way as the S&L program. Current estimates are that about $11 million of support will be made available in 2001 for the RHC program.

Benefits available under the Rural Health Care program:

- Eligible rural health care providers can receive support for any telecommunications service; they receive discounts or reimbursements for monthly telecommunications charges, installation charges, and long distance Internet connection charges.
- Rural health care providers are using funds from this program for a variety of patient services, such as transmitting x-rays from remote areas to be read by health care professionals and experts in urban areas.
- Eligible entities include:
  - Post-secondary educational institutions offering health care instruction, teaching hospitals, and medical schools;
  - Community health centers or health centers providing health care to migrant workers;
  - Local health departments or agencies, not-for-profit hospitals; and
  - Rural health clinics.

The operation of the Rural Health Care program:

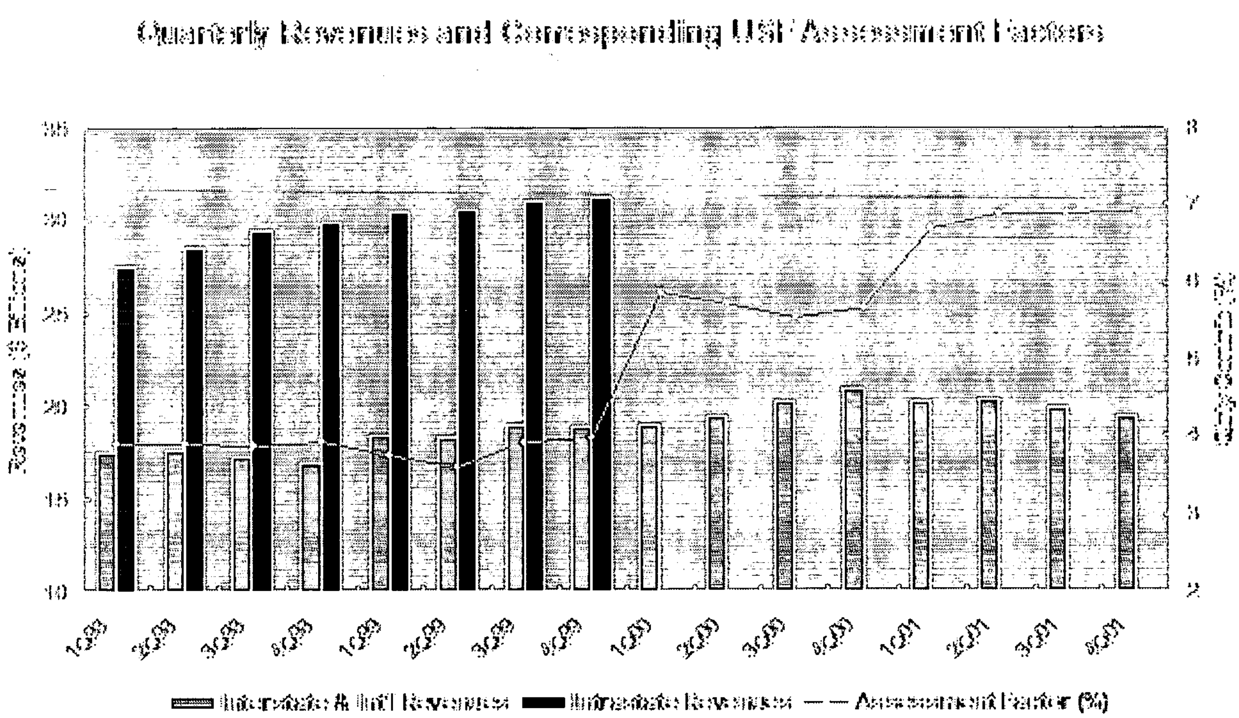
A rural health care provider submits a request for services to the program administrator who posts the request on its Web site, seeking carriers to provide the required services.

- Using Universal Service funds, the selected carrier is reimbursed for the discounts it provides for the services furnished to the health care provider.

1.2 Funding for the Federal Universal Service Fund

All telecommunications carriers that provide service between states and internationally pay contributions into the FCC's Federal USF, to support all four of the programs outlined above - Low-Income, High-Cost, Schools and Libraries, and Rural Health Care. The fund administrator makes payments from the fund to support each Universal Service program.

The chart shown below shows the quarterly assessment rate (factor) applicable to telecommunications service providers revenues from 1998 through what is projected for 2001. The significant increase in the factor that began in the first quarter of 2000 is attributable to the fact that intrastate revenues were precluded from being assessed as a basis for contributions to the federal universal service fund as of January 2000.



The Interstate Telecommunications Relay Service (TRS) fund is another example of a federal support mechanism that facilitates communications with hearing or speech impaired individuals via the transcription from Text Telephones (TTY) to voice or voice to text. More than 4,500 providers of interstate telecommunications service contribute nearly $60 million annually to this fund to pay the cost of operating the relay center.

2. Evolution of State Universal Service Support Mechanisms

As mentioned, the 1996 Telecommunications Act indicated that the provision of universal service was a joint federal and state responsibility and it directed the FCC and the states to establish the appropriate support mechanisms. Subsequently, numerous individual states have heeded the call to promote universal service in order to supplement the benefits provided by the federal programs discussed in the preceding sections. Many states established intrastate universal service programs spurred, in part, by projected reduced levels of federal support, the need to rebalance/restructure intrastate rates to foster competition and for other reasons that will be described in the section entitled "Why State Universal Service Funds ê

'Drivers'".

The 1996 Telecommunications Act provided that "only an Eligible Telecommunications Carrier (ETC) ... would be eligible to receive Federal universal service support" and set forth certain obligations that a service provider had to satisfy in order to be designated by a state commission as an ETC. Among these obligations was the requirement that this entity had to provide a package of "core" or "designated" services that, at a minimum, included each of the following : (a) single-party service; (b) voice grade access to the public switched network providing the ability to place and receive calls; (c) Dual Tone Multifrequency (DTMF) signaling or its functional equivalent; (d) access to emergency services, e.g. Emergency 911; (e) access to operator services and directory assistance; (f) access to interexchange services, and (g) toll limitation services for qualifying low-income consumers. The FCC noted that this package of services would evolve over time. To be designated as an ETC, a carrier must offer these services either using its own facilities or a combination of its own facilities and resale of another carrier's services, must advertise the availability of these services and their corresponding prices, and, as aforementioned, must make Lifeline support accessible to its customers.

The role of states to ensure universal service continues to evolve. At the outset, it is important to note that the creation of distinct state universal service funds has never been mandated either by Federal legislation or FCC orders. As pointed out above, states designate Eligible Telecommunications Carriers entitled to receive Federal universal service support as well as support from that state's own USF, if one has been established. Furthermore, states are responsible for: (a) designating the service areas to be served by non-rural carriers and doing so in a "pro-competitive" manner - e.g., not designating service areas that are so large as to discourage competitive entry by effectively creating an entry barrier; (b) monitoring rates and non-rate factors to ensure the affordability of telecommunications services (e.g., tracking cost of living factors, subscribership levels, etc.); (c) ensuring reasonable comparability of rates for service within the state - the Federal-State Joint Board on Universal Service indicated that the state role is to "supplement, as desired, any amount of federal funds it may receive," and to "address issues regarding implicit intrastate support in a manner appropriate to local conditions," and (d) evaluating and establishing alternative funding mechanisms to support universal service.

2.1 Why State Universal Service Funds ê "Drivers"

A myriad of factors have influenced states to establish their own distinct universal service funds. Changes in federal or state laws and regulations - especially any that reduce previous levels of funding for support mechanisms - are primary stimuli. For example, the enactment of TA-96 and subsequent FCC Orders that affected the amount of support to both non-rural and rural telecommunications service providers motivated a number of state legislatures and regulatory agencies to enact legislation and corresponding regulations to establish state universal service programs. Similarly, some states have instituted "revenue recovery" mechanisms, giving carriers the ability to seek reimbursement, in whole or part, for rate reductions mandated by federal and/or state regulatory agencies. In Arkansas, for instance, incumbent local exchange carriers can request support from the state USF for lost revenues resulting from decreased federal USF funding and/or federal or state-mandated rate reductions. Relatedly, changes in jurisdictional support levels - whether actual or merely anticipated by the industry - also acted as catalysts to consider setting up state support mechanisms. For example, an FCC Order that indicated that the Federal USF might only cover 25% of states' requirements for high cost support generated concerns regarding how the remaining 75% would be recovered from other mechanisms, including state USFs.

Another significant driver that was an incentive for states to establish their own USFs was the emphasis that both the FCC and state Public Utility and Public Service Commissions placed on stimulating competition and moving the telecom industry away from a monopolistic environment. To this point, the FCC stated that "...the development of competition may place pressure on implicit support mechanisms at the state level ... states that use above-cost pricing in urban areas to subsidize below-cost service in rural areas may face pressure to deaverage rates as competitors begin to offer cost-based rates to urban customers." As briefly outlined in the section "Evolution of Federal Universal Service Support Mechanisms", in a monopolistic environment universal service was supported by implicit subsidies; large carriers who served entire regions/markets could support universal service programs through their own rates. Rate designs that provided implicit high-cost support flowed from (1) urban to rural areas; (2) business customers to residential customers; (3) vertical services to basic service, and (4) long distance to local service. Although the Act did not require states to identify implicit subsidies in intrastate rates, the FCC said "we do not believe it would be equitable to expect the federal mechanism - and thus ratepayers nationwide - to provide support to replace implicit state support that has been eroded by competition if the state possesses the resources to replace that support through other means." In a manner analogous to what occurred in the federal jurisdiction, this effectively necessitated the identification of implicit subsidies in state rate designs and their conversion to explicit subsidies, further acting as an impetus to create USFs in various states. Some states, under "revenue recovery" provisions of their state USF rules, permit carriers to recover implicit subsidies previously included in, say, access charges, from state support programs. Under "rate rebalancing" provisions, some states allow carriers to seek reimbursement for mandated rate reductions. In addition, states also establish programs to reimburse agencies for their costs of implementing and administering programs to provide telecommunications services and/or special equipment to physically-challenged individuals.

2.2 Funding State Universal Service Funds ê Who Contributes?

Generally, all telecommunications service providers offering service in a particular state are required to contribute to the fund by paying assessments, often on a monthly basis, to the fund administrator. Service providers usually required to make payments into a fund include: Incumbent Local Exchange Carriers (ILECs); Competitive Local Exchange Carriers (CLECs); Interexchange Carriers (IXCs); resellers; payphone operators; wireless service providers; providers of Commercial Mobile Radio Service (CMRS); operator service providers and competitive access providers. The Public Utility Commission of Texas also requires hotels and motels to pay assessments based on the surcharges they add to customers' bills for use of in-room phones.

State USFs are typically funded by a percentage assessment on each contributor's intrastate retail revenues. Retail revenues exclude all wholesale transactions (to avoid double assessments) and are typically calculated as the billed revenue from end-user retail and business customers. Some states assess carriers' total revenues, including interstate and international revenues as well as intrastate revenues. Assessable revenues generally include the following: local and intrastate long distance toll charges, toll free (e.g., "800," "877," "888" calls) service charges, fees for enhanced services (e.g., call waiting, 3-way calling, caller ID, etc.) and charges for operator services, including directory assistance. Additionally, voice mail service charges, pay phone and pre-paid calling card charges, and charges for wireless and paging services, including airtime, roaming, connection and enhanced service charges are also typically assessable for purposes of calculating payments into state USFs. Revenues derived from non-regulated services e.g., yellow page advertising, Internet Service Provision (ISP), etc. are typically excluded from assessment.

The assessment rate is usually calculated annually by the state fund administrator or regulatory agency staff by forecasting the funding requirements for each of the programs supported by the state fund (see following section, entitled "State Universal Service Funds ê Programs Supported"), adding an allowance for contingencies (i.e., uncollectibles, changes in the number of eligible contributors/recipients, etc.) and costs for administration and then dividing this amount by the total annual base of assessable revenues. The assessment rate can be revised during a year to reflect revisions made necessary due to unforeseen circumstances. As implied by this methodology, the same assessment rate is typically applied to the revenues of each contributor; however, some states calculate different assessment factors for each contributor. As mentioned earlier, assessments are usually collected monthly, although small contributors may choose to pay quarterly, semi-annually or even annually. Most state funds also establish a "diminimus" annual threshold; telecom service providers whose annual payments are below this amount are exempted from contributing to the fund.

2.3 State Universal Service Funds ê Programs Supported

The following is a list of programs most frequently supported by state universal service funds. Only brief "bulleted" descriptions are provided, as appropriate, since many are analogous to programs detailed earlier with respect to the federal USF.

- High Cost Support
  - Provides support to ensure rates are reasonably comparable between rural and non-rural areas
  - Support is typically provided for lines that exceed a designated threshold for cost or revenue
  - Some states set a revenue benchmark based on the statewide average rate per line,
  - Others use a cost model, following the FCC's approach, to determine a statewide average cost per line
- Revenue Recovery/Rate Rebalancing
  - Revenue Recovery
    - Replacement of revenues lost as a result of decreased federal universal service support
    - Recovery of implicit subsidies previously in intrastate rates
  - Rate Rebalancing
    - Reimbursement for rate reductions mandated by regulatory agency
- Low Income Support Mechanisms
  - Lifeline Program
  - Link-up Program
- Emergency 911 Service
  - Offset costs to establish and operate emergency access and dispatch services
- State Telecommunications Relay Service
- Special Telecommunications Equipment for Physically-challenged Individuals
  - Provide funding for discounts or vouchers to purchase equipment
  - Braille phone
  - Terminals/consoles (TTY)
  - Amplified telephones, artificial larynx, etc.
- State Support for Schools, Libraries & Health Care Facilities
  - Supplements federal USF programs
  - Some states provide funds for government offices to obtain advanced telecommunications services

As depicted on the following map, there are currently 26 states that have implemented or enacted legislation to form their own state universal service funds. Total annual support from these funds is about $1.9 billion, compared to $5.3 billion from the federal USF. Other states may support some of the programs described above, but do not have a centrally-administered mechanism to collect funds from the state's telecom service providers and disburse them to qualified recipients of the support programs. Some of these states do so using implicit subsidies in existing rate plans.

Of the states that have established state universal service programs, the following table shows the percentage that have included each of the programs outlined above.

Programs	**No. of States***	**Percent of States with USFs**
High Cost Support	16	62%
Lifeline & Link-Up	12	46%
E-911 (Access to Emergency Services)	3	12%
Revenue Recovery - Rate Rebalancing	8	31%
TRS & Specialized Equipment, Access for Physically-challenged	10	38%

Schools, Libraries, Rural Healthcare & Government	5	19%

* Out of the 26 states/territories with operating Universal service Funds

2.4 State Fund Administration and Management

Universal Service Fund Administration requires expertise in several key disciplines including: telecommunications issues and policy; forecasting; calculation of annual assessment rates; cash and investment management; billing and collection; procedures and information systems design; funds distribution; fund sizing; regulatory support; customer interface and communications; accounting, as well as internal and external auditing. The National Exchange Carrier Association, Inc. (NECA) is a private not-for-profit corporation created in 1983 by order of the FCC to administer the nationwide access charge and revenue distribution plan. As a result of the synergies between that role and the functions necessary to effectively manage universal service funds, NECA has become the recognized leader in the administration and support of both federal and state universal service support mechanisms, having gained unparalleled expertise and experience by successfully designing, implementing and administering numerous telecommunications universal service programs in various jurisdictions. Since 1994 it has put into operation and/or administered state USFs in Vermont, Kansas, Arizona, Wyoming, Arkansas, Oklahoma, Texas, Nebraska, Nevada, Pennsylvania and, most recently, in Puerto Rico. At the federal level, NECA or one of its subsidiaries, also administers the Interstate Telecommunications Relay Service (TRS) fund, the federal telecom universal service support mechanisms for high-cost areas and low-income consumers, as well as the federal Schools and Libraries and High-Cost/Low-Income programs. As a result, it is qualified to detail the duties of an impartial, third-party fund administrator. These can be separated into two categories - "Development Activities Related to Fund Planning & Start-up" and "Ongoing Administrative Activities."

2.4.1 Development Activities Related to Fund Planning & Start-up

Development includes specific activities such as: providing advice on fund sizing; helping identify fund contributors and recipients; reviewing and calculating initial assessment level(s); implementing procedures and databases for collecting, managing, and disbursing funds; and construction of general accounting, reporting and enforcement controls. Operational and administrative methods and procedures are developed that include:

1. Drafting payer remittance worksheets and support request forms, establishing procedures to collect monies from contributors and make corresponding statutory or regulatory agency approved support payments from the USF to authorized recipients,
2. Reviewing/adopting regulator-developed assessment methodologies; contacting telecommunications providers to advise them of their payment obligations, including how to report and remit payments to the administrator,
3. Establishing accounting and treasury procedures to ensure prompt, secure investment of fund balances and to enable disbursements to recipients in a manner satisfying statutory requirements.

Included in this phase is the design of all software necessary to manage funds received, generate payments and produce required tracking reports.

2.4.2 On-going Administrative Activities

On-going activities include interfacing and consulting with the regulatory agency and fund participants, annual assessment rate calculations, billing and collection of assessments, interfacing with the financial institution, reviewing contributor (payer) reports, distributing appropriate fund disbursements, monitoring fund performance/balances, preparing required reports, and cooperating with the independent auditor who is generally chosen by the regulatory agency. Specific administrative functions include:

A. Collection and Disbursement

1. Providing obligated telecommunications carriers with remittance forms to allow them to self-report and certify revenues and calculate their assessment due; reviewing carrier forms to ensure completeness as well as accuracy of calculations and contacting contributors whose accounts contain unexplained variances in reported revenues or USF assessments,
2. Sending initial Notices of Delinquency to all delinquent payers; instituting appropriate procedures to issue follow-up notices to payer(s) and pursue collection of USF payments due, and maintaining logs of notices and all other correspondence related to delinquencies,
3. Developing a support request form to facilitate (monthly) processing of funding requests; ensuring that the requestor is a qualified USF recipient and reviewing submitted forms for accuracy, and distributing funds to eligible recipients, as designated by the appropriate statute or regulatory agency,
4. Preparing comprehensive statements of fund activity, balances and performance on a monthly, annual and/or other basis, as required by the regulatory agency.

B. Investment

1. Investing undistributed fund monies in secure short-term instruments designed to minimize risk while providing maximum liquidity. Net investment earnings can be used to offset fund obligations, reduce future fund requirements, or as otherwise determined by the government or regulatory agency.

C. Customer Relations

1. Establishing frequent, effective communication between the administrator and the regulatory agency as well as the entities contributing to and receiving distributions from the fund; providing prompt, professional telephone "customer service" responses to inquiries,

2.5 Considerations Related to Establishing & Managing Universal Service Funds - "Lessons Learned"

As a result of being at the forefront of universal service policy and the administration of the corresponding programs for more than fifteen years, NECA has become knowledgeable about what has worked well in establishing and USFs as well as what could have been improved upon. The following "Lessons Learned" are a compilation of advice that is included herein to assist agencies considering how best to implement and manage public benefit programs:

Broad participation by industry constituents during the fund establishment and rulemaking stage reduces resistance and confusion during the implementation and on-going operational phases.

Combining all fund-supported programs (e.g. high cost, low income, E-911, TRS, etc.) into a single collection mechanism simplifies and consolidates processes and creates overall cost efficiencies.

Defining fund assessment based on a percent of retail revenues avoids double assessments by exempting wholesale transactions and ensures that contributions are collected cost-effectively in a predictable, sustainable and competitively-neutral manner. Further, precisely defining assessable and/or exempt revenue categories (e.g., payphone, wireless, 'vertical services,' etc.) clarifies requirements for participants and reduces confusion.

Payments (i.e., contributions) into the Fund should be the responsibility of carriers, not end-users. This creates an efficient transaction process of billing and collection between the administrator and the participating service providers without the need for the massive administrative requirements and costs for interfacing with each individual customer.

A monthly collection process (with options for quarterly or annual prepayment) offers administrative simplicity and consistency with the monthly billing processes employed by most service providers.

Establishing a de minimus threshold exempts small contributors from the assessment, or permitting them to less frequent payments (not monthly) into the fund, reduces the administrative burden on all parties without jeopardizing the viability of the fund.

A payment-after-collection methodology is accepted by contributors as a reasonable, conservative approach to fund management and reduces cash flow fluctuations while decreasing the possibility of funding shortfalls.

A "contingency factor" should be incorporated into at least the initial funding requirements to minimize potential cash flow fluctuations, cover initial delinquencies, and account for revenue seasonality during fund start-up.

The regulatory agency and the administrator should jointly develop a Payment Prioritization Plan to provide the administrator specific guidelines for prioritizing or pro-rating payments in the event of a fund shortfall (e.g., fund requirements are forecasted to exceed collections during a period).

Support payments disbursed from the fund should be based on explicit criteria established and approved by the regulatory agency or appropriate governing statutes.

Universal Service Funds are "self-sustaining" - e.g., they are funded by assessments from service providers in accordance with criteria approved by regulatory agencies - therefore, appropriations to "fund the Fund" or a statutory-mandated cap on Fund size are not required.

Documentation clearly delineating the roles of the state regulatory agency staff and the fund administrator streamlines processes and reduces or avoids overlaps.

Endnotes

1. Local loop costs refer to the costs of outside telephone wires, poles and other facilities that link each customer's premises to the public switched network. NTS costs - costs that do not vary with the amount of traffic - are allocated between the state and interstate jurisdictions because all local loops can be used for making and receiving both intrastate and interstate calls.
2. Introduction of access charges also brought about Subscriber Line Charges (SLCs), flat monthly charges assessed on end-users by the LECs to recover interstate loop costs. To ensure SLCs would not place an unfair cost burden on low income individuals, the FCC introduced Low Income support programs (described later) to waive these charges and also reduce installation costs.
3. Low-income consumers living on tribal lands may participate in other programs in order to be eligible for Lifeline and LinkUp. They are: Bureau of Indian Affairs general assistance, Tribally-Administered Temporary Assistance for Needy Families,
4. Head Start (income-qualifying standard), or the National School Lunch Program.
5. For the purposes of this paper HCL support includes both high cost loop support for rural carriers (based on historical or embedded costs) and high cost support for non-rural carriers (based on forward-looking high-cost models).
6. Federal-State Joint Board on Universal Service, CC Docket No. 96-45, Report and Order, FCC 97-157, 12 FCC Rcd 8776 (rel. May 8, 1997).
7. Federal-State Joint Board on Universal Service, Ninth Report and Order and Eighteenth Order on Reconsideration, CC Docket No. 96-45, FCC 99-306 (rel. Nov. 2, 1999), pages 6 and 28.
8. Federal-State Joint Board on Universal Service, CC Docket No. 96-45, Report and Order, FCC 97-157, 12 FCC Rcd

8776 (rel. May 8, 1997), para. 268-272.

9. Federal-State Joint Board on Universal Service, Ninth Report and Order and Eighteenth Order on Reconsideration, CC Docket No. 96-45, FCC 99-306 (rel. Nov. 2, 1999), page 36, § 57.
10. Ibid.

back to index

Abstract

The origin of the term "universal service" can be traced to Theodore Vail, AT&T's first President, who used it in the company's 1907 Report; the company's slogan was "one system, one policy, universal service." The United States Congress codified the concept of Universal Service in the Telecommunications Act of 1934, that included the objective to "make available to all people of the United States a rapid, efficient, nationwide, and world-wide wire and radio communications service with adequate facilities at reasonable charges".

This paper traces the evolution of universal service mechanisms in the United States showing how the introduction of competition necessitated changes. It provides a current snapshot of their status in 2001 and shows how and why individual states have chosen to implement programs to supplement federal support mechanisms.

back to index

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Prior to joining NECA in 1998, Mr. Haas worked for thirty years at AT&T and Bell Laboratories in various assignments including engineering, service costs and rates, corporate planning, business research and public policy. The majority of Steve's career at AT&T concentrated upon Regulatory Relations. He led AT&T's nationwide teams that prepared contracts and tariffs for both the intrastate and federal (interstate) jurisdictions and was instrumental in devising strategies for offering customized integrated solutions to business customers under both custom offer tariffs and other contractual arrangements. In addition, Mr. Haas led AT&T's initial planning and implementation efforts for interstate detariffing of . business services

Mr. Haas has a Bachelors and Masters degree in electrical engineering and earned an MBA in the Executive MBA Program at Rutgers University. He also attended a foreign studies program at Cambridge University in the Great Britain.

http://www.neca.org/

back to index

Use of Satellite in Achieving Universal Service Objectives in Underserved and Remote Areas†

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View Abstract

1. Becoming Connected

Many individuals live in a connected age where access to people, information, and opportunities for interaction are rapidly becoming an everyday part of life. For these fortunate individuals the wide availability of wireless telephone networks, ubiquitous connections for telephone, fax, email, and even access at home to broadband technologies is simply a part of ordinary life. For them, the costs are affordable and the services of such high quality that traditional telephone services are losing ground - in many countries finding a public pay telephone has become a challenge due to the increasing penetration of mobile telephones and the shrinking demand for public telephone service. [1]

Much of the world's population, however, remains unconnected even to the global public switched telephone network. These people have never experienced the convenience of ready access to a telephone, let alone the remarkable ability of the global Internet to close vast distances by delivering messages around the world in seconds. One standard measure of the level of access is "teledensity," expressed as the number of main telephone lines per 100 inhabitants. In highly developed countries (e.g., France, Germany, the United States), the teledensity exceeds 50 but teledensity data reveals that in many countries very few telephones are available.

TABLE 1. MAIN TELEPHONE LINES PER 100 INHABITANTS [2] (Lowest to Highest, 1st January of each year) Note: Values in Italics are estimated or refer to year 1997, 1998 or 1999

	Country	1991	1997	1998	1999	2000
1	Dem. Rep. of the Congo	0.09	0.08	0.08	0.04	0.04
2	Chad	0.07	0.09	0.11	0.118	0.12

3	Afghanistan	0.22	0.14	0.14	0.135	0.14
4	Somalia	0.17	0.15	0.15	0.141	0.15
5	Rwanda	0.17	0.28	0.28	0.163	0.16
6	Niger	0.12	0.16	0.17	0.179	0.18
7	Liberia	0.36	0.16	0.16	0.221	0.24
8	Cambodia	0.06	0.08	0.12	0.226	0.25
9	Mali	0.13	0.19	0.2	0.25	0.25
10	Uganda	0.17	0.24	0.25	0.276	0.27
11	Central African Rep.	0.17	0.29	0.29	0.274	0.28
12	Burundi	0.15	0.25	0.25	0.286	0.29
13	Bangladesh	0.22	0.26	0.26	0.263	0.3
14	Ethiopia	0.26	0.25	0.26	0.275	0.32
15	Madagascar	0.25	0.26	0.27	0.288	0.32
16	Malawi	0.31	0.35	0.35	0.347	0.35
17	Nigeria	0.3	0.36	0.36	0.395	0.38
18	Sierra Leone	0.32	0.4	0.39	0.345	0.38
19	Tanzania	0.29	0.3	0.3	0.379	0.38
20	Mozambique	0.34	0.34	0.36	0.399	0.4

These sobering statistics do not even reflect the fact that the actual teledensity in rural or remote areas is far lower - the relatively high availability of telephone connections in cities tends to skew the country results upward.

For government authorities, the goal of providing a minimum level of affordable access to communication services to all remains elusive, particularly as state-run monopoly telecommunications providers are privatized or restructured into for-profit commercial enterprises. Building out traditional, wired terrestrial networks is often cost prohibitive - rugged terrain, remote locations, and low demand due to low population density leave many people disconnected from the connected world simply by accident of their geographic location. As a matter of economic efficiently, private, non-monopoly communications entities are not afforded economic incentives to offer such universal service absent a government requirement, or a means by which the high costs of providing service in high cost areas are subsidized by "universal service" funding.

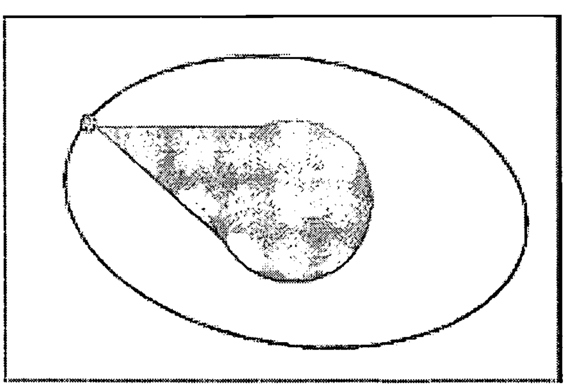
The problem of ensuring universal access is not limited to developing countries. While most striking when measured in terms of lack of access to basic telephone service, the issue exists for policymakers in highly developed countries. In developed countries, the challenge becomes how access to advanced communications services (e.g., high speed Internet connections) can be made available to underserved areas. The U.S. telecommunications regulator, the Federal Communications Commission (FCC), appears to be resigned to the obvious fact that market forces alone will not guarantee that rural Americans have access to these services. [3] Whereas 99.9% of consumers in the most densely populated U.S. ZIP codes currently have access to high-speed data service, only 58.6% of consumers in the least-populated ZIP codes appear to have a high-speed option. [4]

To address the lack of investment by telecommunications firms many governments have set up universal service funding mechanisms, whether by direct funding (e.g., by making subsidies available to carriers for serving some customers) or indirect means (e.g., by granting some form of monopoly to a carrier in exchange for an obligation to provide some measurable level of service to traditionally underserved areas).

In many cases, carriers have used communications satellite technology to meet their universal service obligations. Carriers can often deploy satellite-based solutions more quickly than terrestrial systems because satellites "have an inherent capacity to meet the needs of developing markets. In fact, in some markets, they may provide the only communications solution." [5]

2. Satellite Technology - Geostationary Communication Satellites

Communications satellites launched into the geostationary orbit (GSO) (i.e., the circular orbit in the plane of the equator at a distance from the center of the Earth of approximately 42,164 km where the period and direction of orbital rotation coincides with that of the Earth) [6] have been used for several decades for the transmission of voice, data, and video.[7] From the perspective of an Earth-based observer, these satellites appear to remain fixed in one place. [8] Because of their distance from the Earth, GSO satellites "see" about one third of the Earth's surface. [9]

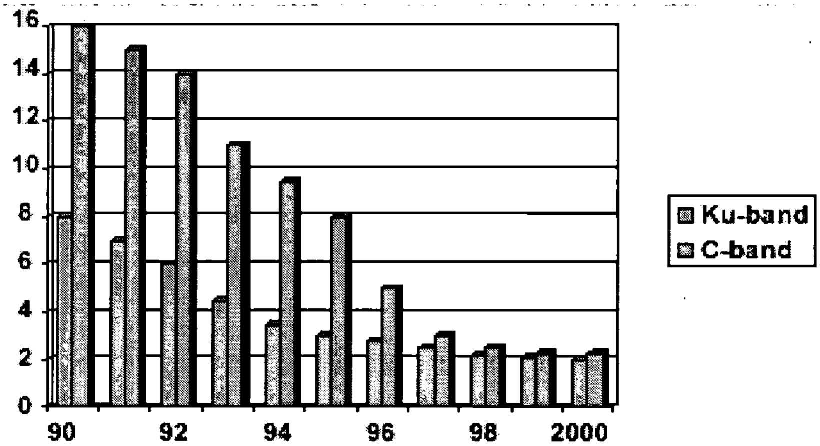


Source: CompassRose International

GSO satellites use on board radio repeaters to receive signals from an earth station and retransmit (downlink) the signal over a very large geographic area. Satellite technologies have gradually improved, and a single large GSO satellite can now provide communications coverage for an entire hemisphere. [10]

In order to establish a communications link with these satellites, operators install a small satellite terminal (VSAT) at the user site. According to the Global VSAT Forum, the leading satellite industry trade association, there are more than one million VSAT systems installed and operating in more than 120 countries throughout the world today. As a result, VSAT manufacturers and their customers benefit from economies of scale that enable cost effective use for a broad range of applications including Internet Protocol (IP)-based narrowband and broadband solutions that apply directly to universal access and sustainable development in regions such as North Africa, the Middle East, and Latin America as well as wide-area-network services that enhance connectivity in industrialized markets such as North America and Western Europe. The most immediate and tangible result of this growing market is lower VSAT pricing.

FIGURE 1: 1990-2000 VSAT TERMINAL PRICING TRENDS - US$000



(Source: COMSYS)

The characteristics of satellites make them well suited to achieving universal service policy goals. Government leaders from different regions have noted the special role of satellites; Nelson Mandela recently observed that "[f]or developing nations, [satellite service] may be the only answer to the challenge of connecting communities that are isolated by terrain or distance from urban telecommunications infrastructure." [11] Importantly, the range of services that satellites can provide includes high-speed, advanced services. The FCC has noted that satellite service "may provide consumers and small businesses in geographically remote and sparsely populated areas with access to high-speed services that would not otherwise be available." [12]

The cost of providing satellite connectivity remains an important consideration. While satellite services may sometimes be the only way to reach underserved communities, the FCC has observed their unique characteristics can lead to manageable costs. [13]

Satellite technology also represents a potentially cost-effective alternative in serving unserved communities, especially those in remote areas. For example, satellites may offer cost advantages over wireline access alternatives in rural and remote areas, where a limited population cannot provide the economies of scale to justify the deployment costs of a wireline network for each community. Satellites have large coverage areas, and in many cases, can reach an entire nation, thereby having the ability to spread the costs of deployment across a number of communities. Satellites also provide communications opportunities for communities isolated in geographically extreme areas, such as mountainous regions and deep valleys, where rugged and impassable terrain makes service via cellular and standard telephone lines impractical. Satellites can offer a variety of telecommunications services, from such basic, low bandwidth services including data messaging services and basic telephone service to more advanced, higher bandwidth services, including voice dispatch, video and high speed Internet access.[14]

In addition to lower VSAT costs, the increased use of IP-based VSAT networks can be attributed to the lower cost of satellite bandwidth due to the use of new, more efficient modulation and coding techniques. These technologies now permit satellite networks to carry more digital information than ever before using a given amount of satellite capacity. In addition, there is more satellite capacity available "on orbit" now than ever before. The increased supply and resulting competition between satellite operators has lowered the cost for satellite capacity.

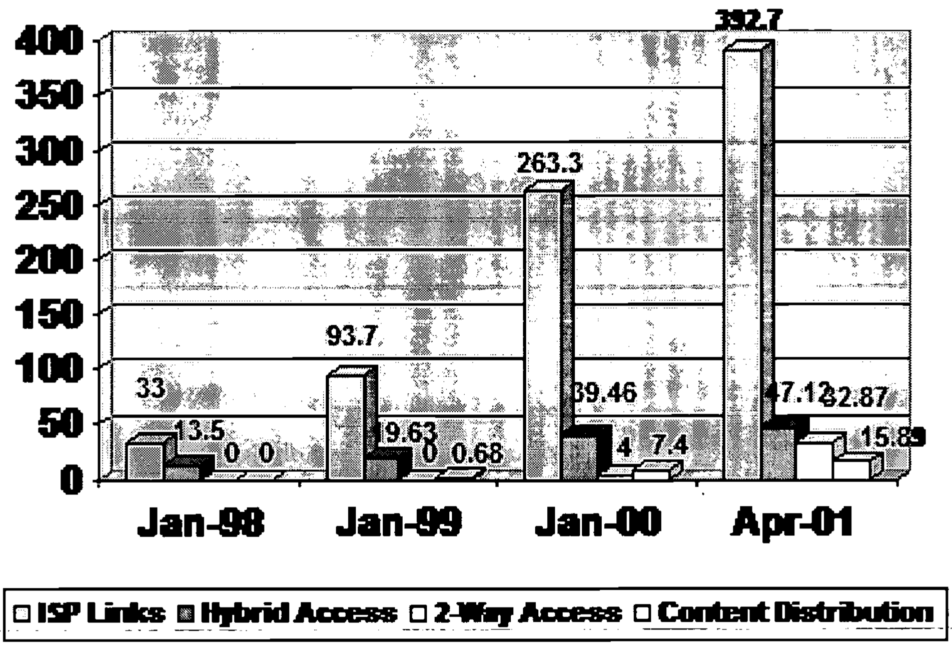
2.1 Effects of Convergence

The spread of digital technologies has resulted in an interesting phenomenon - applications such as video, voice, or data (including Internet and e-mail connectivity) can be combined into a single digital communications stream for transmission and reception. This allows a single satellite system to provide voice, Internet access, and video communications using a common interface. Furthermore, the wide adoption of packet based networks, such as those based on Internet Protocol, allows multiple users to share a single network access point while giving each the appearance of dedicated facilities. The implications for remote access and universal service are profound, particularly in remote communities.

Thus, a single VSAT access point can help to provide rural telephony, Internet access, distance learning, telemedicine[15], news distribution, government, and banking applications to many users in a remote community. Importantly, only those applications required need be configured - it is possible, for example, to install a VSAT access point to support some Internet and voice access and later to connect a wireless local loop distribution system (e.g., fixed wireless access) to extend the satellite Internet and voice connection to multiple telephone subscribers in the community. If a banking institution later wishes to establish a branch in the remote community, it is a simple matter to connect the branch into the access point and thereby to the bank's own internal network. Network operators can also configure the satellite access point to support a digital video channel for distance learning or telemedicine applications - all using Internet Protocol connections. This trend is evident in the increased demand for satellite capacity for Internet use.

FIGURE 2: 1998-2001 GLOBAL VOLUME OF SATELLITE INTERNET USE RISES, 36-MHZ UNITS

(SOURCE: DTT CONSULTING)



3. Peru's Universal Access Initiative

Satellite-based solutions are playing an important role in the delivery of services to underserved areas in Peru. [16] FITEL (Telecommunications Investment Fund) is a fund destined to the provision of universal access, which was created based on the need to secure financing for the provision of telecommunications services in rural areas identified to be of preferential social interest where services would not generally be provided by the private sector due to their high cost and low profitability. FITEL is a division of OSIPTEL, the Supervisory Organism of Private Investment in Telecommunications, a public decentralized agency created in July of 1993 to regulate and supervise the development of the telecommunications market. There are three stages to FITEL's strategy for the development of rural telecommunications.

The objective of the first stage was to offer basic access to telecommunications services. This was achieved through the completion of a pilot project (completed in December 1999), in which Gilat-to-Home Perú was awarded the bid to install a public telephone in 193 towns, and through the completion of a Rural Project Program (PPR), parts of which are still being implemented according to the timelines established in their respective contracts. The PPR consisted of six projects designed around a set of technical and economic criteria complimented with regional integration factors and socioeconomic interaction between the departments that comprised each of the six projects. The objective was to install at least one public telephone in 5,000 rural areas that did not have any service. These public telephones needed to be capable of providing voice, faxes and low speed data and to complete emergency calls at no charge. Internet access was a complimentary objective. The main factors taken into consideration in elaborating the PPR project were the following:

- Socio-economic and geographical integration of the areas in each project.
- Economic homogeneity - joining economically different areas to achieve a compact and attractive area for investment.
- Current division scheme of Peru's National Telecommunications Plan.
- Cultural and historical relationships between the regions and departments.
- Existing regional communication - highways and access routes.

In the second stage of the development strategy, emphasis is being placed on increasing the teledensity of access to Public Telephones in provinces and towns with insufficient services (approximately 1,500 towns that have between 1,000 and 5,000 inhabitants) and by increasing access to Internet through Telecenters in all of the capital cities of the country's rural districts.

In December 2001, OSIPTEL through FITEL, granted winning bids to Consultoría y Gestion de Telecomunicaciones for the Central North zone and to Gilat to Home [17] to the five remaining zones (East Central zone, South Central zone, North zone, North Jungle zone and South zone). The purpose of this project is to increase the public telephone service in population centers of which 90% have only one telephone, which does not meet the needs of the population. OSIPTEL/FITEL organized the bid to adjudicate six projects with a price cap of $8,000/location. [18] These projects were designed to enable the winning companies to cover the immediate needs of the towns and to plan future installations of telephones based on the demand that arises in each area.

The following table outlines the characteristics of the projects:

TABLE 2 - PERU PUBLIC TELEPHONE SERVICE INITIATIVES

Project	Departments	Number of towns benefited	Subsidy per inhabitant (US$)	Bid Winner	Installation Period
Central North	Ancash, La Libertad, Lambayeque	225	6.8	Consultoría y Gestion de Telecomunicaciones	7 months
Central East	Lima, Huánuco, Junín, Pasco, Ucayali	337	5.8	Gilat To Home	8.5 months

South Central	Apurímas, Ayacucho, Cusco, Huancavelica, Ica, Madre de Dios	374	6.5	Gilat To Home	9.5 months
North	Tumbes, Piura, Cajamarca, Amazonas	325	5.7	Gilat To Home	8.5 months
North Jungle	Loreto, San Martín	140	5.3	Gilat To Home	4.6 months
South	Arequipa, Moquegua, Puno, Tacna	215	6.9	Gilat To Home	6.5 months

The third phase considers a further increase in telecommunication services, such as an increase in the teledensity of public telephones and Internet access cabins; the development of projects of small central localities with modern technologies in provinces and towns that have between 5,000 and 10,0000 inhabitants.

As we can see from Peru's planned universal service initiative, these satellite-based solutions can be deployed very quickly, connecting underserved areas to the established telecommunications infrastructure.

4. Challenges to Implementation - Regulatory Issues

Delivery of satellite-based solutions relies on effective national regulatory policies. For example, while some Middle Eastern, North African and Eastern European lesser-developed countries (LDCs) have progressed quickly, other nations have not realized their full potential, largely because outmoded regulations inhibited or prevented the cost-effective provision of VSAT-based services. Effective regulatory policies are at least as important as low costs for space segment and VSAT equipment if satellite operators are to deliver reliable and cost-effective services.

Though much still remains to be done, the trends are encouraging. Through close collaboration between government administrations and the VSAT industry, effective national deregulatory approaches are now being implemented in an increasingly harmonized regional context through organizations such as the European Conference of Postal and Telecommunications Administration (CEPT), the European Commission (EC) and in the Americas by the Inter-American Telecommunication Commission (CITEL).

The former Chairman of the FCC noted that "We know that the ability of satellite systems to serve rural and underserved markets is unsurpassed by terrestrial means. We want to ensure those opportunities, and then to get out of your way so you can get on with your business." [19]The most important initiatives underway include 1) adoption of blanket licensing arrangements, 2) improving regulatory transparency, 3) establishing type approvals for VSAT equipment, and 4) the adoption of "Open Skies" policies allowing competition within markets by multiple satellite operators.

Traditionally, most governments have required each individual VSAT terminal to be individually licensed. With a "blanket licensing" regulation, certain classes of VSATs are configured based upon technical criteria - involving power level, frequency, etc. - that eliminate the risk of unreasonable interference. Thus, regulatory authorities can issue a single blanket license covering an unlimited number of VSAT terminals. The U.S. has adopted this approach, and 43 European nations have now adopted a set of policy principles that provide for blanket licensing of receive-only and interactive VSAT terminals. [20] Implementation by individual European administrations is well underway - as of today a dozen countries have implemented blanket licensing regimes for VSATs, either for receive-only terminals, interactive systems, or both.

Network operators expend huge amounts of time, money and effort in an attempt to determine what regulations apply to VSAT-based systems and services. Efforts to improve transparency through publication of regulatory policies and principles are finally taking hold. In the Americas, a VSAT licensing database has been developed and administered by CITEL that includes the licensing requirements for many administrations in the region. [21] In Europe, a database has now been developed by the CEPT that includes the satellite-licensing data for many of its 43 administrations. [22]

Individual testing requirements and type approvals of telecom terminals are often redundant and vary from country to country. The result is major delays, higher costs and less efficient provision of communications. Fortunately, several regional approaches are underway that reduce or eliminate the need for individual type approval. Members of the Asia Pacific Economic Co-operation group (APEC) signed a Mutual Recognition Agreement to eliminate redundant type approval testing. Implementation of European Community (EC) legislation has begun that eliminates government type approvals of VSAT and other telecom terminals. [23] Where governments have not acted, industry is trying to fill the gap. The Global VSAT Forum's MRA Working Group has developed a technical framework called the "Mutual Recognition Arrangement" that is designed to streamline type approvals. The GVF MRA defines a set of standardized measurements that produce a data package.[24] This package can be used to check compliance of an earth station antenna model with applicable performance requirements. It is hoped that the GVF MRA framework can then be used by administrations willing to accept the MRA data package as a means of satisfying their domestic type approval requirements.

Until fairly recently, many national regulatory authorities restricted access to their markets to a limited number of satellite providers, even though satellites on orbit were technically capable of providing service to their countries and had complied with the procedures of the International Telecommunication Union designed to ensure technical compatibility. These restrictive approaches, often motivated by a desire to protect a national champion, have recently been liberalized in many countries as authorities realize that competition by satellite operators leads to lower costs for satellite services, increased choice, and development of advanced applications by satellite operators eager to differentiate themselves from their competitors. Today, most regulators are moving to an "Open Skies" policy where all satellite operators are free to enter the market under the terms of the specific regulation in force.

5. Conclusion

The effects of convergence, an increased demand for digital connectivity, and the unique operational characteristics of satellites create the possibility for remote and underserved areas to benefit from increasingly affordable satellite solutions to meet their voice, Internet, and video communications needs. The trend toward lower-cost, highly reliable VSAT terminals has lead some network operators to use satellite systems to augment and complement existing terrestrial infrastructure, allowing people separated by distance or rugged terrain to have access to communications services with quality comparable to that available in the most developed regions of the world. Satellite technology is mature and highly robust. While some regulatory challenges remain, the trend is toward increased transparency and "satellite friendly" policies that will set the groundwork for more isolated communities to gain access to the global communications networks.

Endnotes

† I would like to thank the generous assistance of my colleagues at New Skies Satellites, Annette Purves (Manager, Regulatory Affairs) and Catherine Hinckley (Consultant, Regulatory Affairs) for their assistance with this paper.

1. See International Telecommunication Union, available at <http://www.itu.int/sg3focus/teled91-2000.xls>.
2. Id.
3. See Advanced Services Second Report, 15 F.C.C. Rcd. at 20996 220-22 ("[M]any customers in outlying areas may be too far from a central office for DSL and may live in areas that are too sparsely populated to be served by a cable operator")
4. High-Speed Services for Internet Access: Subscribership as of Dec. 31, 2000, Industry Analysis Division, Common Carrier Bureau, FCC (rel. Aug. 2001) (available online at www.fcc.gov/bureaus/commoncarrier/reports.fcc-statelink/comp.html);
5. Remarks of Commissioner Susan Ness before the USTTI Satellite Module, Washington, D.C., Feb. 26, 1997 (available online at 1997 F.C.C. LEXIS 1056 * 4).
6. United States National Telecommunications Information Administration, Pub. Federal Standard 1037C (August 7, 1996).
7. Companies engaged in this business include New Skies Satellites (See <www.newskies.com>), Loral, SES-Global, PanAmSat, and Intelsat.
8. Changes in gravitational forces due to other effects including the wobble of the Earth, its uneven density, and the effects of the Moon, actually cause disruptions to the satellite's orbit. This is why satellites are equipped with a reservoir of on-board propellant that is used to counteract these forces, and keep the satellite in its intended orbital position. When the fuel supply is exhausted, these external effects gradually render the satellite unusable because it can no longer be

maintained in a position that is apparently fixed in relation to the ground. Modern satellites generally carry fuel sufficient to operate for over a decade.

9. Because of the curvature of the earth, geostationary satellites are generally not able to provide service to the extreme polar regions (i.e., higher than approximately 65 degrees North or South latitude).
10. Although non-geostationary satellite systems that are capable of providing service over a large geographic area have been brought into service (e.g., the Iridium and Globalstar "Big LEO" systems) and others remain planned, these systems required initial capital investment of billions of U.S. dollars of to build. Unfortunately, they have not been proven to be financially viable for their original investors and, in some cases, have had to seek bankruptcy protection from creditors. Large GSO satellites, on the other hand, cost approximately US$ 300 million to construct and launch, and can provide service to an entire hemisphere for more than ten years.
11. Letter from Nelson Mandela to Colin Powell, Secretary, Department of State at 2 (June 9, 2001) (attached to Ex Parte letter from New ICO, to M.R. Salas, Secretary, FCC, Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service, ET Docket No. 95-18 et al. (June 26, 2001)).
12. In re Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, Second Report, 15 F.CC. Rcd. 20913, 20937 (2000) ("Advanced Services Second Report").
13. This is in large part because the costs of satellite services do not vary with geographic distance. For example, the cost to establish a satellite connection between Washington D.C. and Buenos Aires on my company's NSS-806 satellite is the same as the cost that would be required to link Washington D.C. to the remote jungle regions of Brazil or the mountains in the Andean nations.
14. Extending Wireless Telecommunications Services to Tribal Lands, Notice of Proposed Rulemaking, 14 F.C.C. Rcd. 13679, 13685-86 12 (1999).
15. Telemedicine allows an expert doctor to create a video conferencing link with practitioners at remote sites and communicate pertinent medical information or procedures, eliminating the risky and time-consuming practice of requiring patients to undertake travel to larger cities.
16. Information on this initiative has been taken from the OSIPTEL web site <www.osiptel.gob.pe>.
17. Israeli firm Gilat Satellite Networks is the manufacturing market leader in rural telephony VSATs, according to the 1999 edition of UK-based satellite consultants Comsys' VSAT report. In 1996, Gilat's rural telephony segment accounted for only 3% of revenues. In 1998, it topped 30%. The firm's rural telephony revenues increased 300% in 1998, reaching more than US$40 million.
18. OSIPTEL/FITEL will provide US$ 11,396,300 for these projects, a savings of 11.85% than the budget initially estimated.
19. Remarks by F.C.C. Chairman William Kennard at the Satellite Seminar Dinner, Intelsat Headquarters, Nov. 1, 2000 (available online at 2000 F.C.C. LEXIS 5851 *5).
20. Europe's policy principle exempts interactive Ku- and Ka-band VSAT terminals from individual licensing requirements, provided the systems meet pre-determined criteria. For example, in the European framework, to qualify interactive VSATs must have 2W or less power, emit 50 dBw EIRP or less, have an antenna aperture of 3.8M or less, and be installed 500 meters or more outside airport perimeter fences. VSATs may still be installed within 500 meters of the airport perimeter, but they would require co-ordination and individual licensing.

21. The database can be seen at <www.citel.oas.org/pcc3/vsat/vsat_information_of_licensing.htm>. It now includes VSAT licensing requirements for 16 countries.
22. The database can be viewed at <www.eto.dk>.
23. This change is due to the Radio and Telecommunications Terminal Equipment Directive 1999/5/EC, which introduces a system based on manufacturers' declaration of conformity and relaxation of the regulatory constraints on the free movement and putting into use of terminal equipment.
24. The GVF MRA can be downloaded at no charge from <www.gvf.org>.

back to index

Abstract

As the adoption of digital technologies spread, policy makers are increasingly called upon to provide access to digital communication services, including access to the Internet. For some governments, the concept of having achieved "universal service" is evolving from providing access to traditional "voice telephony" to providing digital connectivity for hybrid voice, data, and Internet access purposes to overcome what some see as a growing "digital divide" between those connected to the global Internet and others. For certain applications, geostationary satellites play an important role in providing access to both basic and advanced telecommunications services in remote or underserved areas.

back to index

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back to index

CONTRASTING UNIVERSAL SERVICE ARRANGEMENTS RECENT DEVELOPMENTS IN AUSTRALIA AND NEW ZEALAND (update)

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View Abstract

AUSTRALIAN ARRANGEMENTS

History and content of the Universal Service Obligation ('USO')

The Australian USO is 'designed to safeguard access to a minimum level of essential telecommunications services for all persons in Australia. [It] recognises the fundamental importance of telecommunications in supporting effective participation in Australian society[1].

A universal service obligation was first introduced in Australia by the Telecommunications Act 1975 (Cth) which required Telecom (Telstra) to perform its functions in the manner which would best meet the social, industrial and commercial needs of the Australian people for telecommunications services. Telecom was also obliged to make its telecommunications services available throughout Australia, so far as reasonably practicable, and to have regard to the special need for such services of Australians who resided or carried on business outside the cities. The cost of unprofitable services supplied in accordance with these obligations was, in effect, cross-subsidised by those that generated a profit. Telstra's obligations continued in similar form under subsequent legislation, the Telecommunications Act 1989 (Cth).

Telstra was also the nominated 'universal service carrier' under the Telecommunications Act 1991 (Cth) which introduced limited competition with the granting of a general licence to Optus and licences to provide mobile services to Optus and Vodafone. Vodafone and Optus were required to contribute to Telstra's cost of fulfilling the USO.

The current regulatory regime for the USO began life in the Telecommunications Act 1997 (Cth) ('the **1997 Act'**) which removed restrictions on the number of carrier licences and opened the Australian telecommunications market up to full competition. The regime is currently contained in the Telecommunications (Consumer Protection and Services Standards) Act 1999 (Cth) ('the **1999 Act'**).[2]

Specifically, the universal service regime involves an obligation to ensure that:

- standard telephone services;[3]
- payphones;
- prescribed carriage services (none have yet been prescribed) and
- digital data services

...are reasonably available to all people in Australia on an equitable basis, wherever they reside or carry on business[4]. The inclusion of digital data services in 1999 represented a considerable expansion of the USO.

Digital data service arrangements since 1999.

A 'digital data service' is a 'general digital data service' or a 'special digital data service'. The former is a carriage service that provides a digital data capability broadly comparable to that provided by a data channel with a transmission speed of 64 kilobits per second supplied to end-users as part of the designated basic rate ISDN service (supplied by Telstra immediately before 1 July 1997 and complying with the standards for such services made by the European Telecommunications Standards Institute). The latter is a carriage service that provides capability for the delivery of digital data to an end-user broadly comparable to the corresponding capability provided by a data channel with a transmission speed of 64 kilobits per second supplied to end-users as part of the designated basic rate ISDN service.

The digital data services component of the USO was introduced after the 1998 federal election, in response to pressure on the government to 'upgrade' the USO, particularly to include faster access to the Internet[5]. This was done despite the fact that the Australian Communications Authority ('ACA') had held an inquiry at the request of the Minister for Communications, Information Technology and the Arts ('the Minister') to determine whether the USO should be so extended and found that this would not be supported by a cost/benefit assessment and could have unfavourable effects on competition should other carriers besides Telstra wish to take advantage of alternative technology to provide enhanced data services, such as wireless local loop or satellite services[6]. Prior to this change, the provision of 'digital data capability' to specified percentages of Australians by specified dates was a condition of Telstra's carrier licence (eg to 96% of the population by the end of 1998) and Telstra was therefore required to meet the cost of doing so.

The Minister was given the power by the 1999 Act to declare a specified carrier to be a 'general digital data service provider' or a 'special digital data service provider' for a specified general digital data service area or specified special digital data service area, respectively[7]. There may be more than one such service provider in each relevant area. The Minister has determined the general and special digital data service areas[8] and that Telstra is the provider of both general and special digital data services[9]. The Minister has determined that Australia's second largest carrier, Optus, is a provider of special digital data services, but that determination was subsequently revoked. A digital data service provider must prepare a plan that sets out how it will fulfil its obligations in the service areas it is responsible for and this plan must be approved by the Minister.

The digital data services component of the USO also includes the supply of customer equipment as specified by regulation (which can include by way of hire)[10]. The government subsidises the cost of customer equipment for special digital data services.[11]

A digital data service provider's costs of fulfilling its obligations are calculated annually, either on the basis of a formula specified by Ministerial determination or, if no formula has been determined, the costs are the provider's customer equipment costs less customer charges plus a supplementary amount.[12] Customer equipment costs' are a provider's total equipment costs, including rebates payable where customers acquire or hire equipment from third parties. 'Customer charges' are the amounts paid by customers for equipment and the 'supplementary amount' is specified by regulation. The costs are submitted to the ACA, assessed and then added to the amount of the subsidies for the other USO services (see below). The total is then shared by way of an industry levy.

Pre 2000 arrangements for provision and funding of non digital universal services

Prior to 2000, the Minister had the power to declare that specified carriers were universal service providers ('USPs') of one of two types - the national USP or the regional USP. The national USP was the USP for all of Australia other than for any service area in relation to which a regional USP was declared. Two or more carriers could be national USPs and there could be more than one regional USP for the same service area.

Telstra (the partly privatised former monopoly provider) was the only USP and fulfilled the USO across Australia in accordance with its Universal Service Plan, which was approved by the Minister. At the end of each financial year, Telstra submitted a claim to the ACA for its costs (ie the losses it had incurred) in delivering services pursuant to the USO for that financial year and, following assessment of the claim by the ACA, Telstra's losses were shared or levied amongst carriers in proportion to a carrier's share of total carrier revenue.[13]

Evolution of problems relating to the USO

For several years prior to the enactment of the 1997 Act, Telstra's cost of fulfilling the USO was assessed using a model developed in the late 1980s by the Bureau of Transport and Communications Economics and by negotiation between Telstra, Optus and Vodafone. Although the 1997 Act (and then the 1999 Act) allowed for a number of different methods of determining the cost of the USO, the 'default' method was the calculation of the Net Universal Service Cost ('**NUSC**') in pre-determined Net Cost Areas[14]. The NUSC was the sum of the total avoidable revenues from these areas less the avoidable costs of servicing them. In September 1998, the ACA made a determination which reflected a costing model for calculating the NUSC developed by Bellcore International Inc in consultation with the ACA, Telstra, Optus and Vodafone and which was to apply for the years 1997-98 onwards.[15]

Telstra's claims for a number of years prior to 1997-98 had averaged around $250 million. Telstra's first claim under the new model - for the 1997-98 year - was filed with the ACA in September 1998. It was for $1,827,584,235.35. Not surprisingly, it caused an industry uproar. After all, was the cost of providing USO services each year $250 million, $1.8 billion, or somewhere in between?

The sudden jump in Telstra's cost of fulfilling the USO produced by its application of the Bellcore NUSC model had a number of serious implications for the Australian telecommunications industry:

- too high a NUSC could threaten the viability of the industry as a whole;
- a carrier's share (via the levy) of the NUSC could threaten its viability. For example, of the $253,320,000 at which the NUSC was capped for 1997-98 (see below), the levy contribution of AAPT (Australia's third largest carrier) was assessed by the ACA at $2,537,426.14 (approximately 1% of the total NSUC). If the NUSC could conceivably have been as high as Telstra's claim for 1997-98, AAPT's contribution could have been as high as $18 million - a difference of 9 times;
- investment and cash flow uncertainty;
- for Telstra's financial position, the interests of its shareholders and the government's future privatisation plans for Telstra.

In addition, a number of carriers also began to claim, perhaps with some justification, that the burden of contributing to the USO fell 'very narrowly and unfairly on facilities-based competitors[16], causing, it is said, a lack of competitive neutrality between industry participants[17]. In general terms, only those companies which owned telecommunications facilities were required to become carriers and contribute to the NUSC. Accordingly, carriage service providers which resold the same services to their customers as carriers sold to their own customers (under agreements with carriers) were not required to contribute.

By late 1998, the following major issues had arisen in relation to the Australian USO arrangements:

1. what was the cost of providing universal services?
2. even if the cost could be ascertained, was it sustainable, at an industry or operator level?
3. how was the cost to be funded?
4. should the USO be opened up to competition, or is the USO a social policy objective that should exist independently of competition issues[18] and to the costs of which a socially responsible telecommunications industry should contribute?

The USO regime as it stood prior to 2000 was designed to provide Telstra, as the USP, with sufficient compensation so that it would not choose to stop supplying USO services if it had the freedom to do so[19]. A situation had been reached, though, where other carriers believed they would lose less (in terms of contributing to the levy) if they provided USO services themselves. One explanation for this view was that the regime simply compensated the USP for providing USO services, but did not provide or create any incentive for the USP to minimise or reduce the cost of doing so.

Short term government response - the 'Cap Act'

In October 1998, the government announced that it would seek to reach agreement with all carriers to cap the NUSC for 1997-98 at $253.32 million and that, failing agreement, the government would legislate to cap

USO costs at that level. Not surprisingly, no agreement was reached and the Telecommunications Laws Amendment (Universal Service Cap) Act 1999 (Cth) ('the Cap Act') was passed which capped Telstra's claim for 1997-98 at $253.32 million. The claim for subsequent years was also capped at that amount plus CPI, although the Minister was given the power to determine some other amount if appropriate.

The amount of $253.32 million represented just over 1% of industry revenue for the 1997-98 year. This was similar to, but not necessarily greater than universal service costs at the time in other 'highest cost countries', including the United States, Canada and France, which ranged from 1% to 4% of total industry revenue.[20] Ultimately, the Minister determined NUSCs under the Cap Act for the financial years up to 2000 01 at or close to the original Cap Act amount of $253.32 million.

Further consideration of USO problems

After the Cap Act was passed, the problems with the Australian USO arrangements were extensively considered in the context of:

- a call for expressions of interest in tendering for the USO (in April 1999); and
- a review by the Department of Communications, Information Technology and the Arts ('DCITA') of the long term funding arrangements for the USO.

Expressions of interest in tendering for the USO

The Minister called for expressions of interest in tendering for the USO in April 1999 because the government had formed the view that tendering the USO might facilitate the provision of more innovative services to remote areas, improvements in service standards, more efficient delivery of services and a reduction in the cost of fulfilling the USO[21]. Not surprisingly, the call sparked vigorous industry debate.

In general, it was greeted with enthusiasm. Submissions received by DCITA and released publicly disclosed a wide range of views. A majority of submissions, including those of the 4 major carriers, Telstra, Optus, AAPT and Vodafone, supported at least further consideration of a competitive selection process for providing the USO. Submissions also proposed the use of alternative technological solutions (besides fixed line) to provide universal services. For example, Optus proposed the use of satellite services, which was an encouraging sign for the possible future development of facilities-based competition. A small number of entities were against the idea, for example the Consumers' Telecommunications Network as it was not convinced that it would benefit consumers.[22]

It is not entirely clear, though, whether the sudden interest on the part of other carriers in providing USO services was due to a belief that they would lose less if they provided the services themselves (ie via contributions by levy to the NUSC) or to a belief that providing USO services would open up other, potentially profitable business opportunities.

The submissions disclosed general acceptance that tendering should not be permitted to cause any reduction in service quality and acknowledged that continued regulation of the regime was acceptable and even desirable, for example to ensure compliance with service standards and to lessen the possibility of USP failure[23]. There was, however, a dichotomy in submissions between the idea of competing to be selected to provide USO services and competing in the provision of those services.

A number of possible models for tendering were proposed, in particular by the 4 major carriers, that would have involved considerable complexity. Most of the options proposed would have involved amendment of the regulatory regime then in place and raised further issues, such as how to deal with a failure to fulfil universal service obligations and what transitional arrangements would be required.

Although further work obviously still needed to be done, after further industry consideration, 4 'generic' options for introducing contestable USO arrangements were identified:

- appointment of a sole USP for a region following application by interested carriers to the Minister (or ACA), with a subsidy for providing services determined using an economic cost model or industry negotiation;
- tendering out the right to be the sole USP for a region (with the cost of services dealt with by an economic cost model or industry negotiation);
- paying per-customer 'portable subsidies' in a region to all providers of universal services in that region, with the amount of subsidy set administratively;
- paying per-customer 'portable subsidies' in a region to the low bidders in an auction, with the amount of subsidy set by an auction. [24]

One of the difficulties faced by the Australian government was that the concept of tendering to provide universal service obligations was a novel one in countries with developed telecommunications regimes. Although there has been a great deal of discussion and academic debate over the last few years about the concept, and in particular the development of complex auction theories, only a small number of countries with relatively undeveloped regimes had attempted such tenders with the process in such countries being entirely related to price[25]. Accordingly, there was no real precedent for the more sophisticated proposals being proposed in Australia.

Review of the long term funding of the USO

The key issues in relation to funding are the need for industry certainty, greater costing transparency, fairness and equity considerations (for industry and consumers), minimising administrative costs and ensuring that the choice of funding mechanism retains the flexibility to accommodate a rapidly changing technological and service environment.[26]

In August 1999, the Minister requested DCITA to review and report on the best method for determining the cost of the USO, who should fund the USO and scope for improvements in the administration of USO funding arrangements[27]. DCITA identified 4 broad methods for determining the cost of the USO in order to ascertain the amount to be funded:

- industry agreement - by negotiation or some form of majority vote;
- economic cost modelling;
- legislative or administrative determination (eg the Cap Act) which in practice would be based on estimates arrived at by other means; or
- tendering or auction - to identify the amount which needs to be provided to USP(s) to ensure that USO services are delivered, rather than the actual cost of fulfilling the USO (although historical cost information would still be relevant).

DCITA also identified 5 broad options for the source of funding for the USO:

- cost-sharing amongst all carriers in proportion to their existing share of total eligible industry revenue (the then current approach);
- 'unequal sharing' amongst carriers - using exemptions or caps for 'small' or newly established carriers with more of the burden being shifted to the 'larger', more established carriers;
- the USP bears the entire cost - the approach taken in the United Kingdom and some European countries;
- budget funding - ie from taxes; or
- a specified method of recovering the levy.[28]

The submissions received from industry and interested parties in relation to this review were somewhat predictable. The general view expressed seemed to be that economic cost modelling was the best option in the short term but that it would be preferable to move towards the fourth option (market-based determination of costs) in the longer term. There was no consensus on options for the source of funding for the USO. Larger carriers were naturally in favour of budget funding but this was never really a likely option for a number of reasons, including:

- lack of incentive or reason for the government to take on an additional burden being borne by others (industry);
- community resistance;
- possible impact on nature and quality of USO services, eg it is less likely that a government funded USO could be extended to encompass additional services or obligations;
- it would involve a significant conceptual change arguably at odds with the general self-regulatory aims of the telecommunications regime since July 1997;
- lack of efficiency incentives; and
- the interrelationship between USO obligations and USP(s)' other activities.

DCITA's report to the Minister was not publicly released.

The government's March 2000 announcement

Finally, in March 2000, after nearly 18 months of uncertainty, the government announced its plans to 'revitalise' the delivery of the USO:

1. a $150 million tender to extend untimed local call access to all Australians;
2. substantial amendments to the 1999 Act, including to introduce competition into the delivery of the USO; and
3. contestability pilots.

Untimed local call access

About 40,000 Australian households within 'extended zones' covering some 80% of the Australian continent have not had access to untimed local calls due to the limited capacity of Telstra's remote infrastructure (in particular its Digital Radio Concentrator Systems). Timed charges have been used to constrain usage and thereby minimise congestion.

The government sought tenders to receive $150 million in funding (available after the sale of the second tranche of shares in Telstra in late 1999[29]) to install new infrastructure, or to upgrade existing infrastructure, in these extended zones and to provide untimed local calls within those zones, including untimed internet access. In February 2001, Telstra was selected as the successful tenderer, from a relatively limited field which included the second largest carrier Optus, and in June 2001 Telstra entered into an agreement with the government for this project. Telstra commenced providing the relevant services from 31 July 2001 and will be the only universal service provider in the extended zones during the three years this agreement will remain in force.[30]

2000 amendments to the 1999 Act

By means of two amending acts, the 1999 Act was amended in 2000 to make substantial changes to the Australian USO arrangements, although the universal services provided remain unchanged[31]. Essentially, these changes were to do three things:

1. introduce the possibility of competitive provision of USO services (rather than tendering to be selected to provide such services) in initial pilot areas, while still maintaining 'default arrangements' under which primary universal service providers ('PUSPs') will provide services;
2. permit the obligation to contribute to the cost of the USO to be extended beyond just carriers; and
3. provide for a price to be placed on the provision of USO services (by way of a subsidy) on a forward-looking basis, rather than having the cost of the USO determined retrospectively using the NUSC approach.

The following is a summary of the major elements of the new arrangements, which are affectively a combination of the first and third of the 'generic' options identified earlier.

Default arrangements

The Minister may determine a specified carrier or carriage service provider to be the Primary Universal Service Provider (PUSP) for a universal service area (also determined by the Minister). Previously only carriers could be universal service providers. There may be more than one PUSP, including different PUSPs for different service obligations for the same area. As a transitional arrangement, Telstra has been deemed to be the PUSP for the whole of Australia.[32]

Contestable service obligations and Competing Service Providers

The Minister is empowered to determine that the supply of a service obligation in an area is contestable, for example, the provision of pay phones in a particular Australian state. Any carrier or carriage service provider may apply to the ACA for approval as a Competing Universal Service Provider ('CUSP') to provide a contestable service or services. If approved, a CUSP must provide service to any customer in the area on request. This is designed to prevent 'cherry-picking' of higher value customers.

CUSPs may provide additional services, beyond just USO services. In addition to, or instead of, standard USO services, CUSPs may provide non-standard alternative telecommunications services ('ATS') in fulfilment of the USO (eg by providing basic telephony services via new technological solutions). This is designed to increase consumer choice and provide market entry opportunities for more service providers. Telstra may also provide ATS, but only in addition to its standard services.

There must be at least one PUSP for each universal service area, however, to act as the 'carrier of last resort' should a CUSP be unable to continue providing services. At present Telstra is fulfilling this role as the only PUSP.

Policy statements and marketing plans

PUSPs and CUSPs must prepare the following documents which are intended to ensure adequate information is available to the public about a PUSP or CUSP:

- a policy statement, which is a general statement of the policy the provider will apply in supplying equipment, goods or services as a PUSP or CUSP; and
- a marketing plan for each universal service area for which it is a PUSP or a CUSP. A standard marketing plan covers standard USO services, but an ATS marketing plan is required for ATS. A marketing plan sets out the equipment, goods or services the provider will supply and the arrangements for supplying and marketing the equipment, goods or services.

A PUSP or CUSP must consult with the public in relation to these documents and obtain the ACA's approval of the documents. The ACA has issued detailed guidelines to assist carriers and carriage service providers prepare and submit applications to become approved CUSPs. These guidelines also outline how the ACA will assess applications.[33]

USO subsidies and contribution to the cost of the subsidies

The Minister now has the power to determine subsidies for the provision of USO services on a forward-looking basis for up to three years in advance, based on advice from the ACA.[34] The cost of the subsidies is still to be met by an industry levy, but the Minister has been given the power to extend the obligation to contribute to the levy to carriage service providers (although he has not yet done so). Subsidies are 'portable' so that they will be paid to whichever carrier or carriage service provider provided the relevant service during a financial year.

Contestability pilots

Section 11F of the 1999 Act (as amended) permits the Minister to determine two pilot areas in which the new contestability arrangements can be trialled. The two pilot areas which have been selected after extensive consideration and industry consultation are:

- south-west Victoria and south-east South Australia; and
- north-east New South Wales and inland south-east Queensland.

These areas were selected as representative of regional Australia but providing a mix of population densities, demographic characteristics, topographic features and profitable and unprofitable sub areas. It was necessary to select areas big enough to ensure commercial viability, ie to make it worthwhile CUSPs entering. The second area is the largest, with a population of just under a million. The areas have been further broken down into universal service areas[35]. The Minister has determined that the standard telephone service obligation within the USO is a contestable service obligation in the pilot areas.[36]

What has really changed?

Although Australia's universal service arrangements have been substantially changed as a result of detailed assessment of the arrangements since late 1998, at the time of writing, no carrier or carriage service provider had sought approval as a CUSP in either of the pilot areas and Telstra remains the sole universal service provider (and therefore entitled to the entirety of the available subsidies).

There would seem to be a number of possible explanations for the current lack of enthusiasm in participating in the provision of USO services, despite early interest at the time of the above government reviews:

1. the capping of Telstra's NUSC since 1998 and the introduction of forward-looking determinations of subsidies has provided some certainty as to the level of a carrier's contributions. Should the forward-looking subsidies increase dramatically, it seems likely that the Minister would determine that carriage service providers must also contribute in order to spread the burden;
2. economic tightening, so that there is less money available to provide standard telephone services on a loss-making basis as a CUSP, for example, for any infrastructure investment that might be required. Although USO services can be provided on a re-sale basis by a carrier or carriage service

provider in a pilot area using the infrastructure of a third party, there would seem to be little incentive to do so unless there was a clear business case for building a profitable business by breaking into an area using USO subsidies;

3. the regulatory requirements for a CUSP (both for an application and ongoing requirements) are onerous. For example, extensive information must be provided as to an applicant's corporate, financial and technical capability and the preparation of a marketing plan that would meet the ACA's guidelines would involve a significant amount of work and research ;[37]
4. ongoing concerns about the ability of a CUSP to obtain sufficient information from Telstra, although the Minister has recently imposed licence conditions on Telstra requiring it to provide information to CUSPs and aspirant CUSPs on request, subject to confidentiality arrangements and on terms and conditions agreed with Telstra (or failing agreement determined by mediation).[38]

The contestability arrangements can only be extended to other areas after the Minister has tabled a report in Parliament following a public inquiry by the ACA on whether a net benefit has accrued from the operation of the contestability arrangements in the pilot areas. Such an inquiry would not commence until the arrangements have been in place for at least 12 months.[39]

NEW ZEALAND ARRANGEMENTS

History and content of the Kiwi Share Obligations ('KSO')

The New Zealand government's objective for telecommunications is to ensure delivery of 'cost efficient, timely and innovative telecommunications services on an ongoing, fair and equitable basis to all existing and potential users[40]. New Zealand currently has a rather idiosyncratic method of providing universal services.

Following the privatisation of Telecom Corporation of New Zealand Limited in 1990, the New Zealand government retained one convertible preference share (the 'Kiwi Share') in Telecom New Zealand Limited ('TNZ'), registered in the name of the Minister of Finance (the 'Kiwi Shareholder').

The Kiwi Share is the means by which universal services are provided in New Zealand. Under clause 5 of Schedule 1 of the Constitution of TNZ, unless the Kiwi Shareholder agrees otherwise:

- TNZ must ensure that it, and those of its subsidiaries which from time to time provide an 'ordinary residential telephone service', observe the principles relating to the provision of telephone services set out in the Constitution;
- the Board shall not manage the business or exercise any powers of TNZ in a manner which is inconsistent with those principles.

The relevant principles are set out in clause 5.2 and are as follows:

1. local call charging: a local free-calling option must be provided for residential customers;

2. price movement: TNZ may not charge more than the standard residential rental (line rental) for an ordinary telephone service and from 1 November 1989 may not increase the pre-GST standard residential rental in real terms provided that the overall profitability of the subsidiary operating companies of TNZ are not unreasonably impaired;
3. standard prices and availability:

    a. the line rental for residential users in rural areas must be no higher than the standard residential rental; and

    b. TNZ must make the ordinary residential telephone service as widely available as it was at 11 September 1990.

These principles are generally referred to as the Kiwi Share Obligations ('KSO'). 'Ordinary residential telephone service' means the standard local telephone service provided to residential customers for the Standard Residential Rental in accordance with TNZ's usual terms and conditions. The 'Standard Residential Rental' is that specified on page 6 of TNZ's Standard List of Charges for Local Telephone Services effective 1 November 1989 and as amended from time to time in accordance with 2 above.

Unlike Australia, the KSO does not include an obligation to provide pay phones. Another major difference is that in New Zealand, local calls are free, with the cost is built into the line rental.

The KSO is enforceable against TNZ by the Kiwi Shareholder. In practice, no enforcement action has ever been taken, although from time to time issues have arisen as to whether TNZ is complying with the KSO (for example in relation to its 0867 proposal which is dealt with below).[41]

In May 1990, to address concerns that residential telephone services standards might not be maintained after privatisation of TNZ, TNZ agreed at the request of the Minister of Consumer Affairs, to voluntarily publish indicators of the residential telephone service quality, on a half yearly basis via media releases and its company reports. In 1995, the adequacy of these indicators was reviewed by the Minister and TNZ and a new set of indicators agreed, against which TNZ is still reporting.[42]

Not surprisingly, given that the KSO was put in place more than a decade ago, issues have arisen as to its scope and operation as technological changes have occurred. In June 1999, TNZ announced it intended to manage a major increase in its Internet-related traffic by introducing a separate dial-up code (0867) for ISPs which would enable TNZ to use its intelligent network functions to more efficiently manage Internet calls. Residential callers who did not use the 0867 would be charged 2 cents a minute for calls to their ISPs in excess of 10 hours a month. This proposal caused great controversy. The government considered whether this change was a breach of the KSO which requires TNZ to provide residential customers with a local free-calling option but concluded that it was not because calls would be free provided the 0867 code was used.[43]

Debate has also arisen as to whether the KSO should be 'upgraded to include a dial up data service or whether it could be said that 'ordinary residential telephone services' could already encompass such a service.

Not surprisingly, the internet industry and consumer groups claim that the KSO already includes an obligation to supply such a service.[44] The Ministerial Inquiry into Telecommunications (see below) expressed the view that low-speed data, as well as voice was already covered by the definition, but that for the avoidance of doubt, the residential service obligation elements of the KSO should be embodied in legislation with a definition of 'ordinary residential telephone services' that clearly includes low-speed data services. The Inquiry considered that high-speed and broadband services were not currently included and were unlikely to be covered by the KSO in the foreseeable future.[45]

Although the KSO could be altered by changing TNZ's Constitution, this could also be done by agreement between TNZ and the New Zealand government or by legislation.

Current arrangements in relation to the cost of fulfilling the KSO

The Telecommunications (Information Disclosure) Regulations 1999 ('Regulations') currently require TNZ to calculate and disclose the losses it incurs in performing the KSO, including the amount due to each component, a summary of the calculations made in determining the amount due to each component and the amount due to individual customer groups for each component.

TNZ must also disclose the means by which any losses from performing the KSO are recovered including the sources, the amounts recovered from each source and the components of any charges from which TNZ recovered its losses. TNZ must also disclose the methodologies it uses in its calculations, including a description of the model used and the assumptions. Under regulation 10 the methodology used must take account of the matters set out in schedule 2:

- that the losses are the unavoidable net losses (incremental costs less associated revenues such as connection, rental and call revenues paid by customers) incurred by an efficient operator;[46]
- net losses must include intangible benefits (enhanced brand recognition and ubiquity);
- net losses of emergency services and directory services must be separately identified.

Disclosure is required every six months - at the same time as TNZ is required to disclose half-yearly and annual financial results. So far, TNZ has made three disclosures. The most recent, on 30 September 2001, was for the six period ended 30 June 2001[47]. On the basis of the KSO loss for the period 1 January 2001 to 30 June 2001 ($87.1 million), TNZ calculated its estimated total annual KSO loss to 30 June 2001 to be as follows (excluding intangible benefits):[48]

- $66 million as the loss due to provision of first lines to residential customers in uneconomic areas
- $101 million as the loss due to uneconomic first line residential customers in other areas
- $1.8 million loss due to emergency call centres
- $10.9 millions as the loss due to directory services

TOTAL: $179.7 million.

TNZ says it has 391,000 loss-making residential customers, which represents 30% of all residential customers.[49]

The information TNZ is required to disclose under the Regulations goes well beyond that which Telstra disclosed in connection with its NUSC claim under the pre-2000 Australian USO arrangements. Nevertheless, TNZ would appear to have more control over the inputs for its cost calculation than the Bellcore International NSUC cost model permitted.

Under the present arrangements, there is no explicit mechanism for recovery by TNZ of the costs of fulfilling the KSO, whether from other operators or any other source. TNZ covers its losses either from cross-subsidisation from other charges or from a dilution of shareholder value. In the past, TNZ arguably recovered its losses through interconnection payments - an additional 1 cent per minute charge was applied to incoming local interconnected traffic. This charge has recently been removed from TNZ's interconnection agreements with other operators providing local service.[50]

Ministerial Inquiry into Telecommunications

Between February and September 2000 the Ministry of Economic Development, which is responsible for telecommunications, conducted a Ministerial Inquiry into Telecommunications ('Inquiry'). One of the Inquiry's concerns was to establish the minimum level of telecommunications services that should be available to all New Zealanders to meet the social objectives of the community for an information economy[51]. The Inquiry queried whether the existing KSO arrangements were best placed to facilitate New Zealand's 'transition to an information economy, or whether some other form of universal service obligation might be more appropriate[52] and also identified the following issues with New Zealand's current KSO arrangements:[53]

- the KSO may discourage new service providers from entering some areas of the market, in particular for rural residential services. No particular reason was identified but presumably it would be due partly to the difficulty of competing with TNZ's rural line rentals;
- the KSO does not require TNZ to reduce line rental charges over time, for example, to reflect cost savings as a result of technological advancements or cost sharing with other providers under interconnection agreements. Irrespective of productive efficiency, TNZ may increase the price in line with CPI. In practice, line rentals have been kept below the required ceiling but have not reduced.[54]
- whether cross-subsidisation resulting from the obligation to keep rural line rentals in line with residential line rentals was preventing investment and competition from occurring in rural areas where prices are artificially low and encouraging inefficient investment in non rural areas where prices may be artificially high;
- whether there is some more appropriate way of providing universal services than obligations attaching to a share enforceable through TNZ's Constitution, including subsidies for line rentals, or

making some services contestable to enable other service providers to provide services if they could do so more cost-effectively than TNZ. The Inquiry referred to Australia's recent introduction of the means to facilitate limited competition in relation to contestable services;.

Ultimately, the Inquiry made the following recommendations in relation to the KSO in its October 2000 report:

1. the obligations relating to the provision of 'ordinary residential telephone services' should be better defined to avoid uncertainty as to their scope and embodied in legislation so that monitoring and enforcing compliance is more transparent. The concept of the 'ordinary residential telephone service' should evolve over time, depending on the level of service supplied by TNZ to the majority of its residential customers or technically capable of being supplied over its copper wire fixed network (although TNZ will not be precluded from using other technologies to provide such services);

2. Specifically, TNZ should be required to:

    a. maintain the existing geographical coverage of residential telephone services, whether this is done by fixed-wire local loop or, at TNZ's election, by utilising alternative technologies;

    b. irrespective of the technology used, maintain an unlimited local free-calling option for residential customers for ordinary residential telephone services (defined as the Inquiry recommends);

    c. not make any changes to its local free-calling areas (which are like Telstra's local calling zones) without the approval of a proposed Telecommunications Commissioner;

    d. irrespective of the technology used, not increase in real terms the GST exclusive monthly rental for ordinary residential telephone services provided that profitability is not unreasonably impaired; and

    e. continue to increase the proportion of its residential customers that have ordinary residential telephone services (of the enhanced definition) in accordance with a programme publicly released annually.

3. TNZ should be permitted to offer lower residential line rentals in urban areas than in rural areas, ie that aspect of the KSO should be removed;

4. TNZ's interconnection arrangements should not include a contribution from other providers to its losses arising from the KSO, nor should TNZ charge ISPs for local calls by residential users to access the Internet. The proviso in the existing KSO that line rentals may be increased if profitability is 'unreasonably impaired' continues to be appropriate. The Inquiry expressed the view

that TNZ would not currently be able to establish a case for an increase;

5. TNZ's compliance with the KSO should be reviewed every four years to consider whether the KSO should be amended or removed.

The Inquiry briefly considered the possibility of tendering or contracting out the KSO but concluded that unless it was done co-operatively with TNZ and was linked with the provision of services beyond the KSO (eg high speed data and broadband services) there was 'little to recommend' government involvement in such processes.[55] The Inquiry also noted that TNZ was not precluded from tendering or contracting out performance of the KSO to other operators, although it would remain responsible and accountable for the KSO. In reaching this review, the Inquiry referred to the following potential difficulties, which also arose in the Australian context:

- the need for new arrangements (TNZ would have to be relieved of its obligations, eg by amendment of its Constitution or conversion of the Kiwi Share into an ordinary share)
- given that TNZ's fixed network is likely to remain the lowest-cost technology for supply to most residential customers, provision of universal services by another operator would (unless that operator was to build its own facilities, involve arrangements for the other operator to use or acquire TNZ's network;
- as to what would happen on the expiry of any arrangements for another operator to provide universal services, including in relation to any arrangements made re TNZ's network;
- customers might be reluctant to switch to a new operator without an established record.

Initial government response to the report of the Ministerial Inquiry

New Zealand, unlike Australia, currently has no industry specific legislation for its telecommunications industry but in December 2000, in response to the Ministerial Inquiry's report, the government announced that it intended to enact such legislation. The Telecommunications Bill 2001 ('the Bill') was introduced into Parliament in May 2001 and will, when enacted, introduce industry specific arrangements with some similarities to those in Australia.[56]

The government also announced that it did not see any need to embody the existing KSO in legislation (ie in the new Bill) but that it intended to 'upgrade' the KSO by agreement with TNZ by:

- extending geographical coverage;
- to clarify that free local calls include dial up data calls (eg Internet calls);
- requiring an upgrade of TNZ's network so that it can provide 9.6kbps data capability to 99% and 14.4kbps to 95% of residential lines over the next two years. TNZ is to bear the capital cost of this upgrade, estimated about $100 million, which will enable Internet access for 22,000 of the 35,000 lines that currently have no basic Internet access (leaving only 13,500 out of a total of 1,350,000 residential lines with no access) ;[57]
- to establish an improved funding mechanism (more transparent and competitively neutral) under

which TNZ would still calculate its KSO losses but a final determination of those losses would be made by the proposed new Telecommunications Commissioner. TNZ would then seek the Commissioner's approval to oncharge a proportion of its losses (net operating costs component) to its competitors and the Commissioner will determine the amounts payable by competitors;

- improved monitoring and enforcement arrangements under which the Commissioner will monitor performance against agreed standards and will withhold the right to oncharge KSO losses to competitors in the event of non-performance.

The agreement with TNZ in relation to an enhanced KSO was to be recorded in an exchange of letter at the same time the Telecommunications Bill was enacted.

Part 3 of the Bill is intended to implement the government's social policy objective of ensuring services are available in areas where they might not otherwise be supplied on a commercial basis, of a type and at a standard which permits New Zealand citizens to participate in an information economy.

The Bill, as it was introduced into Parliament, provided for the Governor-General (by order made in Council on the recommendation of the Minister) to declare certain instruments that record contracts, arrangements, or understandings between the Crown and telecommunications providers for the supply of telecommunications services to be Telecommunications Service Obligations ('TSO') instruments. The TSO provisions did not expressly refer to the KSO but would have covered such an arrangement. The Minister was only to be permitted to make a recommendation if the service provider to which the instrument applied agreed to the instrument being declared a TSO instrument.

The Bill provided for those service providers that do not supply the services covered by the TSO instrument to contribute towards the net cost of supplying those services, as determined by the Telecommunications Commissioner in proportion to the amount of revenue each provider receives from services that rely on the network of the TSO provider. The proposed TSO cost calculation methodology involved calculating the unavoidable net incremental operating costs to an efficient service provider of providing the service required by the TSO instrument to commercially non-viable customers, taking into account the full range of direct and indirect revenue and associated benefits (such as line rental and profits from other services sold to those customers such as tolls or internet services) derived from providing the services to these customers and the calculation of a reasonable return on the incremental capital employed in providing the services to those customers. The TSO provider was to calculate its net cost which would then be assessed by the Commissioner who would make a determination as to the net cost.

Progress of the Bill

The Bill has been considered by the Commerce Select Committee ('Committee') which reported on 18 September 2001[58]. The Committee recommended that a purpose clause be added for clarification stating that Part 3 was intended to reflect government social policy objectives to ensure certain telecommunications services are available in areas where they may not otherwise be provided on a commercial basis or at affordable prices.

The Committee also stated that it supports the principle that the TSO should, wherever possible, be contestable. The Committee recommended that the Minister be required:

- instead of obtaining the consent of the provider to which a TSO instrument would apply before recommending declaration by the Governor-General, to rather consult liable persons (although not entirely clear this seems to mean persons potentially liable to contribute to the cost of providing the services covered by the TSO) and any persons and organisations the Minister considers appropriate having regard to the subject matter of the proposed TSO instrument; and
- to assess whether or not contestability could reasonably be achieved in relation to each of the obligations to which the instrument applies.

The Committee also recommended that the Commissioner be given the discretion to use a weighted revenue basis (to reflect the elasticity of demand for different types of services) in relation to the calculation of a TSO provider's revenue, rather than a weighted basis, where this can be shown to improve economic efficiency and benefits to end-users of telecommunications services.

Finally, the Committee recommended that a provision be included that requires any provider that wishes to disclose on their invoices any amount that relates to the provider's contribution to TSO costs to disclose contributions to the costs of all TSOs so that no particular groups serviced through TSO arrangements are singled out on an invoice. No such disclosures are made in Australia.

In late November 2001, the government released a Supplementary Order Paper ('SOP') containing the government's proposed amendments to the Bill in light of the Committee's recommendations.
In a departure from the government's previous position in relation to the KSO, the SOP deems as TSO instruments:

1. the 'original' KSO; and
2. any other instrument ('new KSO') that includes or records provisions that are to operate in place of and in addition to the KSO that is agreed or consented to before the commencement of the Bill as legislation, even if the instrument has effect after that date.[59]

The original KSO is defined as TNZ's Constitution, but including changes to the KSO previously made by agreement between the government and TNZ (in relation to directory services and TNZ's 0867 service). This new approach must be intended to include any agreement reached in the current negotiations between TNZ and the government to upgrade the KSO as outlined above.

No doubt this was seen as a relatively simple way of giving the existing (and any upgraded) KSO legislative force and to overcome long-standing issues about the suitability of such obligations being enforceable only through a residual government shareholding in a privatised corporation. Query, though, whether it gives the government any additional powers or flexibility to enhance or modify the KSO (or similar arrangements) given that a TSO instrument will not be declared unless the Minister has obtained the consent of the relevant provider and a TSO instrument is one that records 'a contract, or arrangements or an understanding between the Crown and a service provider for the supply of a particular telecommunications service or range of telecommunications services[60].

The government has not adopted the Committee's recommendation in relation to requirements to be satisfied before the Minister makes a recommendation in relation to the declaration of a TSO instrument. The government proposes changing the methodology by which the TSO provider's net costs are calculated so that the provider takes account of the range of direct and indirect revenues and associated benefits derived from supply less (simply) the costs of providing those services to the relevant customers. The government also proposes that the Commissioner may, in assessing and determining the net cost, choose not to include profits of the TSO provider from any new telecommunications services that involve significant capital investment and that offer capabilities not available from established telecommunications services (which are not defined).

The government has accepted the Committee's recommendation in relation to the use of weighted or unweighted revenue but has added a requirement that the Commissioner, when considering the amount a non TSO provider is to contribute, consider the amount that provider and the TSO provider can pass on to end-users.

As at the time of writing (14 December 2001), the New Zealand Parliament had debated and accepted the changes proposed by the government's SOP and the Bill was simply awaiting its third reading, but agreement had not been reached with TNZ on the upgraded KSO. Nevertheless, the government is still stating publicly that it intends the Bill to be passed[61] and agreement to be reached before Christmas 200.[62]

There have also been press reports that the negotiations are not going well[63] , presumably at least in part because of the proposal that TNZ bear the capital cost of the upgrade. TNZ is apparently also seeking changes to the way in which its losses in fulfilling the KSO are calculated and a cap on the number of free minutes residential users may have when making local calls to connect to the Internet.[64]

The government now seems to want to reach agreement on the upgraded KSO before the Bill is passed and comes into force (presumably so that it captures the agreement as the 'new KSO' and a deemed TSO). If agreement cannot be reached, it is likely that the passing of the Bill will be delayed.[65]

Conclusion

Despite the geographic closeness of Australia and New Zealand and the fact that there are significant telecommunications companies operating in both countries, these countries have taken quite different approaches to the way in which universal services are to be provided. This is in contrast to the increased similarity between the telecommunications regulatory regimes which will exist in other respects if the New Zealand Bill is passed. There are also some differences in the content or scope of the universal service provided, although each country has recently grappled with the issue of whether universal services should or can include a basic data service.

The arrangements in both countries are still in a state of some flux after several years of continuing problems and uncertainty. This state of affairs simply illustrates the complexity of universal service arrangements whether from a policy, regulatory or commercial perspective.

Endnotes

1. Telecommunications Bill 1996, Explanatory Memorandum Volume 1, at p75.
2. The relevant provisions of the 1997 Act were re-enacted and expanded by the 1999 Act. The provisions have since been substantially amended as detailed in this paper.
3. A 'standard telephone service' is a carriage service for the purpose of voice telephony or, in the case of a person with a disability, another form of communication of equivalent functionality which passes the connectivity test. That test is passed if an end-user supplied with the service is ordinarily able to communicate, by means of the service, with each other end-user who is supplied with the same service, whether or not the end-users are connected to the same network: the 1997 Act, s17.
4. Although general digital data services must be reasonably accessible to at least 96% of the Australian population and special digital data services to the remainder of the population.
5. *Australian Telecommunications Regulation, the Communications Law Centre Guide*, 2nd edition, 2001 at p211.
6. *ACA, Digital Data Inquiry, Public Inquiry under section 486(1) of the Telecommunications Act 1997 (Cth).* The ACA instead recommended targeting impediments to the provision of data services in rural and remote areas such as slower data rates for customer access and times call charges for ISP access.
7. The original provisions of the 1999 Act envisaged the selection of digital data service providers by 'selection systems', which could have included tendering, but after amendments in 2000, the regime simply provides for the Minister to determine providers, ie administratively.
8. *Digital Data Service Areas Determination 1999* (No. 1).
9. *Digital Data Service Provider Declaration 1999* (No. 1).
10. The 1999 Act ss10F & 10G and the *Telecommunications (Consumer Protection and Service Standards) (Special Digital Data Service) Regulations 1999*.
11. Ibid, reg 5 - the lesser of 50% of the cost of purchase and installation and $765.
12. The 1999 Act s17.
13. The 1999 Act Part 2 (prior to 2000 amendments).
14. The 1997 Act Part 2, Division 6 (prior to 2000 amendments).
15. *Net Universal Service Costs Avoidable Costs Determination 1998.*
16. Optus submission to DCITA: *Telecommunications Universal Service Obligation Review of Funding* Arrangements, September 1999, at p5.
17. AAPT Limited, *USO Review of Funding Arrangements, AAPT's Comments on the DCITA Discussion Paper*, 13 October 1999 (draft), at pages 5 to 6.
18. Ibid, at p5.
19. The Allen Consulting Group, *Telstra's Weighted Average Cost of Capital Application to the USO*, Final Report to the ACA dated 31 March 1999, at p11.

20. *Discussion Paper, Telecommunications Universal Service Obligation, Review of Funding Arrangements*, DCITA, August 1999 at p30.
21. Press Release 42/99, the Minister's Office, dated 6 April 1999.
22. *Tendering for the Universal Service Obligation?, Consumers' Telecommunications Network Response to the DCITA Discussion Paper: Provision of the Telecommunications Universal Service Obligation*, March 1999.
23. AAPT Limited described the process of making the USO scheme more effective as 'regulated pro-competitive reforms': *Provision of the Universal Service Obligation: AAPT's Response to the Department's Request for Comments and Expressions of Interest*, 7 June 1999, at p6.
24. *Public Forum on Regional Communications*, held by DCITA 24-5 November 1999, Session 8 'USO Contestability'.
25. For example, one-off budget funds have been provided in Peru, Chile and Columbia to build new infrastructure or to build and run new pay phones. In late 1995 the UK regulatory body Oftel considered ways of introducing competition into the provision of universal services including the possibility of tendering the services or some kind of 'pay or play' or franchise arrangements: Oftel *Universal Telecommunications Services, Proposed Arrangements for Universal Service in the UK from 1997*: at para 19. These possibilities have not been pursued. Many other EU regulators have also stated their intentions to consider the possibility of tendering as an alternative means of costing USO services but none has taken steps to implement it. See DCITA Discussion Paper, (*Telecommunications Universal Service Obligation Review of Funding Arrangements*), August 1999.
26. *Public Forum on Regional Communications*, held by DCITA 24-5 November 1999, Session 7 'Current USO Issues and Review Processes'.
27. Covering letter to DCITA's *Discussion Paper, Telecommunications Universal Service Obligation Review of Funding Arrangements*, August 1999.
28. DCITA Discussion Paper, *Telecommunications Universal Service Obligation Review of Funding Arrangements*, August 1999.
29. In total, more than half a billion dollars from the second sale of shares in Telstra has been allocated to extending regional, rural and remote communications: as well as the $150m for untimed local calls, $36m has been allocated to extend mobile coverage along highways, $36m to give all Australians local call access to the Internet and $120m to extend coverage of the Special Broadcasting Service (one of the national television broadcasters) and to eradicate television reception black spots.
30. Notice of the Primary Universal Service Provider for the Extended Zones of Australia, *Commonwealth of Australia Gazette* No. GN 29, 25 July 2001 at p2079.
31. *Telecommunications (Consumer Protection and Service Standards) Act Amendment Acts No. 1 and 2 of 2000.*
32. The 1999 Act ss 12D and 12E.
33. ACA, *Universal Service Obligation Contestability Guidelines*, version 1.1, 24 July 2001. See also ACA, *Discussion Paper, Implementation of Universal Service Obligation, Contestability Pilot Projects*, October 2000.
34. *Universal Service Subsidies (2001-02, 2002-03, 2003-04 Extended Zones) Determination (No. 1) 2001;*
Universal Services Subsidies (2001-02, 2002-03, 2003-04 Contestable Areas) Determination (No.

1) 2001 (Amended No. 2 of 2001); and

Universal Service Subsidies (2001-02, 2002-03, 2003-04 Default Area) Determination (No. 1) 2001.

35. *See Pilot Areas Determination (No. 1) 2001, Universal Service Areas Determination (No. 1) 2001 and Universal Service Areas Determination (No. 1) 2001 (Amendment No. 1 of 2001).*
36. *Contestable Service Obligation Determination (No. 1) 2001.*
37. See ACA, *Universal Service Obligation Contestability Guidelines*, version 1.1, 24 July 2001.
38. *Carrier Licence Conditions (Telstra Corporation Limited) Declaration 1997 (Amendment No. 1 of 2001).*
39. Although the ACA has already provided an indication of the criteria it intends to use to assess the contestability arrangements which include the number of service providers in the market (choice of supplier, proportion of consumers with choice): *Universal Service Obligation - Contestability Pilots, Questions & Answers*, from ACA website.
40. Ministerial Inquiry into Telecommunications, *Issues Paper* 6 April 2000, chapter 3.
41. The government also approved TNZ's merger of its regional operating subsidiaries into a single operating company without agreement being reached on how any calculation of the impact on profitability of those companies should be made afterwards if TNZ wished to increase its standard residential line rentals.
42. Ministry of Economic Development ('MED'), *New Zealand Telecommunications 1987-2001*, section 3.9 'Residential Telephone Service Quality Indicators'. However, unlike Australia's Customer Service Guarantee, no penalty applies for a failure to comply with the service standards reflected in these indicators.
43. Competitors such as Clear also argued that the code was anti-competitive because it denied them interconnection revenue and disrupted their customers but did not proceed further with these claims. In May 2000, Clear and TNZ reached a commercial agreement under which Internet users utilising Clear's ISP will not pay a 2 cent per minute charge for non-0867 calls, in return for which Clear would encourage customers to use the 0867 service: MED, *New Zealand Telecommunications* 1987 - 2001.
44. For example, Media Release of the Internet Society of New Zealand, 'Internal Society opposes Telecom stance on Kiwi share', 12 July 1999.
45. *Ministerial Inquiry into Telecommunications, Final Report*, section 9.1 - the Kiwi Share Obligations on Telecom, 27 September 2000.
46. The rationale for this approach is that the cost of performing the KSO should not include any inefficiencies of TNZ. In the latest calculation of its losses (30 September 2001), TNZ has applied a downward adjustment of 2% to represent this the inefficiency factor: TNZ *Assessing the Cost of the KSO Third Disclosure* 30 September 2001, at p17.
47. TNZ *Kiwi Share Obligation Loss Estimate 30 September 2001 and TNZ Assessing the Cost of the KSO Third Disclosure* 30 September 2001.
48. Intangible benefits have been calculated at between $3.02 and $7.16 million: PHB Hagler Bailly Asia Pacific Limited, *Intangible Benefits of the Kiwi Share Obligations*, prepared for TNZ, 27 September 2000 at p3. In Australia, only limited attempts have been made to calculate the intangible benefits to Telstra of acting as the universal service provider:
49. TNZ *Kiwi Share Obligation Loss Estimate* 30 September 2001, at p3.
50. TNZ *Assessing the Cost of the KSO Third Disclosure* 30 September 2001, at p19.

51. MED *Issues Paper*, section 3.4, 'New Zealand's Approach to Regulation'.
52. MED *Issues Paper*, section 4.6.4, 'Looking to the Future'.
53. MED *Issues Paper*, section 4.6, 'Universal Service Obligations'.
54. Between 1 November 1989 and 1 October 1998, for example, there were 8 increases to residential rentals but the real price did not exceed the level as at 1 November 1989. After obtaining the government's agreement rentals were reduced in August 1997 by $1.25 when the free directory service was removed and a 50c charge imposed for directory assistance: MED *New Zealand Telecommunications 1987-2001* at section 3.8. In Australia, Telstra's residential line rentals have also been subject to price controls (CP1 minus a specified percentage).
55. *Ministerial Inquiry into Telecommunications, Final Report*, section 9.1.4 'Tendering Out the Kiwi Share Obligation'.
56. Although the detail of the Bill is beyond scope of this paper, the proposed arrangements for access to services bear similarities to the Australian arrangements.
57. Government Response to the Telecommunications Inquiry, December 2000 'How is the Government Promoting its Social Objectives?' According to the Ministerial Inquiry into *Telecommunications Final Report*, section 9.1.1 ('Telecom's Investment Programme'), of the 1.9 million lines in TNZ's network (including non-residential lines), there are 95,000 without reliable data speed of 14kbps and for half of these the reason is outside TNZ's control, eg electric fence interference.
58. Media Statement by Minister of Communications, 18 September 2001 'Telecommunications Bill Reported Back from Select Committee' and *Telecommunications Bill, Commentary as reported from the Commerce Committee*.
59. Subject to the provisions of a new KSO, the original KSO may cease to have effect: SOP proposed section 68C. This tends to confirm that the current negotiations are in respect of a major overhaul of the existing KSO which will in effect replace the existing KSO.
60. SOP proposed section 68(3)(a).
61. New Zealand Government Press Release 23 November 2001, 'Government Releases Telecommunications Bill Supplementary Order Paper'. This is some months later than was originally intended:
62. Conversation with the office of the Minister for Economic Development, 22 November 2001.
63. 'Government Reform Set to Threaten Telecom NZ Monopoly', *Communications Day*, 20 November 2001 which described the government as being 'still embroiled in a dispute' with TNZ in relation to upgrading the KSO.
64. Chris Barton, 'Government Sweetens Vodafone's Bill', *The New Zealand Herald*, 10 November 2001.
65. Other surprise changes to the Bill in the SOP may also slow down its passage, eg the inclusion of a requirement that TNZ permit other operators to install equipment on TNZ's towers and that new entrants seeking access to roaming services will have to meet a national coverage threshold of 10%.

back to index

Abstract

As harsh terrain and sparsely populated non-urban areas present major challenges for the provision of universal services in both Australia and New Zealand, it is interesting to compare recent developments in the universal service arrangements of each country. Despite the relatively small population of each country (approximately 19.5 million in Australia and approximately 3.8 million in New Zealand), the issue of universal services seems to have generated considerable attention in both countries over the last few years.

In Australia, since Telstra's late 1998 cost claim for providing universal services of 'crisis' proportions, extensive review of the arrangements has resulted in quite radical and detailed regulatory arrangements facilitating the competitive provision of standard telephone services (to start with) in two pilot areas. These changes were also prompted by the development of a view in the industry that the fulfilment of universal service obligations by a single carrier (Telstra) may have been appropriate in an environment where it was a monopoly provider of a limited range of services based on standard telephony over a single network, but that this had become less appropriate as the environment had changed and become competitive in many areas. The content of the universal service obligation was expanded with the additional of basic digital data services in 1999.

Other carriers were also expressing the view that they could provide universal services at less cost than Telstra, using alternative technology such as satellite services, and that steps should accordingly be taken to open up the provision of universal services to competition and to limit the contribution of other carriers to Telstra's costs as universal service provider (via a levy system).

The extent and complexity of regulation involved in these arrangements is at odds with the self-regulatory approach of much of the balance of Australia's regulatory arrangements for telecommunications. This reflects the place of universal services as a core community obligation of the telecommunications industry as a matter of government policy. However, the new arrangements are not being utilised and there has been no real industry reaction to them. Although it is difficult to assess the arrangements until they can be seen in operation or there is some substantive industry response, this paper will suggest some reasons why they may not have been utilised to date.

By contrast, the key focus of recent debate in New Zealand has been about the content or scope of universal services, rather than the way in which such services are provided or by whom. Nevertheless, steps have been taken to provide for limited regulation of universal services, including by moving the existing arrangements into a legislative framework (after they are enhanced or expanded by agreement) and to share the cost of providing such services amongst industry participants by way of the *Telecommunications Bill 2001*.

Endnotes

1. According to the Australian Communication Authority's preliminary assessment of Telstra's claim for the cost of providing universal services in Australia for the 1997-98 financial year, there are in fact only about 399,555 services in operation in Australia to which universal services are supplied: *Net Universal Service Cost Assessment for 1997-98 Preliminary View*, 30 July 1999.
2. *Public Forum on Regional Communications*, held by the Department of Communications, Information Technology and the Arts ('DCITA'), 24-25 November 1999, Session 8: 'USO Contestability'.

back to index

PAPER UPDATE - 10 JANUARY 2002
CONTRASTING UNIVERSAL SERVICE ARRANGEMENTS
RECENT DEVELOPMENTS IN AUSTRALIA AND NEW ZEALAND

Commencement of Telecommunications Act 2001 (NZ)

On 18 December 2001, after the time of writing (14 December 2001), the New Zealand Parliament passed the Telecommunications Bill 2001. The Telecommunications Act 2001 ('the **Act**') commenced on 20 December 2001. The changes proposed by the government's SOP with respect to TSO and KSO were incorporated into the Act in their entirety. The Act provides as follows:

- The new TSO arrangements are intended to facilitate the supply of telecommunications services at an "affordable" price to New Zealand end-users who may not otherwise be supplied with services on a commercial basis (s 70(1)).

- The Governor-General, on the recommendation of the Minister, may declare an instrument to be a TSO (ss. 70(2) and 70(3)). A declared TSO instrument must record a contract, arrangement or understanding between the government and a service provider for the supply of a particular telecommunications services or services and must identify the end-users who are to be supplied, define the geographical area, specify the retail price and criteria for the standard of the service to be supplied (s 70(4)).

- The Minister must not make a recommendation unless the Telecommunications Service Provider ('**TSP**') to which the TSO instrument applies agrees to the instrument being declared a TSO instrument and the Minister has consulted those liable to contribute to the cost of providing the services covered by the TSO and assessed whether contestability could reasonably be achieved in relation to the obligations to which the instrument applies (s 70(3)).

- The newly appointed Telecommunications Commissioner assesses the compliance of a TSP with a TSO instrument. The penalty for failure to comply is a fine of up to $300,000 and, if the offence is a continuing one, a further fine of up to $10,000 applies for each day or part of a day that it continues (ss. 80-82).

- Arrangements for the assessment of the net cost of providing services covered by a TSO instrument and contribution to that cost by other service providers are as detailed on pages 23 and 25 of the paper (ss. 83-84 and 85).

- The 'original' KSO and any other instrument that includes provisions that are to operate in place of and in addition to the KSO that is agreed or consented to before the commencement of the Act ('new KSO') are deemed to be TSO instruments (s 71(2)). The original KSO ceases to have effect during the period that a new KSO is a deemed TSO instrument but can re-apply if a new KSO ceases to be a deemed TSO instrument.

New Agreement Between TNZ And The New Zealand Government

Just before the Act commenced, TNZ and the New Zealand Government finalised the foreshadowed agreement on the KSO (a 'new KSO') in the form of the Telecommunications Service Obligations Deed for Local Residential Telephone Service. Clause 7 of the Deed provides that the following re-formulated principles shall apply to the supply of local residential telephone service in New Zealand:

- TNZ must maintain a local free-calling option for all residential customers but may offer other optional packages to those who wish to take them as an alternative, including on a geographical or customer segment basis;
- the GST exclusive monthly rental for local residential telephone service must not increase above the 1 November 1989 level unless the overall profitability of TNZ's fixed business, as evidenced by audited accounts prepared for that business, is or will be unreasonably impaired. TNZ may offer lower prices if it wishes, including on a geographical or customer segment basis;
- line rental in rural areas must not be higher than in other areas and TNZ must make local residential telephone service as widely available as it is at the commencement of the Deed;
- directory assistance is to be continued on the basis set out in an exchange of letters between the government and TNZ in 1997.

The Deed also clarifies that the local free-calling option includes standard Internet and fax calls.

At its own cost, TNZ is also required to upgrade its network so that within 2 years it can provide:

- 99% of all existing residential lines with a 9.6kbps data capability; and
- 95% of all existing residential lines with a 14.4kbps data capability.

The Deed also contains new service quality measures against which TNZ must report to the government and the new Telecommunications Commissioner.

Interestingly, the Deed reserves the previous positions of the government and TNZ in relation to the interpretation of the original KSO (for example, on which calls and services are covered by the definition of "ordinary residential telephone service") and provides a process by which the Deed can be amended should a Court subsequently give judgment in favour of either party.

AN UPDATE ON UNIVERSAL SERVICE ARRANGEMENTS IN HONG KONG

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1. Introduction

The Hong Kong Special Administrative Region of the People's Republic of China (Hong Kong) consists of a relatively small land area that is famously densely populated. Nevertheless, away from its urban centres, Hong Kong has a significant number of remote and inaccessible areas and low usage households that, on an economic basis of commercial viability, would not be provided with telecommunications service if it were not for the universal service obligation (USO). USO is defined as the responsibility to provide good, efficient and continuous basic service at reasonable cost on a non-discriminatory basis to all persons in Hong Kong.

2. The Regulatory Framework

The Telecommunications Ordinance permits the Telecommunications Authority, Hong Kong's regulator, to require that one or more of the fixed carrier licensees has the USO. As noted above, the USO requires a licensee subject to it to ensure that a good, efficient and continuous basic service is, in the Telecommunications Authority's opinion, reasonably available to all persons within the areas of Hong Kong covered by the USO.

At present, the USO is borne solely by the dominant local fixed network operator PCCW-HKT Telephone Limited (HKT). Under section 35B(1) of the Telecommunications Ordinance and Special Condition 1 of each FTNS or fixed carrier licensee's licence the Telecommunications Authority has the power to appoint another fixed carrier (or fixed carriers) as an operator with USO. He may do so either generally, or in respect of a particular geographic area or areas, or for particular services.

HKT's licence requires it to provide, maintain and operate its network in such manner to ensure that a good, efficient and continuous basic service is reasonably available to all persons in Hong Kong. This requirement is subject to the proviso that, where HKT is able to demonstrate to the reasonable satisfaction of the Telecommunications Authority that the basic service in a specified area or areas is, or is capable of, being met by any other fixed carrier licensee, and that in the circumstances it would be unreasonable or unnecessary for HKT to be required also to provide the basic service, the Telecommunications Authority may exempt HKT from all or part of the USO for that area or those areas. The proviso anticipates a time when other fixed carrier licensees have been appointed as licensees with the USO for particular areas (or services). However, as noted above, HKT is currently the sole operator with the USO.

Basic service means the provision of:

- A public switched telephone service (including service connection, continued provision of connectivity, a dedicated telephone number, a directory listing (unless the customer otherwise directs), a standard telephone handset (unless the customer elects to provide this) and standard billing and collection services);
- A reasonable number of public payphones including payphones located within publicly or privately owned facilities to which the public have access;
- A reasonable number of public payphones designed for ease of effective use by the hearing impaired;
- A reasonable number of public payphones designed for access by the physically disabled, including wheelchair users;
- Operator provided directory enquiries, fault reporting, service difficulty and connection services;
- A tropical cyclone warning service;
- A thunderstorm and heavy rain warning service;
- A flood warning service;
- Access to a number or numbers for emergency services; and
- Such other services, subject to the Telecommunications Ordinance, as the Telecommunications Authority may include.

HKT is required to provide basic service to any person, on its usual terms and conditions, within a reasonable period after a request, and at the charge or charges authorised by the Telecommunications Authority. HKT is, in this way, obliged to provide universal service on a non-discriminatory basis.

Operators with the USO are entitled to receive a USC to assist them in meeting the costs of complying with the USO (clearly, HKT is at present the only recipient of USCs). HKT would be equally liable to pay a USC to any other fixed carrier licensee with a USO. The methodology for the calculation of the cost of providing universal service, and the amount of the USC, is discussed in section 3 below.

3. Calculation of the Universal Service Contribution

Universal service contribution is defined in the relevant licence special condition as that sum, calculated in accordance with a formula adopted annually by the Telecommunications Authority, to ensure that the current USO operator and any other licensee with such an obligation, as the case may be, receives a fair contribution from all licensees that provide external telecommunications services towards the costs, net of attributable revenues, of serving customers with basic service whom would otherwise not be served because it is not economically viable to do so but who are required to be served under the USO.

The previous methodology for calculating the universal service cost was set out in the Telecommunications Authority's Statement "Universal Service Arrangements: the Regulatory Framework" published on 14 January 1998. In this Statement, the Telecommunications Authority made it clear that he would review the methodology if and when changes in regulatory or operating conditions warranted.

Significant changes in regulatory and operating conditions did occur between 1998 and 1999. These changes included:

- The opening up of the external-services market to competition from 1 January 1999, and the consequent decline in prices for, and profits from, IDD services;
- The replacement of the former delivery fees regime with local access charges in respect of Category A routes and a modified delivery fee arrangement in respect of Category B routes. Local access charges are charges for the delivery of traffic of the external telecommunications services over local networks. Such charges are payable to the local fixed network operator for the provision of access to external services operated by external services providers;
- Tariff re-balancing in respect of residential telephone lines in Hong Kong and the removal of the price cap for commercial telephone lines;
- Rapid growth in mobile telephone penetration, such that mobile penetration now exceeds fixed line penetration; and
- Consumer demand for broadband Internet access and the availability of such access over the telephone lines used for the provision of basic service.

As a result, the Telecommunications Authority consulted the industry in September 1999 and subsequently issued a further Statement, "Universal Service Contribution Calculation Methodology" on 13 July 2000.

Under the Telecommunications Authority's January 1998 Statement, the costing principle that was established for the USC framework was that the USO operator would be compensated only for providing service to uneconomic customers (i.e. customers who would not be served on a pure commercial basis because the total relevant costs of doing so would exceed the total relevant revenues). The total universal service cost is the sum of the net costs of serving individual uneconomic customers.

Relevant revenues are revenues that are derived from the provision of basic service and all other services associated with the provision of standard telephone lines to basic service customers. Such revenues would be foregone if basic service were not provided. Under the previous (1998) framework, the relevant revenues comprised:

- Exchange line connection and removal;
- Exchange line rental;
- Customer premises equipment (CPE) rental;
- Call management services;
- Information-based services;
- Other services associated with the provision of standard telephone lines, such as ringing extensions and directory amendments;
- Interconnection charges from other fixed and mobile network operators in respect of traffic originating from and terminating at the standard telephone lines; and
- Delivery fees for outgoing and incoming external traffic originating from and terminating at the standard telephone lines.

Under the 1998 framework, relevant costs for determining the net USO costs were measured on the basis of avoidability, i.e. costs that would not be incurred but for the provision of basic service and associated services to uneconomic customers. Relevant costs comprised:

- The avoidable annualised capital cost of the customer access network, including the cost of capital;
- Line connection and removal costs;
- Call set up, switching and transmission costs;
- Avoidable operating costs; and
- Avoidable corporate overheads (e.g. those overheads that vary with the number of customers).

The cost of universal service also includes the net cost of providing service from uneconomic payphones. Relevant payphone revenues include the revenues generated by local calls from the payphones, the delivery fees and surcharges relating to external traffic originated from the payphones and any revenue generated by leasing advertising space at the payphone kiosks.

In his July 2000 Statement, the Telecommunications Authority identified four issues as affecting the then existing methodology of calculating USC:

- The expansion of the scope of services that may be provided under the USO operator's licence;
- The introduction of the local access charge and modified delivery fee arrangements;
- Deferral by the USO operator of the tariff increase for residential lines; and
- Use of the telephone lines used for basic service for the provision of broadband services.

Expansion of USO Operator's Services and Introduction of Local Access Charge and Modified Delivery Fee Arrangements

Before the termination of the international monopoly of Hong Kong Telecom International (HKTI) (now known as Reach Networks Hong Kong Ltd), the USO operator was not permitted to operate external services. Accordingly, its relevant revenue for the purpose of calculating USC included delivery fees from outgoing and incoming external traffic delivered by its network from and to customers of basic telephone lines. As a result of liberalisation, the USO operator is now entitled also to operate external services. As a consequence, the revenues and costs of the external services as a whole should be considered for the purposes of calculating the USC, not just those of the access services. Further, the delivery fee arrangement has been replaced by the local access charge over Category A routes and the modified delivery fee arrangement over Category B routes.

During the consultation process, the USO operator submitted that it would be difficult for it to link local access charges to individual customers in the determination of the relevant revenue for those customers. The Telecommunications Authority, acknowledging this difficulty, decided that the best approach would be to average the net revenues from local access charges received by the USO operator from the USC contributors by the number of telephone lines. The average value would then be allocated to each customer when determining whether or not it was individually economic or uneconomic.

Relevant costs now also include the costs incurred by the USO operator in the provision of external services. Again, the USO operator expressed concern over its difficulty in identifying an individual cost for each customer. Each category of route (divided into three major categories of route, Category A, Category B except Mainland China and Mainland China) is therefore allocated a unit cost using data from the USO operator's wholesale settlement and accounting system. The allocated cost for each call is calculated by multiplying the unit cost for the route by the call duration.

Deferral of Residential Tariff Increase

As part of the liberalisation process, HKT was entitled gradually to increase the tariff for residential line rental, initially to HK$90 per month with effect from 1 January 1999. HKT chose, however, not to increase the residential line rental until 1 September 1999. Had HKT raised residential line rental from 1 January 1999, the level of USC would have been reduced during the period between 1 January and the end of August 1999 by HKT's additional revenues. The Telecommunications Authority decided that the USC for the period from 1 January 1999 to the end of August 1999 should be calculated as if HKT had increased its residential line rental from 1 January 1999. The rationale for this decision was that USC contributors should not have to compensate HKT for what was considered by the Telecommunications Authority to be a commercial decision of HKT.

Sharing of Telephone Lines for Basic Service for the Provision of Broadband Services

HKT provides broadband conveyance services to value-added service providers. Under the accounting separation prescribed in the Accounting Manual, HKT is required to separate the revenue and cost of its broadband network from those of the narrowband network, and to exclude such revenue and cost from the USC framework. However, in many cases, the same copper pairs that are used for basic telephone service are also used for the provision of broadband. It is therefore necessary to apportion the costs of the copper pairs between narrowband and broadband services for the purposes of calculating the universal service cost. This is done by establishing relevant costs and revenues of broadband services and charging them under the broadband segment that is excluded from the USC framework. The USC net cost is lowered by the share of cost of the copper pairs allocated to broadband services.

As a consequence of the consultation exercise, in the revised USC calculation methodology (as set out in the Telecommunications Authority's July 2000 Statement) the relevant revenues for calculating the USC now comprise:

Local services

- Exchange line connection and removal;
- Exchange line rental;
- CPE rental;
- Call management services;
- Information-based services;
- Other services associated with the provision of standard telephone lines; and
- Inter-carrier customer access, switching and transmission.

Outgoing external traffic

- Where HKT is the retail provider of the external services, the revenues for the retail services provided to the end users; and

- Where HKT is providing access to the external telecommunications services of other operators, the revenues from local access charges received by HKT over Category A routes and that part of Category B traffic sent via IPLCs in accordance with the Telecommunications Authority's Statement on "Local Access Charge and Modified Delivery Fee Arrangements" published in November 1998; and

- Interconnection charge for Category B traffic sent through its switched external gateway in accordance with the Telecommunications Authority's November 1998 Statement.

Incoming external traffic

- Local access charges, delivery fee or interconnection charge in accordance with the Telecommunications Authority's November 1998 Statement.

Similar changes were imposed in relation to payphone revenues.

Relevant costs now comprise:

Local services

- The avoidable annualised capital cost of the customer access network including the cost of capital;

- Line connection and removal costs;

- Call set up, switching and transmission costs;

- Avoidable operating costs; and

- Avoidable corporate overheads.

Outgoing external traffic

- Where HKT delivers traffic through its switched external gateway, the gateway prices charged and the associated local switching and transmission costs; and

- Where HKT delivers traffic through ISR, all costs associated with the ISR operation, including the

IPLC leasing costs, switching costs and outpayment to overseas operators.

Incoming external traffic

- The network cost of HKT to provide trunk transmission, switching and customer access networks.

4. Collection of the Universal Service Contribution

Prior to liberalisation of the external telecommunications services market in Hong Kong in 1999, HKTI was the only operator licensed to provide external public telephone service. At that time, USC was collected by HKTI on behalf of its related company Hong Kong Telephone Company Limited (HKTC). The divulging of HKTC's commercially sensitive information was not a concern because it was, in any case, known to HKTI as the sole external services provider. In the liberalised market, HKTI can no longer obtain all external traffic information. Accordingly, recognising the need to preserve commercially sensitive information, the Telecommunications Authority decided to appoint an intermediary to collect USC. At the time, the Telecommunications Authority did not have the legal right to handle payments collected from contributing parties. He therefore established a set of selection criteria (factors such as reputation, size of establishment, independence and cost effectiveness) and determined that the party that scored highest against those criteria would be appointed as the intermediary. Citibank NA was selected as the intermediary USC collection body at the conclusion of this selection process. Citibank NA has been appointed pursuant to a three party agreement between Citibank, HKTC (as the beneficiary of USC) and the Telecommunications Authority until the end of 2002.

All external service providers are required to report monthly external traffic statistics to the Office of the Telecommunications Authority (OFTA) within 2 weeks after the end of each month. Citibank is then required to complete the billing procedure within 7 days after receipt of notice of the traffic statistics from OFTA. USC contributors have 30 calendar days to settle their monthly bills. For operators that fail to report traffic punctually, the Telecommunications Authority will estimate the provisional USC based on the previous month's traffic volume, plus an estimated 10% per month growth. If payment of USC is late, a reminder (giving 15 days grace) is sent immediately after the due date. A second reminder is sent if payment is not received by the end of the 15 day allowance period. Interest, calculated at the prime rate plus 2%, is payable on overdue sums, with the interest being retained by HKTC (as the USC beneficiary, HKTC is the party that has suffered from late payment).

If payment is not made punctually, the Telecommunications Authority has power to take such regulatory action, such as suspension or revocation of licences, as he thinks fit to deter late payment or non-payment.

All operators that contribute to the universal service cost are required to bear a share of the administrative cost of the collection mechanism, and of bad debts, based on the number of external traffic minutes that they handle.

5. Current and Future Issues in respect of Universal Service in Hong Kong

While a review of Hong Kong's universal service arrangements has not been formally commenced, the Telecommunications Authority has stated his intention to review again the current USO and USC frameworks to ensure they cope with current and future market conditions.

OFTA has also informally indicated the direction of its current thinking on some of the issues that might be the subject of such a review. These issues divide into essentially two categories, first those that might be described as considerations that underlie the universal service arrangement and secondly considerations in relation to specific elements of basic service.

A review of the universal service arrangement would be likely to re-examine the rationale for the USC to establish whether it remains intact since the last occasion on which the universal service arrangement was amended. At that time, the rationale behind the USC was relatively clear. In the monopoly era, the monopoly operator was free to (and did) cross-subsidise loss making parts of its business with profits generated by the profitable areas and from profitable service offerings. In Hong Kong, the monopoly operator made losses on local network services as a result of low monthly line rental costs and free local calls but cross-subsidised these losses from profits from its IDD business.

When competition was introduced, the former monopoly retained (and still retains) the USO but its right to cross-subsidise the provision of its services was restricted. New entrants, the former monopoly's competitors, have naturally chosen to compete in what they judge to be the most profitable areas and services. If the new entrants were allowed to compete with the former USO operator in this way, without themselves having either any USO or any obligation to contribute to the cost of universal service provision by the USO operator, the result would not be competitively neutral. Although the market has moved on since the last review (for example, tariff rebalancing — whereby the former monopoly USO operator is entitled to increase gradually its monthly line rental — has begun), the Telecommunications Authority considers that the basic rationale for the USC remains intact. The structure of the USC would be unlikely therefore to be altered if a review of universal arrangements were to be carried out.

In respect of the methodology for calculating the cost of providing universal service, there are two opposing forces at work. The re-balancing of tariffs for residential line rental is likely to contribute towards a reduction in the universal service cost. However, the decline in profitability of IDD services is likely to increase such cost. The existing methodology for calculating universal service cost is sufficiently flexible to take account of changes in relevant revenue and relevant cost. It should therefore remain valid. However, the regulator also intends to compare the level of universal service cost with the administrative cost of collection and other quantifiable benefits enjoyed by the USO operator. The Telecommunications Authority has indicated informally that the universal service cost may be abolished if the net cost, i.e. the universal service cost less all quantifiable benefits, does not justify the administrative cost of collection of the USCs. The Telecommunications Authority has not however indicated at what point he would consider that the administrative cost of collection was no longer justified (i.e. whether it might be before, or only when, the administrative cost of collection exceeds the net universal service cost).

The parties that contribute to the cost of universal service provision in Hong Kong are all licensees that provide external services. As mentioned above, as part of the full liberalisation of the local FTNS market in

Hong Kong with effect from 1 January 2003, the Telecommunications Authority intends to review the USO and USC arrangements to ensure they still adequately address present and expected future market conditions. As a consequence of such review, fixed carrier licensees that provide local FTNS may for the first time be required to pay USC and thereby share the costs of meeting the USO.

Basic service is defined earlier in this paper. One of the first questions that a review of universal service arrangements would consider is whether the scope of basic service should be expanded to include broadband access to the Internet. At present the Telecommunications Authority's view is that a basic telephone line is adequate to provide basic access to the Internet (e.g. at 56 kbps) and that it would not be justifiable to expand the definition of basic service to include broadband access. His reasoning is that the rate of penetration of broadband access has not yet reached a level where persons without such access could be said to be seriously disadvantaged as a consequence of such lack of access.

Another element of basic service as presently defined is the provision of a reasonable number of public payphones. Fixed telephone penetration in homes is almost universal. Since the universal service framework was last revised, mobile penetration in Hong Kong has increased rapidly to a present level of some 80%. In these circumstances, the question is whether the provision of public payphones remains a necessary element of basic service. Again, the Telecommunications Authority has indicated his current thinking is that public payphones should continue to be provided as part of basic service because mobile communications are not adequately substitutable for public payphones for the lowest income members of society. In addition, mobile network coverage may still not be available in remote rural areas of Hong Kong. Clearly, however, the number of public payphones that represents a reasonable number for the purposes of providing basic service today may be smaller than the number that would have been reasonable when mobile penetration was lower.

Finally, another of the elements of the current scope of basic service is the provision of a variety of severe weather warnings, namely for tropical cyclones, thunderstorms, heavy rain and flooding. Again, the question is whether severe weather warnings remain a necessary element of basic service. The Telecommunications Authority's current view is that severe weather warnings should probably be removed from the basic service requirements since alternative services are easily available, for example from the Hong Kong Observatory.

6. Conclusion

Although the Telecommunications Authority is always mindful of maintaining the USO and USC frameworks appropriate for the currently existing regulatory and operating environment, full-scale reviews are relatively infrequent. That said, the Telecommunications Authority has recently made it clear that he intends shortly to undertake a review of the frameworks to ensure that they cope with current and future market conditions.

back to index

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back to index

Policy / Regulatory

Tuesday, 15 January 2002
1430–1600
Coral II

T.2.5 Digital Divide

Chair:
JANET PEARCE STENZEL, President, ICM Insights, *USA*

T.2.5.1 Chasing the Broadband Utopia: An Assessment of Global Digital Divide Initiatives (View Abstract)

JAMES SAVAGE, Director, Global Corporate Communications, Philips Broadband Networks, Inc., *USA*

T.2.5.2 Taking the Pacific by Storm (or at Least Arriving on a Small Boat): Deregulation or Conquering Fear of the Digital Divide (View Abstract)

JONATHAN DRALUCK, Vice President, Business Affairs & General Counsel, iBasis, Inc., *USA* and CRAIG INOUYE, Vice President, Asia Pacific, iBasis, Inc., *Hong Kong SAR, China*

T.2.5.3 The Future of USOs: Making the USO Relevant in Bridging the Digital Divide (View Abstract)

JIM HOLMES, Principal Consultant, Ovum Pty Limited, *Australia*

Discussant:
MORLEY WINOGRAD, Executive Director, Center for Telecommunications Management, Marshall School of Business, University of Southern California, *USA* (View Presentation Summary)

Chasing The Broadband Utopia: An Assessment of Global Digital Divide Initiatives

James Savage
Director, Global Corporate Communications
Philips Broadband Networks, Inc.

AUTHOR'S NOTE: This paper was written prior to the author's employment with Royal Philips Electronics. The views expressed herein are solely those of the author and do not necessarily reflect the opinions of Royal Philips Electronics or any of its divisions or affiliated companies.

View Abstract

Introduction & Background

Is broadband a dirty word? It is beginning to seem so: without doubt, the telecommunications sector is undergoing rough times. This may have more to do with the pursuit of unfeasible business models and the hubris of venture capital firms than anything else; there remains very real unmet demand for broadband access. Despite recent setbacks, it is now universally accepted that networking technologies, and especially the Internet, are redefining the economy as surely as telephony, highways and railways did. And real access to the Internet requires broadband. Do you have broadband to the home? If so, would you call it "affordable to the average person"? Do you have a real choice of providers?

Herein lies the problem of the "promise" of the Internet revolution. There is considerable evidence that we have only seen the beginning -the "Model T" stage- of broadband technology. Even so, the technology has jumped far ahead of the business world's ability to develop successful business models that will profitably harness the potential of the 'Net.

But one should look at this as being akin to the automotive industry in the 1920s: For every dozen failures there is a success that quietly redefines the whole sector. Whether for books, air tickets, hotels, wedding registries, hometown newspapers, banking, tax forms or researching a million and one obscure topics, the Internet is now a central part of many people's lives.

Governments are recognizing this reality. But governments face a central policy issue: How to extend the benefits of the Internet to the entire population, and not just to the educated and affluent. This new phenomenon has many names – the "Info-communications economy" (Japan, Singapore), the National Information Infrastructure (USA), the "New National Dream" (Canada), the "Knowledge Society" (Norway), the "E-World" (Malaysia), the "Information Society" (Germany), the "Networked Nation" (Australia) the

"Knowledge Economy" (UK), "Cyber Korea" and many others. These names reflect the acknowledgement by governments worldwide that a profound economic shift is under way – and that public policy is changing to accommodate the requirements of the new economy.

In 2001, the Government of Canada's Department of Industry convened a National Broadband Task Force. The Task Force focused on developing strategies to make broadband service available by 2004 to geographical communities that are unlikely to be served by market forces alone (emphasis added). The Task Force recognized that the market will, over time, successfully address regions that may be served profitably. But what about those who cannot afford even rudimentary service? And what about the potential for schools and educational institutions?

There is an emerging consensus that, as with telephony, real (i.e. broadband) access to the Internet is part of a fundamental right to communicate. It must be included within any definition of "universal access" or "universal service". In the Canadian context, the Task Force defined it as follows:

- All Canadians should have access to broadband network services so that they can take advantage of broadband opportunities wherever they live (emphasis added);
- The definition of broadband and related concepts should be dynamic and reflect changes in technology, applications and Canadians' requirements;
- All Canadians should have access to the social, cultural and economic benefits delivered through broadband applications;
- In addition to broadband infrastructure, access involves the parallel development of content, services, and individual and community capacity;
- all communities, institutions, businesses and individuals in Canada should have equitable and affordable access to broadband services, and to the widest possible range of content and service providers;
- Communities should be engaged in planning broadband networks in light of local needs, and in building local capacity to use broadband services and content;
- The private sector should play a leadership role in the development and operation of broadband networks and services;
- Governments should facilitate the deployment of broadband networks, services and content through policies and regulations that favour private sector investment, competition and innovation, as well as by supporting communities, the creation of Canadian content and the use of broadband to deliver public services;
- Publicly assisted programs to deploy broadband infrastructure to communities unlikely to be served by market forces alone should be guided by such considerations as sustainability, technological neutrality, timeliness, affordability and the value of open, competitive markets;
- Publicly assisted programs should achieve sustainable broadband access to every public learning institution, public library, health care centre and other designated public access point in the country [1].

As part of the Task Force's work, the author was commissioned to undertake a comparative survey identifying and examining relevant national public programs in 14 countries [2] outside Canada that have the objective of extending broadband Internet access. Virtually every developed country and many developing countries have proposed governmental programs designed to foster or extend broadband technologies for economic growth. Some programs are natural extensions of existing telecommunications "universal service" or "universal access" development initiatives. But more often they are now grouped with broader socio-economic development goals, as the technology is - now more than ever - seen as an underpinning for national growth and social development.

A Word of Warning

By necessity, this paper can only provide a "broad-brush" overview of the comparative study's conclusions. The Study, individual country tables and results, and the full Task Force report are all available at www.broadband.gc.ca. At this site the reader will also find updates to the end of 2001. Further information from the study, including analyses, country background materials, spreadsheet tables, etc. are also available upon request from the author at jsavage@raincoastgroup.com.

Commonalities

While governments around the world have taken different approaches towards extending access to broadband services, all governments studied within our analysis appear to share the same underlying socio-economic tenets and, broadly, the same objectives:

- The broadband revolution changes the nature and function of national economic activity: it creates unprecedented opportunities for citizens, groups, education, medicine, communities, companies and governments.
- Because the new technology has no geography, every territory -- no matter how remote -- has the opportunity to become a creative technological hub both for inhabitants and newcomers. It can be an engine for economic growth.
- Rural, remote and disadvantaged areas and groups have the most to gain from harnessing new technology.
- Government matters: Public policy moulds the environment in which the broadband revolution can flourish. Broadband policies are seen as an important part of overall governmental socio-economic policies.
- While the private sector drives the new revolution, without exception governments believe they have a pivotal role in providing an educational and training framework to ensure citizens are able to take full advantage of the new technology. Skills and an educated population are central to a country's ability to succeed.
- There is a common belief that governments must undertake initiatives to bridge the "digital divide"; that market forces alone will not rapidly extend the benefits of broadband access to remote, rural, or otherwise disadvantaged locations (e.g., poorer neighbourhoods in cities, distant islands, sparsely populated territories, disadvantaged minority communities, etc.).

Differences in Approach

As noted, governments worldwide share a common belief in the benefits of broadband access and the role of government in fostering educations and training, assistance to disadvantaged locations and groups, etc. Beyond this common base, however, there are dramatically different strategies for achieving these shared public policy objectives.

The fourteen countries in the comparative analysis provide several examples of three overall emerging public policy approaches to extending broadband access:

(1) The "Light Touch" Regulatory Reform Approach

This approach involves minimal central government intervention in the private sector's expansion of broadband networks and services. Within the study, New Zealand and Switzerland exemplify this strategy. Nevertheless, this should not be seen as a "hands off" approach, as these countries have public policy commitments to universal Internet access. Characteristics of this approach are as follows:

- Focus on transparent regulatory frameworks to encourage competition and open access
- No direct government funding for broadband network / access expansion.
- Government commits additional funds to skills improvement, education and training; some direct funding for schools, etc., to upgrade broadband facilities;
- Niched, targeted programs to tackle specific examples of "digital divide" – no strategic or national program.
- Government may commit additional funds for related R&D
- Greater focus on fostering local and regional government initiatives
- Extending coverage of telephony universal service schemes to Internet access; similar extension of obligations to carriers in lieu of direct government investment.

(2) The Cooperative Approach: Programs Targeting the Digital Divide and Improving Access

Central governments in the Canada, the United States, Australia, Germany and the UK appear to be focusing on what the US Government calls "digital inclusion" policies. While more activist than the New Zealand or Swiss approaches, these countries target their policies to those areas and groups where it is believed market forces will not adequately address disparities.

In other words, private sector broadband services naturally "follow the money" to major cities, affluent socio-economic groups, larger businesses, etc. Governments following this approach are especially concerned that rural/remote areas and disadvantaged communities will be left behind in the broadband revolution. A recent US Government study notes "the availability of advanced telecommunications will become essential to the development of business, industry, shopping, and trade as well as distance learning, telemedicine and telecommuting...This is particularly true for those who live in the rural towns and countryside, who can especially benefit from high-speed, distance-defying connections to external markets and employment opportunities" (from "Advanced Telecommunications in Rural America", USDOC/USDA, April 2000).

Australia's 2000 "National Bandwidth Inquiry" depicted the deployment of broadband as likely to take place almost exclusively in that country's metropolitan centres. This is also the underlying concern of Sweden's

"Small Community Broadband Infrastructure Initiative", which seeks to bring broadband network infrastructure to all Swedish communities with less than 3,000 inhabitants.

These strategies may support governmental socio-economic objectives but are not part of any specific grand economic plan. Instead, the benefits of broadband access are seen as overwhelmingly self-evident and, hence, governmental assistance is a necessary "hand up" to enable disadvantaged groups to harness the potential of the technology.

This approach has the following characteristics:

- Focuses solely on areas where governments believe market forces will not adequately address disparities: rural/remote access, disadvantaged communities, etc., i.e. those on the "wrong side of the Digital Divide".
- Direct central government funding available for last-mile broadband connectivity and related equipment for qualified groups, communities, rural locations
- Government does not actively fund new backbone or major network initiatives, but centres on access.
- Subsidized or free programs for relevant education and training
- Strong focus on distance education, telemedicine, applying broadband for economic development
- Close central government cooperation with regional, municipal, local governments.
- Targeted programs for minority groups, youth, seniors, etc.
- Direct funding for R&D

(3) Comprehensive National Broadband Plans

In some countries, government has undertaken the role of national technology leader. This is found largely in countries where there is a tradition of a highly activist, interventionist public policy framework that drives private sector strategy and investment, i.e. state-driven (or state-guided) industrial policy. Some of these countries have developed large-scale investment plans and grand strategies that tie in broadband network development to grander socio-economic national economic initiatives. Examples found within the study include the Korean Information Infrastructure "Cyber Korea 21", Norway's "eNorway" program, Malaysia's Multimedia Super Corridor, the Singapore ONE initiative, Taiwan, China's "Green Silicon Island" program, and Japan's Info-Communications Strategy for the 21st Century.

These programs vary in their breadth, but are best understood in the wider context of national industrial policy. There are many common elements to the programs within this category:

- Combines features of above categories: universal broadband access, transparent regulation, extensive education and training programs.
- Characteristic of countries with strong state sector and/or tradition of high involvement of government in private sector
- Goal of transforming society into a skills-based economy and society: "knowledge-emergent society" (Japan), "knowledge society" (Norway), "knowledge-based society" (Malaysia, and Taiwan, China), "new economy" (Singapore, Korea), etc.

- Strong competitive element: explicitly benchmarked against other countries and seeking to achieve world leadership in IT skills (Singapore, Japan), broadband coverage (Korea, Singapore), to be world's favourite broadband business centre (Malaysia, Singapore), productivity improvement benchmarks (Korea, Japan, and Taiwan, China).
- Strong quality of life/societal component: using broadband to foster more environmentally-sensitive (greener) industries (Norway, Japan, Korea and Taiwan, China), explicit quality of life goals (sustainable development, access for all).
- Proactive government involvement: direct funding for broadband infrastructure development, comprehensive education and training programs, sweeping involvement of multiple ministries or all government within national broadband development programs; aggressive reforms to regulatory structures, trade and immigration policies etc.

The "Comparative Snapshot" and Where We Go From Here

It should be noted that in most countries the public policy process in evolving rapidly in this area. The study should be read as a "snapshot" of developments as they stand in mid-2001, and puts forward an overview of the policies and programs in the fourteen countries reviewed. The heart of the study is the comparative matrix, which provides detailed information about each of the programs within the fourteen countries. Programs are analyzed within the following categories:

- Objectives
- Governance and Management
- Facilities Ownership
- How Broadband is Defined
- Target Beneficiaries
- Program Incentives
- Technology Architecture
- Cost of Program
- Timetable / Future Planning
- How Success is Measured

With regard to comparing programs between different countries, it is important to note that countries differ dramatically in 'where they are' with these public policy initiatives. In Britain and France, national governments are only beginning to move beyond the study and analysis stage to actual policy and program formulation – and have proposed the commitment of sizeable national budget dollars. New Zealand and Sweden have considered and rejected more elaborate measures and are proposing more targeted legislation. Singapore, Malaysia, Switzerland, Australia and Norway have well-established initiatives – of greatly varying scale – that are already under way. US programs are directed by different government departments and are at different stages of development. Japan and Taiwan, China, are poised to launch aggressive programs to surpass current initiatives.

When the Canadian National Broadband Task Force released its Final Report in July 2001, the media received it with skepticism and wariness. Similar initiatives in Britain, France, and Australia were similarly received. But so, too, in their day were similar public infrastructure projects such as canals, railways and highways. Ultimately, it is still very difficult for us to see the true potential of the Internet. When the first freeways (motorways, autobahns, turnpikes etc) were built in the 1930s there were precious few cars able to go 100 km/h (62mph). Who needed such expensive and elaborate roads in an era of bias-ply tires, drum brakes, and vacuum-operated wipers??

Moreover, many who agree that broadband access is vital are wary of the idea that public funding should be used to foster broadband network development. While most of the countries studied in our analysis are, in one fashion or another, committing public funds (either directly or, more often, indirectly via subsidies to incumbent (and occasionally competitive) carriers) for network development, there is an emphasis on harnessing the private sector as the leader of such development. Nevertheless, there is quite simply no business case for extending broadband service to the remotest or poorest corners of most countries. As with telephony, governments committed to the "universal access" objective are therefore obliged to either subsidize the private sector or get involved directly in broadband development.

Should they do this? Countries such as Japan, Korea, Canada, Sweden, and Germany are committed to the principles of equality of service irrespective of geographical location. In practice this is extremely difficult to achieve. Each of these countries has its "have-not" regions, although equalization policies have made economic disparities far less dramatic than one seen in the United States or Great Britain. And the economic impact of broadband access on "have-not" regions will almost certainly be positive. The real question is whether the benefits will justify the costs to the public purse.

One consequence of the recent financial crisis in the telecommunications sector has been the rise of governments in filling the apparent void of technology leadership. The failure of carriers and manufacturers to develop viable business models has had the unintended effect of ceding leadership to policy-makers and politicians. In a positive sense, this may lead to a more balanced, strategic approach to network growth and development as companies are forced to take a wider, more broadly socio-economic perspective.

However, there is also the view that the current restructuring of the industry will lead to the creation of a handful of global carriers and manufacturers, as well as the ultimate integration of network, equipment and service provision. The industry may then, yet again, follow the automotive precedent by devolving into a small number of global players, with many of today's "national" stars going the way of Studebaker, Morris, Borgward and Prince. If that does happen, the national focus of governments may prove in the long run to be a hindrance to economic efficiency and affordable access. There is already a stellar example of such interference and market failure to be found in the worlds of civil aviation and (to a lesser extent) merchant shipping, where government commitment to flag-bearing lines has hindered the development of what should be a naturally multinational industry.

Nevertheless, government-led efforts such as the Canadian Task Force have constituted a vital step in advancing the discussion of these issues and, critically, have focused our attention on the true economics and sociology of broadband development. It is certainly not "too important to be left to the market", but there is evidence that these government initiatives are galvanizing both the market leaders and the "bottom-up" efforts of grassroots groups, municipalities, shared-use groups etc. to think about ways of extending and expanding broadband access. We may be at the Model T stage traveling on dirt pathways, but we know that at some point soon we will have to have those smooth multi-lane broadband highways ready for the onslaught of high-tech Porsches.

Endnotes

I) Industry Canada, Report of the National Broadband Task Force, Executive Summary (Ottawa, July 2001).

II) Australia, France, Germany, Japan, Korea, Malaysia, New Zealand, Norway, Singapore, Sweden, Switzerland, Taiwan, China, the United Kingdom, and the United States of America.

back to index

Abstract

Virtually all countries have embraced the perceived need to extend broadband Internet access as widely and comprehensively as possible. Many countries have launched publicly-funded initiatives at the national level to undertake this massive effort. Building upon his work for the Canadian 2001 National Broadband Task Force (NBTF), Savage reviews the commonalities, challenges and differences in approach between fourteen Asia-Pacific, North American and European countries undertaking large-scale public broadband expansion programs.

back to index

James Savage

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Savage served as Vice President of International Public Affairs for GTE Corporation (now Verizon), having also served GTE International over the years in various strategic planning and business development roles. In addition, he spearheaded the development of GTE's international wholesale long distance and private line markets and is widely published in the field of international bandwidth economics and business planning.

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back to index

Taking the Pacific By Storm (or at least arriving on a small boat): Deregulation or Conquering Fear of the Digital Divide

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View Abstract

Thesis

Champions of competition travel the world peddling a carefully crafted deregulatory framework for telecommunications. They encourage obstacle-free market entry, leading to multi-carrier markets that produce innovative services at lower prices to more users. While these principles sound as though they are beyond reproach, many governments have exhibited caution, fearing that funding through traditional settlement subsidies will wane.

While the chorus for deregulation and the need to bridge the "digital divide" continues, the uncertainty of many existing regulatory environments discourages major investments in competitive offerings. In many instances, the best approach for would-be competitors in this regulatory limbo is to begin with small steps -- engaging gradually in new services that require little upfront investment and which can introduce immediate and tangible benefits to consumers. In this way, new market entrants can lead regulators by the hand, helping to ease the fear of the journey into the unchartered waters of the new services and technologies of the digital age.

Enticing Regulators

For many regulators, the greatest appeal of deregulation may be the opportunity to gain the knowledge and technology transfer associated with the many new IP-based communications services, such as Internet telephony, and the increasing number of new mobile and speech-recognition-based phone services being deployed worldwide. In particular, Internet telephony, which has been introduced in a significant number of countries, has managed in just a few years to alter the competitive landscape in telecommunications. Internet telephony offers a number of advantages over traditional phone transport. Using the Internet and its universal, open protocols as the transport for phone calls also allows for the introduction of other innovative IP-based voice services. Consider for a moment that there are an estimated 300-400 million PCs worldwide -- a large number except in comparison with the world's nearly 2 billion phones. IP-based applications, particularly those that incorporate speech recognition capabilities, enable any phone - from a black phone built in 1920, to a village payphone, to the latest miniature mobile with cordless earpiece - to bridge the digital divide by becoming an Internet-access device - with the human voice directing navigation through Internet content, messaging services, and other speech-driven applications.

Government officials are naturally eager to find ways to bridge the "digital divide" and deliver to their constituents the benefits of these new technologies. And while there remain countries that rely on bilateral arrangements to fund telecommunications operations, the promise of broad-based economic growth, including stronger job creation and increased state revenues, is causing more and more regulators to set aside their prepared scripts and slowly evaluate the options for opening up telecoms markets. Officials in a number of countries, have, for example, allowed testing and trials of Internet telephony, a "bridge" technology that is rapidly spreading across the developing world. These regulators are allowing the distribution of calling cards, creating new licenses, refitting existing licenses, establishing RFPs, permitting PSTN interconnectivity, and granting signaling point codes previously reserved for incumbents. Moreover, many regulators, enticed by the "leapfrog" prospects of technologies such as VoIP, are even lowering their guard on issues related to the once sacrosanct international settlements regime.

With each new step across this bridge to the future, consumers in developing markets are enjoying greater access to new communications systems at lower costs. These tangible benefits are a powerful force for change. As users who are exposed to new services are joined by governments, who begin to get a taste for the increasing commerce and potential tax revenues that such new services bring, the deregulatory ball, already in motion, tends to pick up speed.

Quick Benefits, Minimal Intrusion: An Internet Telephony Case Study

Charged with protecting consumers and, in some cases, local markets, government officials often have serious concerns about introducing competition and the potential dangers it represents. Many governments still hold a financial stake in their nation's monopoly provider. Regulators also understand that a free market might not be kind to all participants. Opening lines of communications, pointing to the results of deregulation in other markets, and explaining the role that monopoly providers can play in driving the introduction of new services, can help allay the perceived threat of competition and encourage a more welcoming attitude to deregulation.

Internet Telephony is an interesting example for study because it has proven (i) financially attractive to both new market entrants and monopolist providers alike, (ii) it is interoperable with existing national telephone networks, (iii) it is now virtually identical to PSTN in service quality, and (iv) it can be made to fit within the parameters of both old and new regulatory regimes. We will now look at how many of the most common objections to the introduction of this key "bridge" technology can be overcome.

Perception: Internet-based Voice Communications Will Reduce Government Revenues

One major resistance point to the introduction of new telecommunications services is the threat that competition will weaken PTT revenue, thereby reducing government revenues. Many regulators have, however, been receptive to the longer-term business case for Internet-based communications.

Curbing the settlement process, which historically has maintained a balance of payments for carriers terminating international telephone traffic between any two countries, is usually the chief source of anxiety from governments who have enjoyed revenue from this scheme. In fact, certain countries have advocated to the ITU that it recommend Internet-protocol-based traffic be accounted for in the same way as ordinary telecommunications traffic. This protectionist approach necessarily ignores certain realities.

Payments from the international settlement regime are being widely reduced or eliminated. Decreasing accounting rates for the scheme are being demanded by many governments, including the U.S. In addition, the effect of illegal by-pass, call-back, and other practices used to circumvent the settlement system, represent real and significant pressures which are difficult to control and which are leading many regulators to consider deregulation as a means to enhance the competitiveness of their markets and pre-empt the inevitable demise of the settlement regime.

Looking at this issue from another side, countries seeking to maintain settlements often fail to account for the administrative costs of maintaining such a regime (or the costs of lobbying international organizations to maintain the regime). Rather than pursuing negotiations with hundreds of other carriers in dozens of countries, with Internet telephony, a PTT can interconnect with just a few carriers, incur lower transport costs, and provide precisely the same level of global service. To counter declining margins and revenues, national carriers can outsource their international telecommunications traffic and related infrastructure support costs to efficient Internet telephony providers. In fact, this is precisely what is already happening in many parts of the world, including China, Latin America, and Africa, where Internet Telephony providers are successfully meeting this challenge -- cost-effectively carrying as much international transit voice traffic as all but the top 20 traditional carriers worldwide, to over 230 countries and territories.

The tipping point in this deliberation is often reached as regulators consider Internet telephony's potential as a deeper well for national revenues. International carriers, whether using Internet telephony or not, pay national carriers in destination countries to terminate calls in-country, an oft-forgotten income source for PTTs. At the same time, an increasing percentage of international calls originated by these carriers are being routed over Internet telephony networks, reducing the overall costs of transport and improving service margins. The lower prices made possible by this new transport technology also encourages more traffic, whose returns could easily dwarf the shrinking financial benefits of settlement revenues.

Perception: Internet-based Voice Infrastructures Are Not Interoperable with Existing Phone Networks

Many carriers and governments express concern about the compatibility of VoIP with their traditional or mobile phone infrastructure. The huge sunk costs associated with current phone networks require compatibility of any new service. The good news is that through interconnection with the PSTN, Internet-based communications services can be deployed seamlessly, at little or no cost, almost immediately.

Establishing an Internet telephony Point of Presence ("PoP") at any major switching location is relatively simple. The equipment usually costs less than $100,000, an upfront investment that can be defrayed or eliminated by Internet telephony providers through credits to carriers for expected traffic termination payments. VoIP equipment converts voice traffic from its traditional circuit-switched format to digital packets that can be compressed and routed over the Internet. From a traditional carrier's perspective, other than its lower cost, routing global traffic over an Internet telephony network is no different from using ordinary circuit-switched transport.

An interconnection to a VoIP PoP also offers carriers an instant global footprint, allowing a carrier to exchange traffic with the rest of the world's carriers through one highly efficient connection. The power of this new communications solution has even caused PTTs and governments to deploy IP-based voice infrastructures domestically, even locally, as needs warrant.

Internet telephony service works seamlessly, in the background, to let consumers make national or international long distance calls as they normally would - with no prefix digits to dial - while enjoying the mobile use benefits of IP-based collect or calling card services with local language prompts. Carriers can use these calling card services to penetrate new global markets and capture new service revenues from subscribers originating calls overseas, even from markets in which they have no physical presence. Internet telephony services also offer enhanced, near real-time reporting capabilities, enabling carriers more quickly to analyze their most critical international traffic statistics, including answer seizure ratios, average call duration, total traffic in minutes by day or destination, and number of call attempts.

Perhaps most exciting of all are the possibilities offered by enhanced services. Combined with local access through VoIP, Internet telephony networks are better suited than the PSTN as platforms for new, higher margin services that can deliver entirely new sources of voice traffic and revenue. These new services include mobile phone access to email and scheduling, voice instant messaging, audio conferencing, and speech recognition-enabled phone services.

Regulators increasingly understand the key role of these new technologies in bridging the digital divide. Furthermore, as these new technologies are introduced, knowledge transfer takes place as local personnel acquire new technical skills. As importantly for many developing countries, many of the enhanced services made possible by Internet telephony do not require a fully modern telecommunications infrastructure, knowledge of English or other foreign languages. In addition, speech-enabled services respond not to touch-tone signals, but rather, to the human voice. Customers without a home phone can use an inexpensive calling card to make calls from a kiosk or public telephone and thereby access enhanced services.

Perception: Consumers Will Suffer From Poor Quality

Developing markets, especially those with low telephony penetration, are often concerned that the price of adopting VoIP as a leapfrog technology is poor service quality. The surprising reality is that today, nearly all the world's largest carriers in the most highly developed telecommunications markets, including all of the largest US international carriers, use Internet telephony as part of their international service. The reason: Tier One carriers, working with Internet telephony providers, have found that VoIP service quality is now virtually indistinguishable from that of traditional transport.

Perception: Minimal Regulation Will Lead to Unfair Market Practices and Loss of Control

The decision about whether to classify Internet telephony as a traditional voice service or as a value-added service is one of the most reliable predictors of success for this bridge technology. Most countries require providers of voice services to obtain a telecom license from the government and these are issued only if new market entrants are permitted. The pre-conditions for such licenses, which can take years to obtain, may include exclusivity periods, build-out requirements, restrictions on services that can be provided, additional fees, and the establishment of a local corporate subsidiary (as well as a host of related compliance requirements). In short, the challenge of even-handed implementation and predictable rules can be difficult to meet. Classifying Internet telephony as a value-added service, on the other hand, may, but does not necessarily, entail a registration or "class license." This simpler, more streamlined approach often has few or no conditions, is granted automatically and can deliver consumers the benefits of these new services more quickly.

China, Singapore, and Thailand have all assumed increasingly liberalized regulatory positions toward Internet telephony. In a now infamous case, the Chen brothers, who began offering Internet telephony service in 1988 at half of China Telecom's rates, were jailed. With no competitive laws (or restrictions) in place, and other ministries arguing that a ban on Internet telephony would disadvantage China's economic competitiveness, the Ministry of Information Industry issued three test licenses in the spring of 1999 as an exploratory measure to assess the impact of introducing Internet telephony. Jitong Communications immediately welcomed more than 2000 prospective customers, who lined up at 2:00 a.m. to buy the first available calling cards. Jitong achieved $35 million in revenues in the first five months of this service. China Unicom attracted 700,000 IP-based customers in its first five months, while China Netcom saw 500 people a day sign up for its VoIP calling cards.

In Singapore, when regulators first considered opening that country's telecommunications market, a decision was taken to give the national carrier, SingTel, a continued monopoly until 2007. In the wake of the success of VoIP elsewhere in Asia, that regulatory position evolved to duopoly, and eventually to full liberalization. Not to be upstaged, the Communications Authority of Thailand itself offered Internet telephony prepaid calling cards to wide acclaim, with tariffs 21- 40% lower than traditional peak rates. On the regulatory front, the trend in both developed and developing markets, seems clear.

Conclusion

Light regulation encourages private sector investment in the Internet and Internet Telephony networks. Regulators have seen beyond their previously strict definition of voice telephony, perhaps recognizing that inappropriately regulating one portion of the Internet could adversely affect the growth of the entire Internet sector. As we have seen, Internet telephony is clearly emerging as a critical bridge technology and service, that is up to the challenge of spanning the digital divide - offering compelling financial and macroeconomic benefits, compatibility with existing PSTN and mobile infrastructure, and greater value for consumers. Together these qualities are turning the regulatory tide. Increasingly, regulators are seizing the moment to open their markets to new VoIP services that benefit not only their citizens, but also the national carriers and governments whose interests had previously locked the door to deregulation.

Endnotes

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Because many communications with regulators take place on a non-public basis, we do not cite their particularized determinations.

See generally "Report by the Chairman on IP Telephony;" International Telecommunications Union World Telecommunication Policy Forum, 9 March 2001.

See, e.g., Report and Order on Reconsideration and Order Lifting Stay, *In the Matter of International Settlement Rates*, IB Docket No. 96-261 (May 28, 1999).

Based on a comparison of iBasis 1H 2001 traffic with global voice traffic statistics in industry analyst publication *TeleGeography 2002*; by a similar comparison, the top two U.S.-based Internet Telephony carriers are now among the top half-dozen U.S. carriers in terms of international transit traffic. *Id.*

The explosion of Internet-based voice communications promises much more. New, hi-tech applications, also based on IP standards, can be delivered using Internet telephony networks. This year, voice web services, speech recognition applications, unified messaging, and VoIP will produce over $5 billion in revenue -- $50 billion in 2004. IDC, "Web Talk 2000," "Unified Communications, A Cut Above Unified Messaging" (2000), Voice over IP forecast (2001, to be published). These activities have the potential to produce huge growth in services and commerce, greatly increasing, not to mention producing new sources of tax revenues.

A Class 5 switch costs approximately $20 million and is estimated to handle only 20% of the traffic that IP Telephony equipment can carry, but the latter is scalable for other purposes.

Internet telephony can utilize signaling systems identical to those employed with traditional telephony. More major installations may require an international point code, which is typically allocated by the national regulator. A point code is required for several reasons. First, a point code is required to identify available international Internet pathways and to route customers' originated traffic to those circuits. Second, a point code is required to route a country's-inbound and -outbound traffic between its Internet-based international network and the domestic networks. Finally, many of the advanced functions of offerings like unified messaging may operate more efficiently with a point code. Our experience so far is that most regulators are allowing Internet telephony providers to obtain these resources on a non-discriminatory basis without significant delays or hurdles. However, a few regulators are still trying to determine how to handle this issue, which can add delays and affect investment decisions.

China, whose major carriers have leap-frogged circuit-switched deployment, is an excellent example, according to recent reports. China Netcom is laying 6,000 miles of 20Gbps IP-based fiber-optic network backbone in and to 15 cities, complete with video-on-demand capability at each desktop. China Telecom, the first to launch IP-based services, will roll out its initial network to connect 25 cities. China Unicom has already spent hundreds of millions of dollars, with the goal of installing IP gateways in 310 cities in 30 provinces.

Many countries are taking cues from the EU (Directive 90/388/EEC) that classifies Internet telephony as a value-added service and as such these services are licensed by most national regulators on a class, instead of an individual, basis. Some countries, following the U.S. example, impose no requirements. *See, e.g., Federal-State Joint Board on Universal Service*, Report to U.S. Congress, CC Docket 96-45 (April 10, 1998) and related FCC Notice of Inquiry (1999). Countries may also differentiate among types of providers. Retail providers, which provide services to the public, are typically more highly regulated and must obtain a full telecom license. Wholesale providers may, if anything, simply be required to register. China introduced competition among its licensed providers by allowing outsourced Internet Telephony solutions.

back to index

Abstract

Champions of competition have traveled the world peddling a carefully crafted deregulatory framework. The model empowers independent bodies to usher obstacle-free entry for multiple players who can exchange traffic seamlessly over cost-priced elements of the public telephone network. While these principles are beyond reproach, governments have exhibited caution. Even for countries that have signaled a willingness to adapt, even-handed implementation with predictable rules and tools can be difficult to find, much less at the business speed preached by Westerners.

While the entrepreneurial gumption of competitive providers ensures the viability of their market-opening advocacy, an uncertain regulatory climate dictates against major financial investments. Instead, competitive providers can start by getting their feet wet. Engaging gradually in the marketplace, companies can lead regulators by the hand in establishing new policy, introducing heretofore unavailable technology, and increasing access to the digital age.

Indeed, there is no driver for change that compares to the prospect of greater Internet savvy and the commercial opportunities that it brings. The introduction of Internet telephony is a case in point. This technology has spurred international and national competitive telephone service for countries whose markets are just opening.

Using the Internet and its universal, open protocols also allows the provision of other innovative voice services, benefiting even those far from the technological edge. Consider that there are an estimated 300-400 million PCs worldwide. On the other hand, there are nearly 2 billion phones. Using IP-based speech recognition platforms, any phone - from a black phone built in 1920 to the latest miniature mobile - will help bridge the digital divide by becoming an Internet-access device - with the human voice directing navigation through Internet content, messaging services, and other speech recognition interfaces.

The point is not lost on regulators, who are eager to deliver new technology and lower costs. Responding to reasonable, specific requests, these regulators are sidestepping prepared scripts and actually opening markets. Officials have allowed testing and trials of Internet telephony, created new licenses for the first time, refit old licenses to apply, established RFPs, permitted network interconnectivity, granted signaling point codes previously reserved for incumbents, endorsed Internet telephony calling cards (especially useful for those without a telephone), lowered their guard about the international settlements regime, and identified subtle nuances in considering appropriate levels of government oversight.

With the taste of increasing commerce, we believe that we can get the deregulatory ball rolling even faster.

back to index

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Jonathan Draluck is responsible for promoting the company's business interests through industry, regulatory and government channels, developing agreements with partners and customers, and providing advice on a broad range of legal issues. As a former telecommunications attorney with Swidler Berlin Shereff Friedman, LLP in Washington D.C., Draluck represented major competitive telecommunications carriers and network providers, executing foreign and domestic market entry strategies on their behalf. At Swidler, he negotiated favorable terms for network interconnection, traffic exchange, and unbundling, and advocated procompetitive positions to regulators around the world. In the firm's transactional practice, he counseled arbitrageurs and institutional investors on law enforcement actions related to pending mergers and acquisitions. Previously, Draluck litigated antitrust matters at the U.S. Federal Trade Commission, where he served as attorney advisor to the Director of the Bureau of Competition. Here, he also worked in Bucharest as an advisor to the Romanian Ministry of Finance on the implementation of that country's first competition law. Draluck holds a degree in Political Science from the University of Pennsylvania and a J.D. from Emory University School of Law.

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back to index

The Future of USOs: Making the USO Relevant in Bridging the Digital Divide

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View Abstract

1. Traditional universal service and universal access policies

Universal service and universal access policies were initially designed to encourage telephone service take up and usage, and to achieve initial benefits associated with network effects and the significant incremental utility improvement of additional subscribers in the growth phase of networks. It was based on the notion that there is national value in all being connected to the network, because cost recovery could be achieved faster under mass service take-up conditions.

The key issue has always been affordability of access. Access was traditionally subsidised through usage charges.

Access was also cross subsidised internally through connection and service tariffs set at equality or with limited difference ranges. This meant that customers in areas where access and on-going network costs were highest were not thereby excluded from service. Tariff averaging addressed their circumstances.

Universal service extended beyond dedicated services — it typically covered the provision of public telephone services (payphone services) — it therefore extended to access. Universal service and access policies are therefore socially and economically inclusive policies in every sense.

2. The key challenges for universal service and access

The traditional challenges for universal service and access relate to the means of providing service to uneconomic areas and to uneconomic customers. The mechanisms for delivery were underpinned by the monopoly conditions in the industry. Only in monopoly circumstances could the levels and extent of cross-subsidy be maintained.

More recent challenges relate to the sustainability of universal service policies in a multi-carrier, competitive environment, where competition in profitable markets has reduced the sources of cross subsidy revenue. Consequently new means have had to be devised to ensure that universal service schemes can continue to be funded. These have ranged from voucher systems (enabling the customer to shop around for service) to industry contributory funding schemes to capital grants from national budgets.

3. The role of Government

The role of Government was initially to direct the monopoly enterprise in its provision of services, through ownership and/or regulation. This model is no longer appropriate in an era of carrier competition and increasing privatisation.

Various new or updated models have been developed for the provision of universal service in the competitive era, with modified roles for Government, including:

- In relation to services to uneconomic areas
  - Provision of funds through national budgets, whether once only or on-going
  - Management of a universal service fund, whether directly, through the regulator, or through a specially established body
  - Carrier and operator contributory mechanisms
  - Establishment of competitive structures for service provision.
- In relation to services to uneconomic customers
  - Development of 'Lifeline' service programs
  - Rebates for specific classes of users — e.g. State pensioners.

Governments have recognised the need to act cautiously to avoid distorting competitive markets in the process of seeking suitable universal service outcomes. On the other hand, they cannot move from one scheme for universal service provision to another without ensuring service continuity. This has led to many incumbents carrying the burden of past policies for longer than appropriate, as in the case of NTT in Japan.

4. The challenge of broadband for universal service

To be part of national and international market places in the future and to fully participate in the e-culture that is developing, all citizens will need ready access to broadband services. The term, 'digital divide', is becoming increasingly used to describe the haves and the have-nots in relation to access to digital telecommunications services.

The have-nots will become increasingly economically and socially disadvantaged as societies build their fundamental patterns of interaction around services that are delivered on-line. Legacy service delivery systems will become increasingly costly as they support fewer and fewer people and businesses. The commercial imperative will be to seek recovery of higher costs or to discontinue the services altogether. Regional Australia can testify to the withdrawal of services based on physical branch structures in banking and finance, government, retail, etc.

Broadband access will be increasingly required in future to access suppliers, markets, community resources and services in the most cost effective ways. Without such access, the disadvantages of remoteness or social position are compounded.

5. The need for broadband access to be ubiquitous

The need for ubiquity is not just at the network infrastructure or operator levels. The need relates to the requirements of online commerce and of the information society of the future. The costs of multiple transaction arrangements are high. B2C e-commerce systems are typically looking at a single model for interaction to maximise the advantages and to minimise their own customer transaction costs. As noted, legacy arrangements will become increasingly expensive to maintain, with consequences for transaction prices or, in time, for the continuation of such services.

6. Finding the right mix of broadband technologies

Governments and regulators do not consciously pick winners in technologies, any more. They seek to permit the market to choose technology mixes

In the medium term the mass broadband market (households and SMEs (Small and Medium Enterprises) will be served by cable and DSL (Digital Subscriber Line) — the mix will depend on

- quality of copper loops
- ubiquity of cable services
- regulated ULL (Unbundled Local Loop) price and delivery framework.

Increasingly, governments see their prime role as the creation of a regulatory system that delivers a competitive and sustainable wholesale market for the optimum provision of broadband services. Such regulatory systems permit competitor access to bottleneck resources on fair and reasonable terms, without being a disincentive for network investment.

7. Models for universal broadband service

There are many overlapping models for governmental and regulatory intervention:

- Model (1) - Adding broadband to existing service definitions for USO purposes
- Model (2) — Sponsoring and funding infrastructure
- Model (3) - Regulating for availability and prices
- Model (4) - Targeting special areas for implementation

- Model (5) - Government becoming a lead customer.

Many countries have hybrid mixtures of these models.

8. Model (1) — Adding broadband to existing service definitions for USO purposes

Australian experience

One example of adding broadband to pre-existing lists of services for USO purposes is the Australian DDSO — or Digital Data Service Obligation, introduced following review in 1997. The DDSO obliged the universal service provider (Telstra) to establish a digital data capability (effectively, 64 Kbps ISDN) Australia wide by 2000, and to provide service to all who require it. The price for such services was not established, and is a matter for negotiation between the parties. The Government made available direct support to customers who apply for it.

A major difficulty with this approach is that the service in question — ISDN — is a relatively expensive one, and provides limited bandwidth. The high speed Internet access requirements of the immediate future are hardly going to be satisfied by basic rate ISDN.

Korean experience

Korea Telecom is well into the implementation of an ambitious program to rollout DSL services to effectively all households, and to achieve a 70% penetration rate — over 20 million services — by the end of 2002. At present take-up exceeds 5 million. Korea Telecom is achieving this dramatic result by offering clear additional value — broadband high speed internet access to information and entertainment (games) — for effectively the same price as narrowband telephony service. The value proposition is clear and irresistible. Korea Telecom is backing its ability to convert the customer base into substantial profitability at an early time.

Issues

Adding broadband to the USO may be a useful first step in fixing an obligation for service provision. But issues associated with price and applications are not so easily solved. Without substantial applications to act as incentives for take-up, customers need to examine value in terms of price. In Korea, a low incremental charge together with entertainment applications, meets those requirements. Elsewhere, the trade-offs are less clear.

9. Model (2) - Sponsoring and funding infrastructure

Once only cost contributions

Once only cost contributions have been adopted as a solution to the provision of service in a number of countries. For example, Chile adopted the approach of providing one time only capital grants from the national budget for the extension of the national infrastructure and services to areas not served, during the 1990s. The goal in the case of Chile was the provision of on-going telephony service to the areas selected, with competition for the right to serve.

A similar approach has been adopted in the case of Australia. From the part sale of the incumbent operator, Telstra, the Australian Government has set aside a $A 1 billion fund to assist with the development of additional and alternative infrastructure in regional areas. The fund is known as the Regional Telecommunications Infrastructure Fund. Funds have been made available not only as contributions to the initial capital requirement, but also to pay for professional assistance to communities to prepare business case assessments for projects.

Other Government initiatives in the Region are associated with the focused development of a particular facility or a particular location, to establish a critical mass of innovation and development.

The Singapore government has funded the development of Singapore One, the country's high speed backbone network, designed to support industry in its development of broadband and multimedia applications.

The Malaysian government has funded the Multimedia Super Corridor, and the development of Cyberjaya in the Klang Valley south of Kuala Lumpur, as part of a plan to create a concentration of ICT development activity that will achieve critical mass sufficient for sustaining itself in the longer term. The approach is supported by the sound theory that fragmented efforts across the country, that are not co-located in any sense, are unlikely to produce an indigenous industry capable of holding its own on a global level.

Issues

Sponsoring infrastructure may be useful, especially if commercial considerations by individual firms might result in delayed or under-dimensioned facilities. Such initiatives may result in stranded services and facilities if provided on the basis of poor business cases, or well in advance of potential need. A 'build and they will come' approach, alone, cannot be an adequate national broadband strategy.

10. Model (3) - Regulating for availability and prices

Most Governments are content to facilitate availability of broadband access at this stage, rather than to further regulate access prices. The exception is Korea, where the government has encouraged Korea Telecom to roll out ADSL on a rapid basis, and to do so at low incremental prices relative to narrowband access. In consequence, there is little incentive not to take up the offering.

It is arguable that the piecemeal funding of additional local infrastructure, as in the Australian RTIF programs, and regulation that enables cost based access to bottleneck infrastructure by competitors, creates a powerful barrier to broadband investment, particularly in small town regional and rural areas. In these locations business cases are already fragile, without the additional uncertainty of publicly funded non-commercial involvement.

Consequently, regulation and Government intervention can impede the rollout of broadband infrastructure and services on a commercially viable large scale, notwithstanding intentions to the contrary.

The Australian approach of offering direct subsidies to ISDN users in regional and rural areas has also been unsuccessful, with only 74 applications in 2 years. In principle, however, such arrangements might work under other conditions — such as in the case of the US schools and libraries program.

Issues

Regulatory intervention for the provision of narrowband services on a universal basis has generally delivered results because it leverages off the high levels of total community service penetration — initially in the form of cross subsidies, and, in a multi-operator environment, through industry contributions. That model is not available for broadband. Regulation at this time, in advance of the critical mass of applications for all market segments, is likely to fail. Many commentators see Government intervention as needing to address demand side factors, rather than just supply.

11. Model (4) - Targeting special areas for implementation

Specific programs have been adopted to target and contribute to the funding of broadband service provision to community facilities that have a mass user attraction. The US schools and libraries program has been very successful in this respect. It specifically addresses the development of skills for the future by focussing on two critical categories of community facility.

12. Model (5) - Government becoming a lead customer

A further model, that may be pursued in conjunction with others, is for the Government to link its telecommunications purchases not only to the provision of services for its own activities, but for the community at large. Typically this model involves a base load of government business sufficient to warrant investment in infrastructure to handle that additional business as well as the load contracted.

A number of Australian states have adopted this approach — including Victoria with its Vic One initiative for providing high speed connections to all regional communities in the State with police stations and schools. South Australia has also permitted private sector organisations to buy services at prices in its contract schedules.

Issues

The development of market economies means that the economic role of Government is reducing, although it still accounts for a material proportion of telecommunications spending, particularly in rural and regional locations. Government has a dilemma. It needs to consider trade-offs between —

- efficient purchasing and lowest cost delivery of its own programs
- industry development
- interfering in potentially competitive markets
- reducing opportunities for other entrants to provide services.

Results to date suggest that governments have not been effective in the long term in these interventions.

13. Evaluation

Progress is piecemeal

There is no one model for universal provision of broadband services. In this there is a similarity with narrowband universal service schemes. However, in the case of narrowband, there are mature and well recognised models — but these have yet to develop and to bear fruit in the case of broadband.

Dependence on Government

All of the models are dependent on Government — either as facilitator, lead user or financier. This is not surprising, given that clear and sustainable business cases are likely to attract private sector investment, even in the current economic climate. Broadband rollout is still on-going in metropolitan central business districts without government assistance. Heavy dependence on Government is a problem for the future commercial sustainable of regional initiatives.

Commercial sustainability

Publicly funded stranded assets are an unfortunate characteristic of regional development programs. Invariably some business cases were too fragile to withstand changed circumstances — including changes in government funding priorities.

In the case of broadband services, sustainability is considered to be dependent on

- network effects
- new applications (likely to be a range rather than one)
- increasing popular commitment to e-commerce.

All of these things are likely to come about in due course, but there is no guarantee on timing or scale. Commercial sustainability is a matter of chance. That national well-being is considered to be at stake does not, of itself, improve the chances.

14. Matching models to circumstances

All of the models listed above have the capacity to assist in regional broadband service delivery. All have limitations and accompanying issues. The models are non-exclusive and can be used in any combination.

The figure below suggests the circumstances in which each model might have best effect.

Model	When to use	When not to use	Who is using*
(1) Adding broadband to USO service definitions	When substantial infrastructure is in place or committed When funding has been determined When obligations of all parties are clarified Possibly under effectively monopoly conditions.	When seeking to encourage voluntary industry investment for broadband access When narrowband network access is not ubiquitous — that is, under 30 per 100 population in all areas If this is the only action that will be taken	Australia — in relation to ISDN 64 Kbit/s service Korea — effectively in the case of ADSL
(2) Sponsoring and funding infrastructure	When there is a rigorous business case that has been independently assessed When there are genuine concerns that competitor access to privately funded infrastructure will be denied	When there is material risk of destroying commercial investment initiatives	Australia — at federal and State levels Malaysia Singapore

(3) Regulating availability and prices	When broadband services and applications are mature and lack competitive market controls When uneconomic areas will fall behind metropolitan and other areas — regulating for equity	When regulatory structures are immature and non-responsive to changing conditions of demand and supply	Australia — availability of ISDN Korea — effectively regulating for both in the case of ADSL
(4) Targeting special areas for implementation	When there is a need to build critical mass for future growth sustainability Where the target has community multiplier effects	Where private initiatives are likely to be displaced Where private initiatives are unlikely to deliver uniform or certain outcomes	Australia Malaysia Singapore United States
(5) Government becoming a lead customer	Where the benefits are purely collateral to effective government purchasing (else there will be hidden subsidies)	Where actual or potential competition dynamics are at risk of being undermined	Australia — some States

Figure 1. Circumstances for each broadband USO model

Note: * Examples
Source: Ovum

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15. The consequences of failure — increasing the digital divide

Determining the appropriate role of Government in making broadband services available to all, and deciding on the appropriate mix of policy instruments to do this, are not trivial matters. There are substantial risks that almost any action will have collateral effects, and may not only facilitate delivery of services, but influence the effectiveness of competition and other market means of providing longer-term sustainability.

The consequences of failure are serious. The most important consequence of failure may be to increase the digital divide — to exacerbate the difference in economic capabilities of groups and communities within society. The likely consequence will be continued urbanisation and continued rural and regional impoverishment.

Another consequence is to delay the economic benefits of e-commerce to all. As broadband service infrastructure underpins the delivery of e-commerce services and supports on-line transactions, firms will have increasing incentives to manage their costs down by supporting one means of dealing with their suppliers and customers. If they are constrained to transact with fringe customers and suppliers in areas unserved by broadband, they will incur heavy cost penalties. Scale benefits will be denied. The result will be either reduced national competitiveness, or reduced service to those on the fringe. In the latter case, the practical effects of the digital divide will be manifest.

The various initiatives to date also raise the fundamental issue — namely, whether the USO framework remains appropriate as a national policy instrument for achieving economic and social objectives in the broadband era.

back to index

Abstract

USO policy was conceived in the era when the prime purpose of telecommunications was to deliver telephony grade service. This is not today's world. In 2002 all countries recognise that, to a greater or lesser extent, they are part of a global economy that is connected and functions through digital connectivity. Access to the Internet and to e-business environments is important for global, national and regional competitiveness, and will become more so. The paper will explain the nature of the digital divide and examine the consequences of it widening. The primary thrust of the paper, however, is to examine national policy initiatives, particularly in the Asia Pacific, for extending USO frameworks to include broadband access. The paper offers an assessment of various initiatives and of their likely success in achieving equitable access to the Internet in the longer term.

back to index

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Jim Holmes is a Principal Consultant with Ovum based in Melbourne. He joined Ovum after 31 years in senior management positions in the public sector, the telecommunications industry and the electricity industry.

Prior to joining Ovum Jim was the Executive Manager, Business Development and Executive Manager, Corporate Strategy in the Victorian electricity transmission organisation, PowerNet. In those capacities he was responsible for regulatory design and development, including participation on behalf of the State of Victoria in the development of the National Electricity Market and its regulation via an industry code. These assignments extended over three years.

Prior to that Jim held a number of senior executive positions in Telstra and its predecessor organisations, including assignments as Directory, Regulatory Affairs and Corporate Secretary. Prior to the establishment of the independent telecommunications regulatory agency, Austel, in 1989, Jim was responsible to the then Telecommunications Commission as the internal regulator, and in that capacity was responsible for the effective and successful liberalisation of the customer premises, customer cabling, value added service and private network sectors of the industry, and the development and implementation of local industry development obligations on private sector participants in selected, critical segments of the customer premises market.

Jim has consulted to incumbents, new entrants, investors, policy makers and regulators in Australia, the Asia Pacific and elsewhere - covering investment analysis, strategy determination, policy and regulation, marketing and pricing, and scarce resource management.

Jim is a graduate of Sydney, Melbourne and Monash Universities with degrees in the humanities and law.

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back to index

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Morley Winograd is an internationally recognized authority on the impact of technology on life and work. He is the co-author of Taking Control: Politics in the Information Age (Holt, 1996), the first book to identify a new type of voter, "wired workers," whose values, derived from their experiences with technology, would become the driving force in changing American politics. In December 1997, he was asked to apply those ideas to the task of reinventing the Federal government, as Vice President Gore's Senior Policy Advisor, National Partnership for Reinventing Government. Since then, governments in Italy, Mexico, Israel, Costa Rica, and Argentina have asked Winograd to help with their own reform efforts. His lectures on the topic of technology's reshaping America have won wide praise in forums as diverse as the Commonwealth Club of San Francisco, Los Angeles' Town Hall, Harvard's JFK School of Government, and Bologna University's John Hopkins School of International Affairs.

Prior to his work in government, Winograd spent eighteen years with AT&T, retiring as a Regional Vice President for Commercial Markets. Prior to that assignment, he was President of AT&T's University of Sales Excellence, a two-campus corporate training center that he reshaped into a university environment. His innovative approach was recognized in management training books such as Stewardship, by Peter Block, and The Monster Under the Bed, by Stan Davis and Jim Botkin. He also served in a number of other sales and marketing positions with both Michigan Bell Telephone and AT&T.

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back to index

Everyone sees the importance of closing the digital divide, defined as making universally available the networked digital technologies of the information age. The only real point of disagreement can be about how to accomplish this goal, not its intrinsic desirability. I would like to suggest the value of examining some historical experiences on how we have attempted to close this divide with other technologies to see if there are lessons to be learned for our policy approach to the newest technological necessities.

Of course none of the technologies start out as necessities. They only become so as their value to those using them becomes clear to the rest of the world. But we are already past that stage of development with networked digital technologies. I am old enough to remember when this was just beginning to be true of one ubiquitous technology of today--Television. Today in the US TV penetration is estimated to be 98% of all households, as close to universal service as we are likely to see for any technology.

Much earlier than that, and certainly before I was born, another technology was becoming clearly a necessity, namely the telephone. But to get past the conflicting claims of different devices and standards and to create enough certainty about its ultimate success that would make investors willing to part with their money, the founder of my former employer, Alexander Graham Bell, argued for the need for government regulation to rationalize the marketplace. Eventually he won this argument in return for guarantees of universal service. That required subsidizing the least profitable ends of the network by those with the most economic interest in using it. The result? After about a hundred years, in the United States, 94% penetration is about as far as we have ever gotten.

So what lessons can we draw from these two experiences? Many people suggest it means we would be better off letting the market take care of the issue of the digital divide rather than using government regulation to get to our goal. I think that is too simplistic a reading of history. Rural deployment of voice telephony would not have achieved the penetration rates it did without some kind of government subsidy. That idea may have served its purpose well and may no longer be as important as finding a way to provide broadband access to similarly situated customers, but its impossible to ignore the positive role government played in making it happen.

TV was a different kind of technology and did not have the drawbacks of needing fixed investments to each home in order to complete its network reach. It used the airwaves and household devices with antennas to capture the content; thereby gaining the penetration it has today. The infrastructure of TV towers and programming content was an attractive investment for the private sector because of the oligopoly they were granted in spectrum. The household device, or television set, was purchased for increasingly lower prices and higher quality because, once the technological standards were set for receiving the network signals, the market was free to innovate and advance the technology based on real customer requirements.

There are other lessons we can learn from TV's deployment. First, it's a product that people wanted to buy because of the services it provided. It began with community demonstrations, much like today's plans for deploying kiosks in community centers and libraries, and rapidly spread to first adopters who couldn't wait to have their own access device. But as rapidly as devices were deployed, the content and value of what a household gained by buying the technology was able to keep pace, thereby assuring continuing penetration levels.

Secondly, TV networks were able to take advantage of a de facto oligopoly in broadcast spectrum to build out their infrastructure and to use a business model of consumer advertising to recover the cost of deployment. Before we automatically leap to the idea of government subsidies or tax incentives to close today's digital divide, we ought to look at a less expensive way to attract investments, namely monopoly or oligopoly franchises that expire after the investment costs have been recovered.

This historical example provides many insightful lessons on how to close the digital divide. Create a product whose usefulness, not its technology, is so powerful that everyone wants to have one. Then find a way to have the end user absorb only the cost of his/her own access device, which is not predefined except for the minimal technological requirements necessary to make it interoperable. Finally give content and infrastructure providers the economic incentives they need to deploy the technology. If we can put that model into action, the digital divide will close quickly and universal market penetration will soon be a reality.

back to index

$ Economics & Financing

Tuesday, 15 January 2002
1100–1230
Tapa III

T.1.6 Strategic Issues of Submarine Cables and Network

Co-Moderators:
STEVE MCCLELLAND, Editor-in-Chief, Telecommunications International, *United Kingdom*
THOMAS SOJA, President & CEO, T Soja & Associates, Inc. (TSA), *USA*

Panelists:
FIONA BECK, President and CEO, Southern Cross Cable Network, *Bermuda*
SCOTT DAVIES, Executive Director, Macquaries Bank, *Australia*
JEAN GODELUCK, CEO, Alcatel Submarine Networks, *France*
EDWARD MCCORMACK, COO, FLAG Telecom Ltd, *United Kingdom*
ALAN ROBINSON, Vice President, Global Operations Engineering Services, Cable & Wireless, *United Kingdom*
STÉPHANE TÉRAL, Director, Optical Transport, Ryan Hankin Kent (RHK), *USA*
BRIAN ROUSSELL, Vice President, Sales & Marketing, Tycom Ltd., *USA*

back to sessions

Policy / Regulatory

Tuesday, 15 January 2002
1430–1600
Tapa III

T.2.6 Quantitative & Qualitative Elements in Bandwidth & Spectrum Planning

Chair:
GREGG DAFFNER, President, G3 Global Communications Consulting, *USA*

T.2.6.1 Capacity Risk Management Using Real Options (View Abstract)

YANN D'HALLUIN, PhD Student and PETER FORSYTH, Professor, Dept. of Computer Science and KENNETH VETZAL, Associate Professor, Centre for Advanced Studies in Finance, University of Waterloo, *Canada*

T.2.6.2 Beyond Transport: Comprehensive Bandwidth Solutions (View Abstract)

ANDY KOWALIK, Director of Strategic Information; MARIA DELA CRUZ, Senior Manager, Strategic Information and DAVE GERHART, Senior Manager, Capacity Planning, Tyco Telecommunications, *USA*

T.2.6.3 The Bandwidth Tsunami, Network Innovation and the Evolution of Bandwidth Markets (View Abstract)

ANDREW SIMPSON, Registered Foreign Lawyer, Arculli & Associates, *Hong Kong SAR, China*

Presenter:
PETER WATERS, Partner, Arculli & Associates / Gilbert & Tobin, *Hong Kong SAR China*

Capacity Risk Management using Real Options

Y. d'Halluin, P.A. Forsyth, and K.R. Vetzal
University of Waterloo
Canada

View Abstract

1. Introduction

In the past, bandwidth was traded infrequently, with deals taking months to complete. Performance which can be monitored in terms of packet losses, and response time (ping times) was rarely considered. However, in May 1999 Enron proposed the development of a global bandwidth commodity market. The concept of a pooling point where bandwidth market players could settle contracts in a matter of seconds was introduced. Today, long-term contracts (e.g. indefeasible rights of usage or IRU) are being replaced by shorter-term contracts, and bandwidth is moving toward being effectively traded on demand. Bandwidth is well on the road to become the next large commodity market. With a forecasted notional size exceeding $1 trillion annually [4], the bandwidth market is expected to become similar in size to large commodity markets. However, the bandwidth market is still in its infancy and good data does not yet exist.

The volatility present in the demand market for capacity requires the development of risk management and investment decision systems. As in most corporate investment decisions, timing is crucial in a competitive market. The traditional approach of valuing an investment, which consists of using the net present value (NPV) rule to decide whether to invest, ignores the possibility of flexible decision making in response to market conditions. As an alternative, the real options approach [1] can be used to effectively model investment flexibility.

In this paper, we apply a real options framework to the problem of the optimal timing investment into new capacity. The outline of this paper is as follows. Section 2 describes the modeling framework. In Section 3 we present the mathematical model and introduce an upgrade decision algorithm. Section 4 contains different simulated results and conclusions are provided in Section 5.

2. The risk factor in Capacity: Demand

When discussing the fall in bandwidth pricing between 1996 and 2000, David R. Huber, founder and CEO of optical upstart Corvis Corps noted that "if BMW could do that you could buy a new BMW for $2.50" [6]. Two reasons can explain the rapidly falling price. First, the recent deregulation in the telecommunication market has put pressure on network providers and consequently, they have to reduce margins to remain competitive. Second, large network operators are trying to keep prices low in order to reach network utilization levels at which they can begin to be profitable. They have to get enough network traffic or utilization to cover the fixed costs of network building and operation.

Consequently, the fundamental factor driving profitability is the amount, which can be sold, as opposed to the price received per unit. The owner of an optical fiber network faces this type of situation. New wavelength services allow the user to purchase limited capacity for days or even hours. Effectively, users pay only for the bandwidth they use. The revenue to the owner of the network is determined by the prevailing price and the amount used (demand for capacity). A study of the bandwidth market reveals some interesting facts. Our estimates of volatility are in the range of 80-150% per year (see Figure 1). This can be compared with a volatility of 20-40% per year for most major stock market indexes. This phenomenon is in fact typical of computer components. The relentless developments of technology decrease the costs while demand increases exponentially. An example of this effect can be found in storage media. The price per megabyte of disk drives has decreased exponentially. Investment in a disk manufacturing plant is profitable as long as technological improvements, in terms of the cost per megabyte, decrease quickly and the demand increases sufficiently rapidly.

This situation is in contrast with traditional financial markets where the price and not the demand is the dominating factor (in other words, in financial markets it is almost always assumed that demand curves are perfectly elastic). Demand for capacity is, in our opinion, the largest uncertainty in bandwidth investment. Consequently, investment decisions should be valued based on demand.

3. Model

The value of any corporation is primarily determined by the quality of the investment decisions made by that firm. Poor decisions can damage a business sometimes irreparably. Traditionally, corporate investment decisions have been analyzed using techniques such as net present value (NPV) or the closely related concept of internal rate of return. In some situations, these decision criteria can be quite misleading.

According to the NPV decision rule, an investment should be realized if it has positive NPV, i.e. it is worth more in present value terms than it costs. Of course, if the NPV is negative then the investment should not be made. However, this analysis is fundamentally static in nature in that the investment is either made now or not at all. In a highly uncertain environment like bandwidth, there may be a third possibility: waiting and deciding whether or not to invest later on, after some uncertainty has been resolved. This is what real options are used for.

The real options approach builds on the ideas of financial option valuation. Corporate investment decisions can be viewed as analogous to financial options. A firm confronted with a choice of whether to invest faces a decision like that of the holder of a financial option choosing whether or not to exercise it. To apply real options, we need estimates of parameters analogous to those for the Black-Scholes financial option valuation model [2]. The exercise price of a real option is simply the cost of the investment. The value of the real assets obtained from making the investment corresponds to the price of the underlying stock. Likewise, we need a discount rate, a time period during which the option can be exercised, and a measure of the risk of the project. It is important to note that while it is sometimes straightforward to apply financial option theory to real options, at other times the complications intrinsic to real options render the valuation very difficult.

3.1. Mathematical Model

The related field of *real options* extends the basic ideas of option pricing to corporate investment decisions. Every option has some defining characteristics and we need to consider the following for our application:

- An **expiry date** (e.g. six months): last date at which you can use (exercise) your option. However, note that some options have multiple possible exercise dates.
- An **investment horizon**: time at which all equipment is written off, and the value of any contracts/rights is converted to cash.
- A **strike price** (X): price at which one party has agreed to pay the other party when the option is exercised.

An underlying random factor determines the value of an option contract as an investment. For liquid commodities, this is usually the price. However, we will consider usage (see Section 3) to be the underlying factor. In order to use this factor we need to show how we can model the demand for capacity over time (see Figure 1).

Let Q be the variable representing the demand for capacity. Mathematically, the different paths followed by the demand (see Figure 2) can be modeled as

$$dQ = \mu(Q, y, \overline{Q})Qdt + \sigma(Q,t)QdZ$$

Equation 1

where μ is the drift rate or growth rate, σ is the volatility, dZ is the increment of a Wiener process and $\overline{Q}$ is the maximum capacity in bits per second that can be sustained by a line (e.g. OC-3, OC-12, and so on). The Wiener process can be thought of as

$$dZ = \Phi\sqrt{dt},$$

Equation 2

where Φ is a random variable drawn from a normal distribution with mean zero and unit variance. The degree of randomness in equation (1) is determined by the volatility σ. Note that in the absence of randomness (σ = 0),

$$Q = Q_0 \exp(\mu t),$$

Equation 3

where Q_0 is a constant.
Based on hedging arguments (see [2,3]), a partial differential equation for the value of an investment $V(t,Q,\overline{Q})$ is found to be

$$\frac{\partial V}{\partial t}+\frac{1}{2}\sigma^2 Q^2\frac{\partial^2 V}{\partial Q^2}+\left(u(Q,t,\overline{Q})-\kappa\sigma(Q,t)\right)\frac{\partial V}{\partial Q}-r(t)V=0,$$

Equation 4

where κ is the market price of risk for investments with values determined by the demand for capacity Q and $r(t)$ the interest rate. This variable will hereafter be referred to as the ``telecom market price of risk." Essentially, this captures the tradeoffs between risk and return for contracts that are dependent on Q.

In the pricing of financial options, the price of the option at the expiry date is known (as a function of the underlying stock price). But, the price of the option before expiry is unknown (and that is what we would be attempting to determine). In our case, we consider an investment horizon T. Mathematically, we then have

$$V(Q,T,\overline{Q})=f(Q,\overline{Q}).$$

Equation 5

Although the method discussed in this paper can be used with arbitrary $f(Q,\overline{Q})$, for simplicity we will restrict our attention to the case where the value of all capital investment at T is assumed to be zero.

$$f(Q,\overline{Q})=0$$

Equation 6

We will take this investment horizon to be T = 5 years. This may be somewhat pessimistic, but in a rapidly changing field such as telecommunications, this is probably an appropriate length of time to consider.

Since the solution of the value of the investment is known at t = T, the forward equation (4) is transformed into a backward equation by substituting t = T - t which evolves from the investment horizon date T to the present date. Equation (4) becomes

$$\frac{\partial V}{\partial \tau}=\frac{1}{2}\sigma^2 Q^2\frac{\partial^2 V}{\partial Q^2}+\left(u(Q,\tau,\overline{Q})-\kappa\sigma(Q,\tau)\right)\frac{\partial V}{\partial Q}-r(\tau)V.$$

Equation 7

Consider a set of lines Q_i with maximum transmission rate $\overline{Q}_i$. For example $\overline{Q}_1$ could be an OC-12, $\overline{Q}_2$ an OC-48, and so on (see Figure 3). Let V_i be the value of an investment in a line with capacity $\overline{Q}_i$. We seek to

- solve a set of PDEs (7) for lines, i.e.

$$\frac{fV_i}{f\tau} = \frac{1}{2}\sigma^2 Q^2 \frac{f^2 V_i}{fQ^2} + \left(\mu(Q,\tau,\overline{Q}_i) - \kappa\sigma(Q,\tau)\right)Q\frac{fV_i}{fQ} - r(\tau)V_i$$

Equation 8

We assume that the owner of the line receives discrete payments, e.g. on a monthly basis. At each payment date τ_p the investment generates cash flow. We have for line i of maximum transmission rate $\overline{Q}_i$

$$V_i(Q,\tau_p)^+ = V_i(Q,\tau_p)^- + \Pi_i(Q,\tau_p)$$

Equation 9

and

$$\Pi_i(Q,\tau_p) = \min(Q,\overline{Q}_i)P(\tau_p) - M_i$$

Equation 10

where $P(\tau_p)$ corresponds to the revenue per megabits per month per mile and M_i is the maintenance cost in dollars per bit per second per mile. $\Pi_i(Q,\tau_p)$ represents the cash flow at each payment date (e.g. monthly). This is simply the difference between the payment received and the maintenance cost (which is assumed to be constant). The payment received can be no larger than the maximum transmission rate $\overline{Q}_i$ of line i multiplied by the price.

We assume that the price $P(\tau)$ is a known decreasing function of time [4], hence we will use $P(\tau) = P\exp(-\alpha(T-\tau))$, where P is the spot price. This is measured in dollars per month per mile per bit per second of the line with the lowest transmission rate among the set of lines that we are considering. In our case, this is an OC-12 line (see Figure 3). α is a decay parameter which determines the rate at which the spot price decreases with time. Note that we require that the spot price be the same across the various possible lines at any point so as to avoid arbitrage. For example, if the spot price of an OC-48 line was less than that of an OC-12, we could buy capacity of an OC-48 line and then immediately sell it at the OC-12 spot price.

We solve the optimal decision problem using a dynamic programming approach. Essentially, we solve the PDE's (8) backwards in time (τ increasing) and determine the optimal decision at each cash-flow date. Consider the lines ordered as i = 1, ..., n where $\overline{Q}_{i+1} > \overline{Q}_i$ (see Figure 3). At each online date τ_{up}, we solve two problems V_i and V^*_i, where V^*_i denotes that the line i is upgraded during $\tau_{up} + \tau_{notice}$, and no revenue is produced during that period of time. Solving back to the decision date τ_{notice}, we then determine the optimal action, by comparing the value of the line if nothing was done and the value of the line if it had been upgraded to higher capacity, minus the upgrade cost $K_{i\to j}$. $K_{i\to j}$ is the cost of upgrading from line i of maximum transmission rate $\overline{Q}_i$ to line j of maximum transmission rate $\overline{Q}_j$ of line i multiplied by the price.

Note that the above algorithm allows for the possibility that it may be optimal to jump several levels of capacity when the demand for capacity Q is very large or the cost K is low. Also, note that we are not assuming that the upgrade is instantaneous, i.e. when the decision to upgrade is made; the line is out of service for some finite time (e.g. up to 90 days). No cash revenue is received during the downtime.

4. Results

In this section we conduct a sensitivity analysis of the optimal decision to upgrade to the different model parameters. Unless specified otherwise, we are solving for a 5-year investment option, with monthly payment and quarterly investment decisions. We consider the Toronto/New York City pair, which is 550 miles apart. We study the optimal investment strategy for four different transmission rates: OC-12, OC-48, OC-192 and OC-768. The upgrade costs are assumed to follow the same decreasing curve as the revenue per month per Mbps, thus we will use the same decay factor α (see Table 1) as for the spot price per month per mile per Mbps, i.e.

$$K_{i\to j} = K_{i\to j}^{0} \exp(-\alpha \tau)$$

Equation 11

where $K_{i\to j}^{0}$ is the upgrade cost from line i to j. Parameter values (see Table 1) obviously will have a large impact on our computed results. Parameter estimation is complicated by the fact that the bandwidth market is still at its infancy and past data is limited.

We begin by considering the issues raised by the optimal decision scheme. Anecdotal evidence suggests that upgrades occur when usage reaches about 50% of the maximum transmission rate. We found that the minimum upgrade percentage found is around 62% for an OC-192 line. Moreover, we found that, given our input parameters, it is better to upgrade to the maximum transmission rate attainable (i.e. OC-768) than to upgrade to the intermediate OC-192 line when considering an OC-48 line. This also appears to be in contradiction with the common conception that upon upgrading we should go to the next available transmission rate. This contradiction with practice comes from the high degree of uncertainty existing in the demand for capacity. Intuitively, this means that it is worthwhile waiting to see how the demand evolves and then upgrade to the maximum transmission rate line we can build (e.g. OC-768) at that time. It can be optimal to upgrade an OC-48 line to an OC-192 line, but in this particular case it is optimal to wait until demand is at 98% of an OC-48 transmission capacity and then to upgrade directly to an OC-768. We emphasize that the results indicate that it is better to wait until the maximum capacity of the line is reached, and then upgrade to the highest transmission rate possible, rather than to upgrade incrementally at lower usages. This is due to decreasing upgrade costs (with time) and the uncertainty due to volatility in usage.

Next, we tried to reconcile what telecom operators were doing in practice (i.e. update at 50%) and our results. We found that in order to achieve this upgrade percentage we had to either increase the growth rate of demand or decrease volatility. In both cases the numbers used for growth rate of demand and volatility were too unreasonable to make sense. Consequently, due to the uncertainty in demand, we observed that it might be optimal to wait until the maximum capacity for a line is reached before upgrading. Essentially, this is because a sudden increase in usage may be a random event and may not be sustained. However, at high level of capacity, there will be many times when the demand for capacity exceeds the maximum capacity available.

Up to now, we have ignored any detrimental effects due to network congestion. We remark that some European operators have contracts where performance is guaranteed, i.e. slow packets are delivered free. As well, a congested network may drive customers to other bandwidth suppliers. We modeled these effects in a simple way. We assume that if the demand for capacity exceeds the maximum transmission rate available by 20%, revenue is reduced to zero. Again, we could view this as a penalty factor introduced into contracts or a penalty for producing customer dissatisfaction. The new revenue function is given by

$$V_i(Q,\tau)^+ = \begin{cases} V_i(Q,\tau)^- + \min(Q,\overline{Q}_i)P(\tau_p) - M_i & \text{if } Q \le 1.2\overline{Q}_i \\ V_i(Q,\tau)^- - M_i & \text{otherwise} \end{cases}$$

As to be expected, the upgrade decision arises much earlier.

5. Conclusion

In this paper, we have shown that the price is the not the risk factor in bandwidth (i.e. prices are decreasing with very little volatility). Demand is the risk factor. We have also argued that in some cases traditional corporate decision-making methods such as NPV have drawbacks. Real options do not render the traditional NPV method useless, but it does help to capture the flexibility.

While considering a limited number of scenarios, our modeling framework allows us to consider numerous possibilities. For example, we could solve for longer investment horizons (e.g. more than five years) and introduce new lines that will only be available in the future (e.g. 4,5,6 years from now). Our study allows us to draw some very interesting conclusions.

The optimal decision time is highly sensitive to the specifications of the parameters. This observation is consistent with the high level of uncertainty for the demand for capacity. The anecdotal rule, "upgrade at usage of 50% of maximum capacity" may be sensible, but it appears that this would involve unrealistic parameters (e.g. a very low volatility of s = 20% or an extremely high growth rate of m = 125%). The only case where it seems reasonable to apply the 50% rule is when we consider the scenario with different downtime periods. However, even in this situation, the 50% rule holds only for an OC-192 line and there is only one line we could upgrade to.

We also notice that in some cases it is optimal to skip the intermediate lines and go directly to the line with the highest transmission rate. This results in an upgrade decision at about 95% of the current transmission rate. These results agree with the conclusions of [5].

Finally, we remark that a certain number of numerical issues arise when modeling bandwidth investment decisions. Since it was out of the scope of this paper, most of the numerical issues (e.g. oscillations, numerical accuracy) were not discussed. However, for future work it may be worth considering a detailed study of the convergence of the solution and how it is affected by the discontinuities introduced at each notice date. Moreover, we could extend our model to handle monthly notice dates.

Acknowledgments

Bell University Laboratories at the University of Waterloo funded this work. We would like to thank Gerry Kealey for many useful discussions.

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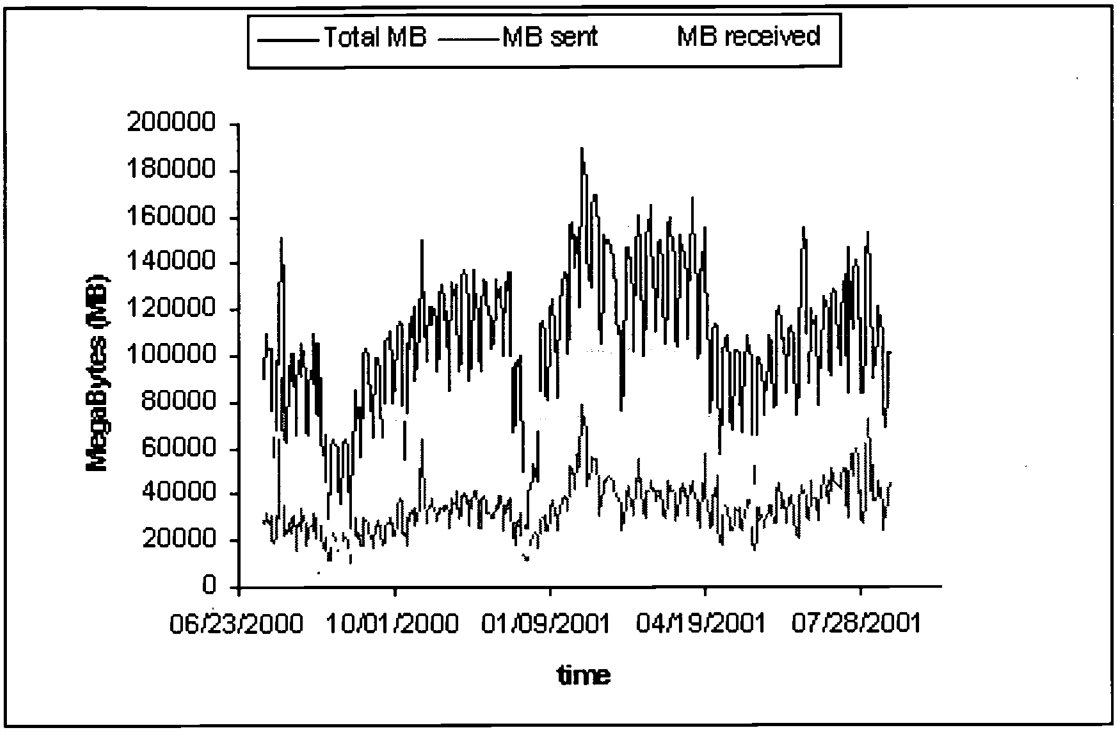

FIGURE 1. TOTAL DAILY NETWORK TRAFFIC INTO AND OUT OF THE UNIVERSITY OF WATERLOO SINCE JULY 2000

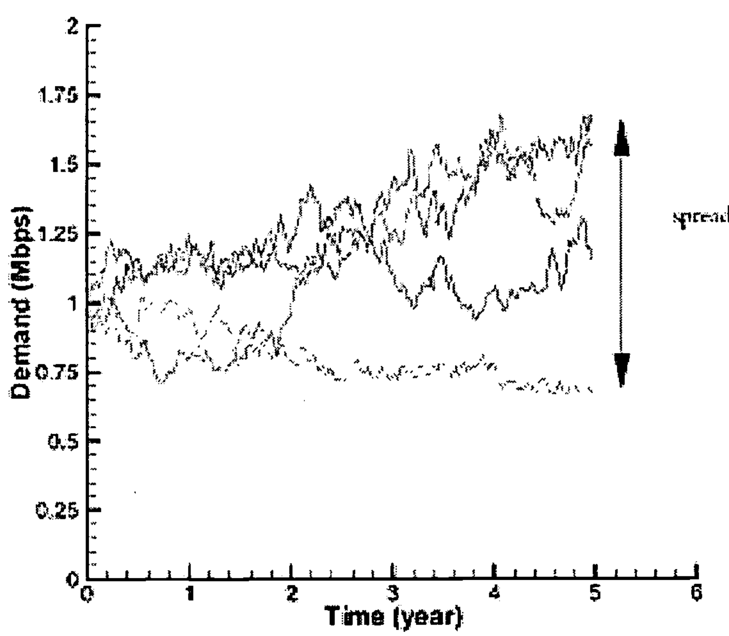

FIGURE 2. POSSIBLE PATH FOLLOWED BY THE DEMAND FOR CAPACITY IN THE NEXT FIVE YEARS

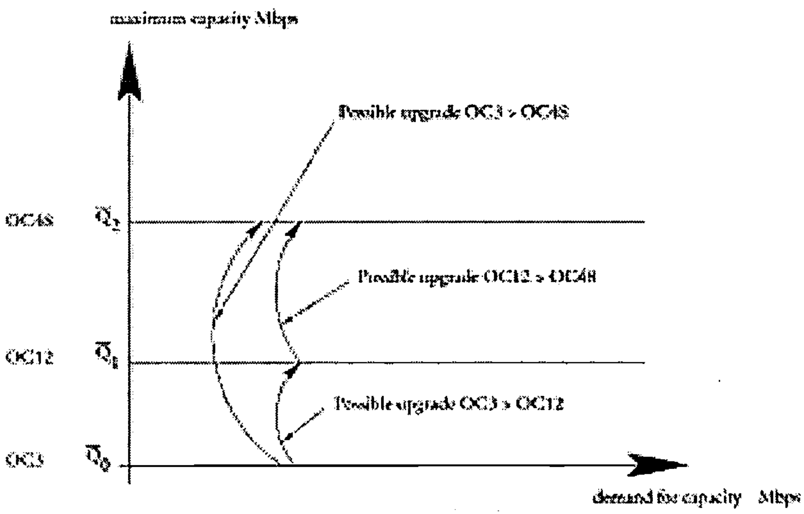

FIGURE 3. WE CONSIDER A SET OF LINES Q_i WITH MAXIMUM TRANSMISSION RATE $\overline{Q}_i$. WE SEEK TO SOLVE A SET OF PDES (8) FOR EACH UPGRADE POSSIBILITY

Parameters	Definitions	Values
σ	Volatility (year)^(-1/2)	0.79
r	Risk free rate (year)^(-1)	0.05
μ	Growth rate (year)^(-1)	0.92
K	Spot price ($/month/mile)	0.10
P	Decay factor (year)^(-1)	0.50

TABLE 1. ESTIMATED PARAMETERS

Endnotes

1. Note that this does not create an arbitrage opportunity because unused bandwidth cannot be stored for later use.

back to index

Abstract

The existing telecommunications infrastructure in most of the world is adequate to deliver voice and text applications, but demand for broadband services such as streaming video and large file transfer (e.g. movies) is accelerating. The explosion in Internet use has created a huge demand for telecommunications capacity. However, the

demand for capacity is extremely volatile, which makes network planning difficult. In this paper, modern financial option pricing methods are applied to the problem of network investment decision timing. In particular, we study the optimal decision problem of building new network capacity in the presence of stochastic demand for services. Adding new capacity requires a capital investment, which must be balanced by uncertain future revenues. We study the underlying risk factor in the bandwidth market, and then apply real options theory to the upgrade decision problem. We notice that sometimes it is optimal to wait until the maximum capacity of a line is nearly reached before upgrading directly to the line with the highest known transmission rate (skipping the intermediate lines). It appears that current upgrade practice underestimates the conflicting effects of growth and volatility. This implies that there is overcapacity in available bandwidth. We believe that this methodology can offer insights for network management.

back to index

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back to index

Beyond Transport: Implementing Comprehensive Bandwidth Solutions

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View Abstract

Introduction

The late 1990's was an era marked with intense capital investment in telecommunication infrastructure, a plethora of funding from the capital markets and overall exuberant expectations for growth and profitability for the Bandwidth market. Entrepreneurial business models based on the concept of carriers' carriers were everywhere to be found, and as a result the competitive landscape intensified quite markedly. However, the early 2000's are marked with quite a different atmosphere. An environment of consolidation and re-structuring.... An environment where competition and supply levels in the market reached points where they exceeded the underlying demand levels. An environment where deteriorating market conditions threaten the viability of those players strapped with the debt service levels taken on to fund the business models.

As the undersea wholesale bandwidth market continues to evolve and mature, it presents a multitude of challenges for existing and emerging players. However, at the same time, it offers opportunity to those players that are able and willing to evolve their corporate strategies and expand their business models. Profit margins for wholesale bandwidth will continue to get squeezed, and wholesale bandwidth providers need to adopt more proactive strategies and offer broader portfolios in order to generate additional revenue streams and profits, not only to remain competitive, but to remain viable. As the industry continues progresses into this new landscape, bandwidth and service providers are challenged with providing customers with a comprehensive portfolio of bandwidth solutions while concurrently being able to manage supply and demand aspects of the econometrics equation.

From a Demand Perspective, successful providers will need to accurately forecast, and anticipate, the bandwidth solutions of customers. This applies not only to quantities of projected bandwidth demand, but, more importantly, definition of the portfolio of products and services that will be necessary to offer bandwidth solutions to customers. From a Supply perspective, providers will need to efficiently manage their cost basis and supply chain (whether through actual receivables or through partnerships) on a global scale. They must recognize that solutions will vary widely among customer segments, and regions of the world, and as such must have proactive, adaptable and scaleable operations and capabilities to achieve customer satisfaction.

The Bandwidth Market Value Chain

As with so many industries, communication providers are always seeking to reach beyond their current product offerings and move up the value chain into offering "value added services." In recent years, however, those services have been slow in coming and difficult to predict. Often the business value associated with a new technology development is difficult to evaluate and position in the marketplace. So many of the expected 'next wave' bandwidth intensive applications are not being commercialized for a number of business, technical and social reasons.

A number of factors have combined to delay the rollout of such applications and have contributed to a slowdown in the previously expected demand for bandwidth.[1]

- Intellectual property and copyright protection rulings that have forced bandwidth intensive shareware providers such as Napster to scale back or cease operations.
- Last mile technical and commercial obstacles that have delayed the availability of high speed Internet access to the vast majority of U.S. homes and overseas markets
- Pull back in corporate IT spending as Year 2000 compliance programs are closed out and general market conditions are putting the brakes on computer and telecommunication spending by MNC's and small-to-medium size enterprises
- The inability of leading web-based organizations (Amazon, Yahoo, Priceline) to show profits and a compelling business model with sustainable revenue growth.
- Lack of next generation web-based applications for business and consumers that demonstrate the meeting of needs that can be satisfied with more bandwidth
- Regulatory and business retrenchment in the aftermath of the 1996 Telecommunication Deregulation Act
- Contraction of finance and venture capital markets

The expansion of free market economies and continued commercial and social globalization will help to offset these factors and fuel growth in the corporate areas, albeit not at the same dramatic pace anticipated in the past several years. In addition, larger consumer demand is anticipated as high-speed connectivity reaches more residential households. Given the current market conditions and perception of an oversupply of network capacity (or the widely accepted view of an excess amount of dark fiber), how is a global communications provider best positioned to meet the near term challenges and be ready to capitalize on future opportunities?

Opportunities Within the Enterprise Market Segment

Given the current set of market difficulties facing the consumer segment (erosion of pricing in long distance, prolonged roll-out of high speed access to the home and the lack of profitable content based providers), the near term focus should be on the business community. Both multi-national corporations and small to medium enterprises constitute market segments of strong potential growth in the near term. However, the organizational capabilities and structure of the global bandwidth provider will be a critical success factor.

According to the Yankee Group, SME spending in Europe on communication services is expected to increase by 47% in 2001 over 2000 levels[2]. Such robust growth, while an attractive target, is difficult to secure and the majority of purchasers continue their relationship with their incumbent carriers. Clearly a very targeted approach would be required of any carrier attempting to gain market share in a particular region of Europe. For larger, more global players, forming partnerships or alliances with local providers such as Metro Area Networks, ISPs or incumbent providers would allow for this market segment to enjoy greater utilization of available subsea capacity. In this way, the combined strengths of each partner allow for these organizations to extend their reach via the latest network architecture while being supported by a local organization better able to provide a high level of customer service.

The MNC market is an even more appealing segment as the size and quantity of these organizations lend themselves to the larger, global telecom providers. Firms that provide services to these types of customers need to have the following capabilities:

- Access to and/or development of a variety of business critical functions designed to take advantage of the available networking technology while meeting a business specific need at lower cost, greater speed and better quality.
- Close working knowledge of the major market segments that will require turn key, global communication solutions.
- High levels of quality of service, low pricing and flexible product configurations to allow for changes and modifications to the base offering
- Access to the latest technology so as to continue to drive down the cost per bit of bandwidth while offering a select number of value added services
- Global business savvy with an intimate knowledge of local conditions, whether at the MNC's headquarters, distributed manufacturing centers, primary suppliers. As well as regulatory, tax and operational issues including settlement charges

Within the next 12 to 18 months, these areas offer an opportunity for those global carriers that are able to implement efficient and economical sourcing strategies to address the sector. Since not all organizations possess the skill sets and local expertise required, it is anticipated that there will be a rise in joint ventures, alliances and partnerships in the short term, with a quickening pace towards consolidation if some players continue to struggle with current market conditions. Such opportunities will need to be successfully exploited in order for submarine telecom providers to alleviate the forecasted drop in system investment in the coming years.

The rollout of today's global fiber-optic network, based on the latest DWDM technology, is moving into a period in which the total available capacity appears to have outpaced demand. Select regions, such as Trans-Atlantic and Latin America have seen multiple systems commissioned in the past 18 months that have provided significant new capacity and placed significant downward pressure on prices. Depending on the route, price erosion on the order of 30-50% per year has been experienced and is likely to continue in the near term. Given this situation, growing this business will prove difficult. There are a number of options available to the global telecommunication provider towards that end, including the extension of network footprints by way of integration with metro area networks, acquisition of assets released by bankrupt carriers and arranging 'swaps' with other carriers. While all of these opportunities represent the least profitable market segments of telecom, namely network access and real estate, customers are still insisting on ubiquitous, high-quality service. Without this as a minimum, reaching the more profitable section of the market, including value-added services, becomes elusive.

Once a network provider has established its ability in meeting the fundamental network requirements of high quality and low price, only then can a well reasoned strategy be developed on what new services will be offered and how they will be obtained. In the near term, deals that allow bandwidth providers to extend their product offerings into extended geographic and market segments will be pragmatic routes to market. A popular method in use today is the swapping of capacity between major capacity suppliers is evidence of this strategy. While current market demand and financing constraints will limit the build-out of new systems, system owners will look for ways to increase the number of channels that can be transmitted on existing fiber and also seek to upgrade 2.5 Gb/s terminal equipment to 10 Gb/s technology. These two steps will allow network capacity to increase and meet near term needs without a new round of system builds. This is an approach in favor today with the capital markets, so suppliers should have better access to financing these kinds of capital investments.

The Need for Strategic Partners

The current market dynamics suggest that the ability of a company to successfully migrate up the value chain will be dependent on companies to develop and sustain strategic partnerships. Furthermore, they will need to formulate and execute focused, industry specific business plans that identify regional and global players and a corresponding portfolio of requisite services. Strategic partnerships will also play an important role in allowing network providers to offer more than basic bandwidth transport services.

Recent industry announcements between broadband communication providers and managed service providers are indicative of how a strategic alliance can lead to service offerings that deliver end-to-end managed service solutions to corporations. Complex Web application development and application management services are generally well beyond the capability of today's global provider of bandwidth. At the same time, firms with that kind of expertise will need access to network backbone and hosting or collocation services. Together, a strategic alliance can further the aim of both companies and help customers realize the promise of Web based business applications. Realizing this promise in the business sector is the critical success factor that will help communication providers bridge the gap between today's market uncertainty and tomorrow's bandwidth consuming environment.

In order to facilitate timely service provisioning and efficient network operations a strategic partner is currently considered to be the most rationale alternative. The scope of effort and associated timeframe required to solve any particular customer-specific city termination requirement (which cannot be reliably predicted in advance) is substantial, even in terms of simply negotiating an agreement. It would be unmanageable and impractical to establish relationships on a case by case basis as a specific potential customer requirement is identified. Instead, a flexible approach that facilitates accommodating customers' needs while maintaining prudent and judicious capital investment strategies will undoubtedly prove to be a critical success factor.

While demand for bandwidth remains evident in most regions, the current market environment contains economic factors that demand more prudent capital investment decisions. As such, wholesale capacity providers need to incorporate a build-buy decision process in order to remain as viable players. In order to take advantage of a broader range of capacity sales opportunities using secondary or "thin" routes, a Global Strategic Partner that complements a global carrier's footprint is necessary. The implication in the market is that there will only be a small handful that can provide high-bandwidth circuits on a global basis. By leveraging the respective strengths of respective partners both will benefit from an economically prudent rationalization of supply. Furthermore, such a strategic relationship between could also serve to be a stabilizing force within a currently volatile industry.

To execute on such a strategy, a global carrier needs to consider strategic partners that offer the following characteristics:

- Complementary Global Networks, the advantages of which can be leveraged immediately for capacity sales segment
- Ability to co-build and mesh for future network growth.
- Joint R&D efforts to enhance and promote service offerings.
- Opportunities to offer integrated bundles of higher value services, leveraging each others core competencies

Next Steps for Global Bandwidth Providers

One of the challenges facing network planning and business development is the lack of clarity concerning the underlying traffic that will be carried on the unused portion of today's networks as well as the next generation of fiber optic systems. The view held by most is that demand will eventually be enormous, but just 'how big' and when that ramp will resume is difficult to quantify. The balance between market need and technological capability appears to have shifted towards bandwidth enabling technology outpacing the market demands. In spite of this, research efforts continue to offer the promise of further advances in the capabilities of fiber optic communications. In June of 2001, for instance, it was reported that scientists from Bell Labs had determined that it is theoretically possible to send approximately 100 terabits of information on a single strand of fiber[3]. While this equates to 20 billion one page e-mails, the unanswered question is what applications will be developed (and at what price points) that will consumes fiber at this level of capacity? Even the most recently commissioned subsea networks are touted as having the potential capacity of "downloading the entire U.S. Library of Congress in 16 seconds."[4] Since such a download requirement is not a relevant business application, the question remains as to who will be consumers of this quantity of bandwidth? Will it be primarily individuals, businesses, educational and research institutions, governments or some other yet to be unidentified group? While the outcome is uncertain, those players in this space must be resolved in their belief that the final answer represents a dramatic increase in bandwidth requirements and those with the best optical communication networks will be poised to capitalize on this anticipated demand.

It is vital that the undersea carrier ensures that the technology of current and next generation networks support those services, applications and technologies that will require large quantities of capacity. The drivers of future demand will be more than just sending e-mail and web browsing. Unfortunately, there is no practical way for a one company to devote sufficient financial and organizational resources to the development and commercialization of every envisioned application. As a result, today's global network providers must evaluate how to encourage and contribute in this development process, which is typically well beyond the underlying bandwidth enabling technology. Some of the ways in which this can be accomplished include:

- Collaborative Research Efforts.
- Corporate VC Programs.
- Foster Development of Bandwidth Ecosystem & "Heavy Hitter" Applications
- Offer Network Test Bed Services

While each of these initiatives has the potential to help bridge the gap between today's reality and tomorrow's predicted requirements, significant corporate 'soul-searching' will be necessary in selecting the path to take and deciding how best to position scare resources in support of the goal. The only option that will ensure failure is to pursue past approaches. All the major telecommunication providers are struggling to find their role in the current changing landscape. Recent market developments suggest that the providers of global bandwidth, especially whose focus is on undersea networks, face three alternative futures[5]

- Evolve into full service providers
- Be strategically acquired by a multinational carrier or

- Fail and have their assets acquired or stranded

The degree to which today's bandwidth providers can move forward and build on past gains will be dependent on the ability of their organization to quickly capitalize on these trends and define themselves in the context of what's next. The introduction of the microprocessor, steam engine and printing press created waves of disruptive, chaotic energy that took decades to rationalize, focus, and generate goods and services that benefited all humanity. In a similar manner, the Internet has only given us a brief glimpse of the underlying potential of instantaneous ubiquitous communications made possible by the power and control of light. Those individuals and organizations with courage and conviction will succeed in making the promise of this technology a reality.

As industry consolidation continues there will be even greater pressure to merge and grow, perhaps to the point where, in the near future, only several network providers will remain in the global market sector. It is expected that new models for network development activities will emerge. Models where system developers work in cooperation with carriers to improve the overall efficiency of network supply. Inasmuch as the entrepreneurial carrier's carrier model revolutionized the industry in recent years, these new cooperative models will undoubtedly impact the industry in the upcoming years.

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back to index

Abstract

As the undersea wholesale bandwidth market continues to evolve and mature, it presents a multitude of challenges for existing and emerging players. However, at the same time, it offers opportunity to those players that are able and willing to evolve their corporate strategies and expand their business models. Profit margins for wholesale bandwidth will continue to get squeezed, and wholesale bandwidth providers need to adopt more proactive strategies and offer broader portfolios in order to generate additional revenue streams and profits, not only to remain competitive, but to remain viable. As the industry continues progresses into this new landscape, bandwidth and service providers are challenged with providing customers with a comprehensive portfolio of bandwidth solutions while concurrently being able to control supply and demand aspects of the econometrics equation.

From a Demand Perspective, successful providers will need to accurately forecast, and anticipate, the bandwidth solutions of customers. This applies not only to quantities of projected bandwidth demand, but, more importantly, definition of the portfolio of products and services that will be necessary to offer bandwidth solutions to customers. From a Supply perspective, providers will need to efficiently manage their cost basis and supply chain (whether it be through actual receivables or partnerships) on a global scale. They must recognize that solutions will vary widely among customer segments, and regions of the world, and as such must have proactive, adaptable and scaleable operations and capabilities to achieve customer satisfaction.

This paper will address the various factors bandwidth and service providers need to consider in evolving their businesses in the emerging environment. Industry forces, such as consolidation of the number of players and convergence of infrastructure and services, will also be evaluated. The growing importance of the enterprise customer and an assessment of the corresponding "Bandwidth Solution Needs" will be discussed. Finally, this paper will provide an overview of the various commercial options and issues (organic growth, merger/acquisition, strategic partnerships, etc.) related to delivering the requisite services to succeed in this emerging environment.

back to index

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Director of Strategic Information, Tyco Telecommunications

Beginning with Bell Laboratories Undersea Development Laboratory in 1990, Mr. Kowalik has held a variety of assignments focused primarily on design and development of undersea transmission technology. He has held various positions in engineering and project management in applying undersea technology for US Government applications. In 1997, Mr. Kowalik joined Tyco Submarine Systems Ltd. to apply his knowledge of undersea technology to the commercial sector.

Mr. Kowalik, as part of Tyco Submarine Systems, has supported Sales efforts as an account manager, developed and implemented market forecasting processes and most recently, strategic planning and financial analysis. Mr. Kowalik has most recently served as TSSL's Director of Strategic Information where he was responsible for conducting market research/evaluation and strategic planning functions. His work was an integral part of the development of the TyCom business plan and corresponding financial models.

Currently, as the Tyco Telecommunications Director of Strategic Information, Mr. Kowalik's responsibilities are focused on providing insight for the future direction of Tyco Telecommunications, not only from a network connectivity perspective, but from a service offering perspective as well. Mr. Kowalik's background has uniquely prepared him for his current responsibilities.

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back to index

The Bandwidth Tsunami, Network Innovation and the Evolution of Bandwidth Markets

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View Abstract

I. Introduction

Whether there is a looming oversupply of international bandwidth (the threatened "glut") or an imminent undersupply (because of the suggested "gluttony" of capacity-hungry consumers and rich media), continued expansion in the volume of bandwidth sale and purchase transactions appears inevitable. The large and expanding bandwidth market makes the means by which bandwidth vendors and bandwidth buyers transact business critically important. This paper characterises the international bandwidth marketplace as increasingly 'democratised' and poised for radical development but beset by uncertainties likely to inhibit desirable developments from occurring in the immediate future.

II. Trends in International Cable Capacity

International bandwidth capacity is currently growing at a dramatic rate, with strong investment in submarine cable and new technologies. In the Asia-Pacific region capacity is growing faster than anywhere else, giving rise to a "bandwidth tidal wave". Proposed investment in submarine cable infrastructure in the Asia Pacific region is of such magnitude that by the end of 2002 it is forecast that available capacity will exceed that on offer in any other region of the world[1]. Furthermore, the capacity available on newly deployed infrastructure, in contrast to the capacity of older cable systems, is such that the installation of just a single new cable network might itself have a significant impact on competition in the Asia Pacific region.[2]

Technological innovation will sustain further growth in the bandwidth available on existing and new networks. New multiplexing technology (e.g. dense wave division multiplexing or DWDM[3]) will enable networks to increase significantly the capacity of each fibre. Most of the cables installed during 2001/2002 are designed to be upgraded to several times their initial capacity. For example, the deployment of DWDM technology on existing networks can be achieved at lower cost than installing new cables. Incremental capacity increases can also be achieved through upgrades to some older cables, although the level of capacity upgrade available will depend on the type of technology deployed in the original cable construction (e.g. some existing cables are unable to support DWDM technology). In addition to the exponential increase in bandwidth capacity, other fundamental changes are having a direct impact on the competitive dynamics of the markets.

The pattern of cable ownership is changing also. In the recent past, capacity was built by companies and consortia who intended to use it to provide their own services. In relation to international capacity, at least, that is decreasingly the case. New international submarine cable systems are often not funded solely by the traditional PTTs (or their descendants) but by specialist bandwidth vendors, albeit in consortia to which the telcos may be parties. The new breed of bandwidth vendors abstains from retail activities but invests in global network infrastructure specifically for the purpose of selling capacity at the wholesale level. Such vendors are able to offer infrastructure and products across a global platform through the deployment of new technologies. A relatively small bandwidth vendor may deliver end-to-end global products which provide wholesale customers with benefits in terms of economies of scope and scale and a seamless global reach with high quality of service (eg: C2C, Level 3 and Global Crossing).

This new breed of bandwidth vendors participate in private cable consortia in order to obtain international capacity on terms which provide it with exclusive rights of access and control over its share of the cable[4] for the life of the cable (including the right to implement upgrades to the cable). This enables the vendor to make autonomous decisions to upgrade the amount of capacity available on its share of the fibre without consultation or participation from the original participants or the entity holding the ownership rights.

Even consortia and consortium members who invest in capacity for use in their own retail operations are likely to build more capacity than they immediately need. Much of the capacity in the submarine cables is (or would be, if it were lit) surplus to its owners' requirements. Investors may also find that, as a result of technological developments, the capacity available on any existing network exceeds that which their own retail operations require.

Given that a large proportion of new cable is unlit, and given the continuing emergence of new technologies for upgrading cable to ever higher capacities, gross bandwidth seems likely to continue to grow at a high rate and may well exceed demand in the medium term. The exponential increase in capacity over the next two years will force carriers to compete for business through steep price reductions[5]. New entrants themselves are already acknowledging intense competition in the region[6].

Where they have excess capacity, cable owners have strong incentives to maximise usage. Owners will seek to entice other carriers and service providers to purchase the surplus capacity, rather than invest in new competing infrastructure, by offering prices which fall towards incremental cost (taking account of the high fixed costs incurred). These developments on the supply-side of the capacity market are reinforced by demand-side effects consequent upon technological developments.

III. The 'Democratization' of Capacity Markets

International capacity is no longer controlled exclusively by the vertically integrated communications giants.

Increasingly, bandwidth is offered by specialized capacity providers motivated to sell their product, rather than to limit their potential competitors' access to it. Additionally, these supply-side changes are matched by developments on the demand-side, driven largely by developments in network technology.

Advances in network technology encourage a "buy" rather than "build" decision in respect of international capacity. Legacy networks in which service logic was hard-wired into the switching system itself have given way to intelligent network ("IN") solutions, in which a high level of intelligence is distributed throughout the network. Advanced IN features allow bandwidth buyers to obtain more extensive control over the underlying infrastructure than previously was possible. Significant changes can now be introduced into networks, including by virtually instantaneous deployment of new software and recalibration of end user devices, enabling near-instantaneous provisioning on a virtual basis. The intelligence has shifted out of the switch and relocated in computer nodes. The nodes are controlled by end-users or wholesale customers and distributed throughout the network, so network control has migrated from cable owners (i.e. bandwidth vendors) to their customers (i.e. bandwidth buyers).

The tendency for network control to shift towards third parties diminishes the relevance of vertical integration. Vigorous competition can take place between participants at different levels of the industry, including between infrastructure owners and non-owners.

Furthermore, as the applications deployed by wholesale customers can now be supported over multiple infrastructure substrates, wholesale customers are no longer tied to the functionality offered by any particular network. Accordingly, these innovations diminish the technical impediments to churn, minimise the cost of churn, and significantly enhance the contestability of the market, resulting in customers being able to control routing decisions to implement real-time least-cost routing.

The result is fundamental change in the manner in which bandwidth capacity is acquired. The international bandwidth market is becoming increasingly 'democratized' as the competitive positions of bandwidth buyers increasingly resemble those of cable owners.

In the past, the bandwidth capacity on offer from network owners to other carriers and service providers has been limited to comparatively small volumes (E1 links, with multiples of 64 E1s being supplied in the form of a single STM-1 link) and short-term sales only (one to three years) on commercial terms which were little better than the retail terms offered to large corporate customers. However, a key characteristic of contemporary capacity markets is the trend for wholesale customers to seek to acquire bandwidth on terms that place them in substantially the same position as if they had constructed their own network. This allows bandwidth buyers to compete in the market for international services (including wholesale and corporate) on nearly equal terms with the traditional international carriers.

Specifically, bandwidth buyers are now concerned not solely with price but also with:

- obtaining access to large volumes of capacity (STM-4, STM-16, STM-64 and rights of access to entire wavelengths);
- securing long-term supply arrangements;

- capping the costs associated with long-term supply;
- maximizing the flexibility with which they can utilise the capacity (for example by a right to request capacity upgrades on minimum notice periods pursuant to an agreed pricing regime or a right to request equipment upgrades for the support of new and innovative services);
- ability to drop the fibre to a range of locations and increase the number of drop points as demand grows in new locations;
- ability to route their own traffic;
- diversity of routing and network redundancy considerations; and
- ability to manage financial reporting and taxation implications.

With the trend towards placing wholesale customers in the same position as if they owned the infrastructure, wholesale contracts are likely to be long term arrangements - sometimes for as long as the life of the cable. To the extent that bandwidth buyers can secure their desired terms on these variables, they can approximate owner-like certainty (e.g. in their cost-base) and flexibility, neutralising the competitive advantage of vertically integrated participants in the market.

The result is a "democratisation" of the international telecommunications sector, with increased competition at every layer of the industry as niche players compete on a close-to-equal basis with vertically integrated entities, so far as the principal factor of production is concerned[7]. This trend to democratisation of the international bandwidth sector sustains, and is reinforced by, evolution in the market for "physical"[8] bandwidth.

IV. Evolution in "Physical" Bandwidth Markets

A further innovation serving to increase liquidity in the international bandwidth market is the emergence of the "IP exchange". IP exchanges or telehousing facilities provide connectivity between multiple backbone providers and customers at a single point of interconnection. These developments arise out of the inherent inefficiencies in the bilateral nature of the traditional buyer-seller relationship.

IP exchange operators can aggregate traffic and forward it to the major backbone providers, delivering improvements in performance, cost and reliability (particularly where such IP exchanges offer "carrier specialised network management services", including the routing of international traffic, to other carriers, eg: Level 3 and C2C). IP exchanges enable capacity to be physically traded in (almost) real time, thereby enhancing the efficiency of the bandwidth market.

IP exchanges impact directly on the competitiveness of the bandwidth capacity markets, by:

- enabling smaller wholesale customers to achieve economies of scale through sharing infrastructure and aggregating traffic;
- increasing smaller wholesale customers' bargaining power in the acquisition of bandwidth;
- providing customers with the opportunity to purchase from diverse bandwidth providers at the exchange, eliminating the need to acquire a separate link to the POI of each IP backbone provider

(which increases contestability in the market by minimising the costs associated with churning from one backbone provider to another); and
- facilitating the provisioning of bandwidth on a real-time or nearly real-time basis (in contrast to the status quo whereby such transactions are implemented over a period of several weeks or months).

From the bandwidth vendor's perspective, connection to an IP exchange:

- facilitates disposal of unused bandwidth (on an anonymous basis), optimising the utilisation of existing networks; and
- can reduce the search costs that that network would otherwise incur in selling broadband capacity, by introducing multiple potential bandwidth buyers at a single POI.

The key virtue of IP exchanges, then, is that they reduce the transaction costs faced by either party to a bandwidth trade. A number of IP exchange operators (such as Band-X Limited, RateXchange Corporation and Arbinet-theXchange Inc.) are creating bandwidth exchanges where transmission capacity is bought and sold via an on-line virtual trading floor.

V. Towards a "Financial" Bandwidth Market

Regardless of whether there is an oversupply or an undersupply of bandwidth, there are many more bandwidth users than bandwidth owners, so an efficient market for allocating the resource is a desirable and, where technically and legally possible, inevitable development. With the development of the markets for "physical" bandwidth, and the emergence of IP exchanges in particular, a "spot" market is on the verge of developing for bandwidth. To date, the market for switched minutes most closely approximates a spot market, among telecommunications products. The next evolutionary step for bandwidth markets will be a progression from "physical" trading, in actual capacity, to "financial" trading, upon the development of bandwidth derivatives products such as options. The potential traded bandwidth market may be huge, with estimates ranging from $200 billion to $1 trillion[9], and comparisons being drawn to the combined size of the traded gas and electricity markets.

"Financial" bandwidth trading will provide a means by which telecommunications entities can hedge against price fluctuations and availability uncertainties. Financial trading in bandwidth is attracting the attention of players who have not traditionally been major telecommunications sector participants, such as participants from other commodity sectors (eg: energy markets), banks and financial institutions (eg: Morgan Stanley, Goldman Sachs and Dresdner Kleinwort Wasserstein). Such entrants are potentially powerful participants in the imminent market for bandwidth derivatives. The involvement of players from other industries can accelerate the development of the bandwidth markets by leveraging from their experience in commodity markets such as oil, gas and power. The timeframe for realisation of trading in bandwidth derivatives is likely to be much shorter than in other industries, as commodities industries have exhibited progressively shorter timelines, with accumulating market experience.

The commercial information aggregated at such exchanges will be of significant strategic value, enabling participants to trade on the volatility of the market (e.g. to take long or a short positions). Such a market would also enable participants to manage risk by hedging strategies. Such a market can be expected to increase the liquidity of bandwidth and promote economic efficiency.

The advantages to industry participants and their financiers of a "financial" market for bandwidth, and the seeming inevitability of such a market should not conceal the hurdles to its development. In particular, the highly uncertain, unpredictable character of the industry during its present phase of dramatic growth should be expected to delay the emergence of a market for derivative products.

In particular, while some commentators conceive of bandwidth being already on the verge of "commoditization," and therefore ripe for derivative products to crystallize around it, this might be premature. Although thoroughly unbundled bandwidth elements would be susceptible to trading, participants may prefer to deal in something more than the most fundamental basis of bandwidth. Bandwidth with certain characteristics, such as quality assurances (e.g. service level guarantees) may be the preferred subject of trade. If that is the case, diversity in the traded product (i.e. a lack of "fungibility") may make it resistant to being traded on a financial market.

The existence of a degree of uncertainty is fundamental to the utility of derivatives and of the essence of arbitrage opportunities in such a market, but the deep and extensive industry uncertainties prevalent at the present time are an obstacle to pricing and trading decisions. The next step of bandwidth market evolution can be expected to be realised once the market for physical bandwidth settles into a lesser order of uncertainty.

VI. Conclusion

With dramatic increase in the amount of bandwidth available on international submarine cable networks, the market for bandwidth is undergoing correspondingly dramatic change:

- capacity is increasingly built and owned by specialist bandwidth vendors, rather than by the traditional PTTs who are vertically integrated into the retail sector;
- new cable system technologies confer increasing power on bandwidth buyers to manage the capacity they acquire, influencing the build-buy decision;
- long-term rights of access and extensive rights to control and upgrade acquired capacity place bandwidth buyers in substantially the same position as if they had built their own network, allowing them to compete on a more even basis with vertically integrated players in the wholesale and corporate markets; and
- IP exchanges are increasing bandwidth buyers bargaining power and lowering transaction costs, to foster increased liquidity in the market for "physical" bandwidth.

The logical next evolutionary step for bandwidth markets will be the emergence of a "financial" market for derivative bandwidth products. This appears inevitable and has clearly foreseeable benefits for the industry, but may be delayed until deep uncertainties affecting the industry have diminished.

Endnotes

1. Telegeography, *International Bandwidth* 2001 p24
2. "Such advances mean that, with all wavelength lit, bandwidth on a single network currently under construction could dwarf the combined existing capacity of all the other cables on the same route." Telegeography, *International Bandwidth* 2001, Washington DC, 2001, p14
3. DWDM technology boosts transmission capacity by assigning optical signals to specific wavelengths (referred to as lambda ( )) within a designated frequency band and then multiplexing the resulting signals out onto one fibre.
4. Capacity in submarine cable is not shared out into discrete fibre pairs. It is shared by electronic containerisation of discrete transmission rates.
5. "Although international bandwidth prices in Asia have been much higher than in other regions, we expect prices per given unit of capacity will decline by 50% per annum. The aim of new entrants, such as Level 3 and Global Crossing, to take market share away from telecom incumbents in Asia will serve as a catalyst for such pricing pressure." Jardine Fleming, *Asia's backbones* p3
6. See, comment by Level 3's Chief Executive Officer in Asia following the landing in Hong Kong of the first leg of its Tiger undersea cable in June 2000: "Level 3 is going to be the first company in this market offering international broadband connectivity with an initial reduction of up to 60 percent on current bandwidth prices. The market response in anticipation of this new undersea cable is very encouraging. Level 3's cable is seen as greatly enhancing the availability and affordability of high capacity connectivity worldwide for Hong Kong-based operations." Jardine Fleming, *Asia's backbones* p51.
7. "With so much bandwidth supply, we believe network service providers will become less dependant on being bound to a particular backbone provider. Today, vertically-integrated telecom carriers combine backbone assets (through participation in club cables) with divisions that provide services and solutions for customer's network needs. In future, we believe the dominance of such an integrated model will give way to a more horizontal landscape, with value migrating to the service end. [...] The companies which will be able to capitalise on this trend will be a formidable threat to vertically-structured incumbents, who cannot remain as market leaders in everything that they do." Jardine Fleming, *Asia's backbones* pp 3-4, 23
8. As distinct from derivative bandwidth products, as discussed in section VI of this paper.
9. O'Hara, N & Ryan, C. *Fast Forward for Fibre Trading*, http://www.commodities-now.com/cnonline/sept2000/article3/a3-pl.shtml

back to index

Abstract

Whether there is a looming oversupply of international bandwidth (the threatened "glut") or an imminent undersupply (because of the suggested "gluttony" of capacity-hungry consumers and rich media), continued expansion in the volume of bandwidth sale and purchase transactions appears inevitable. The large and expanding bandwidth market makes the means by which bandwidth vendors and bandwidth buyers transact business critically important. This paper characterises the international bandwidth marketplace as increasingly 'democratised', with the competitive position of bandwidth acquirers increasingly resembling that of cable owners. Bandwidth markets are poised for radical development but beset by uncertainties likely to inhibit desirable developments from occurring in the immediate future.

back to index

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Andrew completed bachelors degrees in Arts and Law at the University of Canterbury, New Zealand in 1992 and subsequently Master of Laws degrees at the University of Canterbury (1993) and University of Sydney (1995). Andrew received his PhD from the University of Sydney in 2001, having completed his doctoral thesis on Australian telecommunications regulation.

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back to index

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Peter has experience in complex structuring issues, which require an understanding of the intersection between technical, regulatory, competition law and commercial issues. He has been involved in the establishment of large scale telecommunications joint ventures, including the deployment of the world's first large scale HFC local broadband network, and in major telecommunications-related mergers in Asia Pacific and in Europe.

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back to index

Social/Cultural

Wednesday, 16 January 2002
0845–1015
South Pacific I - II

W.1.1 Communicating in an Electronic World

Chair:

PHILIP BOSSERT, Chairman & CEO, China Hawaii Investment Corporation, *USA*

W.1.1.1 Towards a Better Accessible World? Public Sector Information in a Digital World (View Abstract)

JO STEYAERT, Researcher and ULRIKE MARIS, Research-Assistant, Dept. of Communication Science, Catholic University of Leuven, *Belgium*

W.1.1.2 The Next Generation: Empirical Research, Ethical Issues, and the Implementation of Choreographed Intelligent Agents in the Pacific (View Abstract)

THOMAS COOPER, Professor, Dept. of Visual and Media Arts, Emerson College, *USA*

W.1.1.3 Internet for Public Service (View Abstract)

T.H. CHOWDARY, Information Technology Advisor, Government of Andhra Pradesh & Director, Center for Telecommunication Management & Studies, *India*

W.1.1.4 Stop Advertising, Start Doing! Connecting with Customers in the Information Age (View Abstract)

EMMA SMITH, President & CEO, At Large Media, *United Kingdom*

back to sessions

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Dr. Philip J. Bossert is currently Chairman & CEO of China Hawaii Investment Corporation, a business development services company with offices in Shanghai and Honolulu that represents and supports Hawaii companies and organizations in China and Chinese companies and organizations in Hawaii.

Before joining China Hawaii Investment Corporation, Dr. Bossert was Vice President for Business Development & Education for Ohana Learning, a Hawaii & California based software company developing interactive multi-media technologies for education. Prior to that, Dr. Bossert served as Deputy Director of the Hawaii State Department of Business, Economic Development & Tourism and, prior to that, was President & CEO of Strategic Information Solutions, Inc. He has also served as Project Director for the Hawaii Education & Research Network, as Assistant Superintendent for Information & Telecommunication Services for the Hawaii State Department of Education, and as Strategic Information Systems Manager for GTE Hawaiian Tel (now Verizon Hawaii). Prior to that, he was President of Hawaii Loa College, Director of Long-Range Planning for Chaminade University, and Executive Director of the Hawaii Committee for the Humanities.

Dr. Bossert has been a Fulbright-Hayes Scholar, Woodrow Wilson Fellow, and National Endowment for the Humanities Grantee. He studied philosophy at the University of Freiburg in Germany and at Louvain University in Belgium. He holds a B.A. in Economics & Philosophy from Rockhurst College in Kansas City and an M.A. and Ph.D. in Philosophy from Washington University in St. Louis. He is also a graduate of the Defense Language Institute in Monterey, California, and worked as an interpreter for the Army Security Agency in Berlin, Germany.

Dr. Bossert has published five books and more than thirty articles and reviews in the areas of information science, technology & education, and philosophy. He wrote a monthly column on "Telecommunication Services" for Information Times magazine and was the host for more than five years of various monthly cable television programs focusing on educational technology and media literacy. He has worked as a consultant for numerous corporations and non-profit organizations in the US and Asia, and has served on wide variety of civic and community boards.

back to index

Towards a Better Accessible world? Public Sector Information in a Digital World.

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View Abstract

1. Preface

Government information plays a fundamental role in the well-functioning of 21st century's democracies (see f.i. Barber, 1984). Easily accessible government information is seen as an absolute requirement for the maintenance of the competitiveness of industry and the well-functioning of society in general and democracy in particular. Governments around the world have realised the importance of access to public sector information and have developed over the past 20 years a framework of access legislation. However, research indicates that the knowledge and accessibility of government information by citizens and companies still faces serious problems. Access rights as such don't seem to be enough to obtain an informed society, accessibility is needed as well. As a result, governments are under pressure to develop new frameworks that should make their information more accessible for citizens. Since the massive growth of the World Wide Web in the mid nineties, governments world-wide have enhanced ICT and e-government as the ultimate solution to the problem of accessibility. Although the many advantages, the use of ICT has confronted governments with new issues (for an interesting overview see: van de Donk, W., Snellen, I.Th.M. & P.W. Tops 1996). This paper presents work in progress by order of the Flemish government (Belgium) (Maris & Steyaert, 2001). The aim of the project is to develop a legal framework to enable the Flemish government to become more transparent. A short overview of the literature concerning different aspects of access and accessibility of government information is presented. Based on this literature a framework is developed that should lead governments towards more transparency. This framework is used to compare the situation in different countries (Singapore, The Netherlands, Sweden and Flanders).

2. Government information

The literature concerning public sector information (Beers, 1996; Frissen & Snellen, 1990; de Terwangne & de la Croix-Davio, 1994) confronts us with many different efforts to define the subject. The definition of public sector varies from one author to another. The European Commission for instance in the Green Paper on public sector information in the information society (1998) distinguishes between two types of public sector information: information of an administrative nature and of a non-administrative nature. The first category relates to the function of Government and the administration itself and the second category to information on the outside world that is gathered during the execution of public tasks (Geographic Information, information on businesses, on

R&D etc.). Within administrative information a further distinction can be made between information that is fundamental for the functioning of democracy (like laws, court cases, Parliamentary information) and information that does not have such a fundamental character. Another possible distinction draws a line between information that is relevant for a general public (like Parliamentary information) or for a very limited set of directly interested persons. From a market perspective, information can be divided according to its (potential) economic value. It should be noted that both administrative and non-administrative information can have a considerable market value. The above mentioned distinctions may have consequences for the way those different types of information are treated. They can have a considerable bearing on issues like pricing and copyright and touch upon delicate issues like data protection. The distinctions made by the European Commission point out that the process of defining government information itself is not without consequences. The usage of certain definitions (certainly by governments) has implications for the way it will be treated (by governments and the society as a whole). In the laws and discussions on access to public sector information three possible approaches appear to emerge: 1) the functional approach, in which the public sector includes those bodies with state authority or public service tasks, 2) the legalist/institutional approach: only bodies that are explicitly listed in the relevant law(s) have a public sector character and 3) the financial approach, whereby the public sector includes all bodies mainly financed by public funds (i.e. not operating under the normal rules of the market). In this paper we will consider government information as files with information and data produced and/or collected by, by order of or at the expense of the government. Thus all the information the government or a body that functions as a government organisation produces or possesses resorts under the name of 'public sector information'.

3. Access to public sector information

3. 1. Access to public sector information: a short historical overview

If we take a closer look at the policy towards public sector information it is striking to see that, not only in the countries treated in this paper, but in most parts of the world policy regarding the public sector always has been the subject of strong regulations. This policy often finds its reasons in the past.

During what is called the 'Ancien Regime' in Europe, public governance was covered with mysteriousness. In most European countries there was no general regulation that guided the policy. Every country had some regulations, which prescribed publicity and others, which prescribed secrecy. This led to a situation in which it became increasingly uncertain whether in a given situation the principles of publicity would apply or the principles of secrecy. As a consequence in most European countries secrecy became the general rule in the day-by-day practice (Boes, 1995: 39). The raise of the modern democracy made that this situation became more and more unacceptable to the general public. On the one hand more and more citizens and pressure organisations in the 20th century demanded a more transparent government so as to enable the control of the government. On the other hand that situation came more and more into conflict with the 'freedom of speech' right (see further) that was consolidated in various treaties by the middle of the 20th century. In many Western countries this led to a legislation concerning the 'publicity of government information'.

3. 2. The Council of Europe

One of the first important convention in Europe was the Convention for the Protection of Human Rights and

Fundamental Freedoms . Although it does not contain specific articles that grant citizens access to public sector information, the convention contains elements that constituted the building blocks for the development of an information policy by the members of the Council of Europe. Several articles where important in this view. Article 10 is the most important one. This article grants everybody the freedom of expression. To be able to grant everybody this right, the convention recognises clearly that this right includes the freedom to hold opinions and to receive and impart information and ideas without interference by public authority and regardless of frontiers. The article also mentions the exceptions to this right in a limitative way: national security, territorial integrity or public safety, prevention of disorder or crime, protection of health or morals, protection of the reputation or rights of others, preventing the disclosure of information received in confidence, maintaining the authority and impartiality of the judiciary. These restrictions can be found in the legislation of most countries. The articles 8 (Right to respect for private and family life), article 2 (Right to life) and article 6$1 (Right to a fair trial) also have had an important impact in stipulating the role of governments in spreading out their information in public.

What the 'publicity of government information' in European countries is concerned, other initiatives of the Council of Europe have played an important role as well. In 1970 the Parliamentary Assembly of the Council of Europe voted resolution 428 "Declaration on mass communication media and human rights " where they confirmed that the freedom of expression includes the freedom to collect, to obtain, to communicate, to publish and to spread information and ideas. To the members of the Assembly this right implies that the public authority under certain conditions shall have to inform the general public about matters of public importance. In Recommendation 582 "on Mass communication media and human rights" the Assembly goes one step further and suggests that Article 10 of the ECHR should be enlarged with the right to retrieve information. More interesting for this paper is the Recommendation 854 in 1979 'Access by the public to government records and freedom of information'. In this recommendation the Parliamentary Assembly of the Council of Europe invites the member states to develop a system of freedom of information. The principles developed in this recommendation for public access to government information will appear in the legislation of different member states. One of the suggestions is the right to have access to official documents. This right would then imply the right to receive information on demand from government agencies, the right to control files with personal information and the right to correct these files. The Council explicitly motivates this recommendation by stating that without these rights a parliamentary democracy can not function properly.

The Committee of Ministers of the Council of Europe also took a major step forward concerning access to public sector information. The first step was the acceptance of Recommendation (81)19 "on the access to information held by public authorities ". This recommendation is very important because of the principles included in the annexes. These principles form the basis of the regulation concerning the right of access to government information and include the right of access for natural as well as legal persons within the jurisdiction of the state. This right can be executed on demand of a person without a claim of personal interest. Denials of access by authorities have to be motivated and have to be in accordance with the law. The person has the right to appeal. Another important step is the "Declaration on the freedom of expression and information (29 April 1982)". In this declaration the Committee of Ministers emphasises that to accomplish freedom of expression and information governments should try to create an "open information policy in the public sector, including access to information". Although these resolutions and recommendations do not have the status of law, they did have an important impact on the way European governments (and the European Union) have develop their legal framework regulating the access to public sector information.

3. 3. European Union

Inspired by the efforts done by the Council of Europe, the European Union has developed a framework concerning government information. In contrast with the work of the Council of Europe, the agreements developed by the European Union are binding for the member states. As a consequence the policy of the European Union has had a greater direct influence on the member states than the efforts of the Council of Europe. Much of the attention the European Union has given to public sector information is concentrated on two aspects: access to and exploitation of government information. The first important decision was taken in 1990 by the issue of the Council Directive 90/313/EEC of 7 June 1990 on the freedom of access to information on the environment. The impact of this directive in many members states was important since it granted citizens the right of access to information on the environment held by the public sector. Second important aspect was the fact that all citizens in the European Union enjoyed this right on an equal basis. The aim of the directive was to harmonize the different existing legislation in the different member states as these differences caused unequal access for European citizens as well as unequal opportunities to commercialise this information.

In 1992 a second step was taken in the Treaty of Maastricht . A declaration (n°17) 'on the right of access to information' was added to the Treaty. This declaration stated that "transparency of the decision-making process strengthens the democratic nature of the institutions and the public's confidence in the administration". The Council followed this declaration by adopting the Council Decision 93/731/EC of 20 December 1993 on public access to Council documents (amended in 1996 and 2000). The Commission followed in 1994 (94/90/ECSC, EC, Euratom and amended in 1996) with the Commission Decision of 8 February 1994 on public access to Commission documents. The European Parliament waited until 1997 before adopting the same kind of legislation (97/632/EC, ECSC, Euratom: European Parliament Decision of 10 July 1997 on public access to European Parliament , amended in 1998).

On May 30, 2001 a new regulation came into force. The regulation (EC) No 1049/2001 of the European Parliament and of the Council regarding public access to European Parliament, Council and Commission documents provides a general regulation for the EU . Closely related to access to public sector information has always been the problem of privacy. In 1995 the European Parliament and the Council adopted a directive (95/46/EC) on the protection of individuals with regard to the processing of personal data and on the free movement of such data.

In the following years several initiatives where undertaken by the Council, the Commission and the European Parliament in this matter. Two aspects have dominated this debate: the information market and access as a democratic principle. Another step was the publications of the already mentioned Green Paper on Public Sector Information in the Information Society in 1999 . The Green Paper is divided into three parts. Part one deals with the importance of public sector information (importance of access for European citizens and the opportunities for economic growth and employment). Part two covers the relation between the Information Society and the public sector and deals with aspects as e-government and public sector information and aspects of electronic access. The third part covers the issues linked to access and exploitation of public sector information, such as conditions for access to public sector information, practical tools for facilitating access pricing and competition issues, copyright, privacy and the liability issues of information.

3.4. Access to public sector information: aspects

In the literature access to public sector information (for instance Frissen & Snellen, 1990; Boes, 1995) is defined in two different ways: active and passive publicity. Passive publicity is the right to look in to administrative documents and obtain a copy of them. The communication pattern used in this is consultation (Bordewijk & Van Kaam, 1982). Consultation is the process whereby individuals query an information system to find the chosen subject the moment they want in pace that is chosen by them. This right, limited by restrictions inspired by aspects as personal information, national security, etc, is the right stated in the above described policies. Sometimes this right is interpreted in the literature as including the right to obtain an explanation about the content of a document. But also an active form exists which holds the obligation to spread information without a formal request by a person. In the active form, the initiative to communicate lies in the hand of the authority. The communication pattern used here is allocution (Bordewijk & Van Kaam, 1982). In allocution an information packet composed by an information centre gets spread throughout a community by this centre at a point of time and pace decided by this centre. This communication pattern is typical for broadcasting.

4. From access to accessibility

The policies as developed by these international bodies have had an influence on the policy development in the (European) countries discussed in this paper(see further). As a consequence the notion of access to government information was spread throughout those member states of the European Union, which hadn't developed a framework yet (see further).

Governments started to disseminate their information and ICT's where used as an important tool. The arrival of internet in the mid-nineties accelerated this process. For the first time in history governments disposed of a tool that could enable governments not only to respect their own access-legislation but even to go further than that. Massive amounts of public sector information where put on the net. Along with this, a problem occurred: the accessibility of government information. In recent years a shift in the debate is noted from the problem of access to information to the problem of accessibility. These evolutions have accelerated the need for a policy framework.

4. 1. Accessibility

Beers (1996) distinguishes between five aspects of accessibility of government information (some of which are related to access as well): 1) access to the medium which the information is distributed upon, 2) traceability: knowing that information exists, knowing where, when and how it can be found, and being able do guide yourself trough the information 3) comprehensibility of the content, 4) comprehensibility of the presentation of the content and 5) the price for consulting the information. One of the first conditions for accessibility of government information is that in order to have access to the information, access is needed to the medium carrying the information: written media, oral media or electronic media. Especially in the case of e-government important differences exist in society between the have's and the have not's. The question is then how governments can solve this problem of unequal distribution of access to media: through public access in libraries, via an 'universal service obligation' for electronic media (internet as a basic necessity for living just like electricity or water?) or via other means?

The traceability of information supposes that the governments actively notify the society about the information it possesses and where its location is. Here possible interference between the government and the private market is possible since historically this often has been one of the added values offered by the content industry. Having the information traced is not enough. Once the information is obtained it is necessary that it should be comprehensive in content and in presentation. Government agencies face a dilemma in this context: if they neglect this aspect they will expose themselves to the critique that it's information is 'inaccessible', if they put much effort in this aspect they dos so at risk of being accused of manipulation of information. This aspect traditionally is the most important domain of the content industry. Since governments where unable to make their information such as laws for example comprehensible, the content industry created a market in creating books (and other media) where this kind of information was made comprehensible. The question here is where the role of the governments ends and market role begins. These questions are very closely connected to the last point of accessibility: the price for consulting public sector information. The first aspect related to this is the price-fixing. It is very difficult to fix a price for government information since the relation between cost of production and the data itself is hardly demonstrable (the data are often a by-product of some kind of service). In an electronic environment once the information is online, the marginal cost of spreading the information to one more person is almost nil. The second aspect is that the government most of the time has a monopoly on it's information. Price-fixing via the working of the market is thus hardly possible. Relating the price-fixing to the (potential) profit is difficult as well. Different types of profit exist: societal, individual or economic which can hardly be quantified. And even if the government should find a solution to the price-fixing problem, moral problems can be formulated. The government has gathered its information with tax money. Thus it would be unfair that potential users should pay a second time to consult this information, certainly when considering the fact that they are often obliged to give this information to the authorities. Nonetheless it is widely accepted that governments can obtain a reimbursement for the costs connected to the delivery of the information (for instance the price of a paper copy or a facsimile). This discussion becomes more interesting and important again when considering e-government. Then even this cost is reduced to a minimum (the push of a button, since the price of reproduction is nil).

4. 2. The transparency model

As mentioned in the introduction, the aim of our project is to develop a (legal) framework for transparent governments. The central question is: how can governments present themselves to society as a fully transparent organisation? In order to do so, we are developing a transparency model. In our view, governments not only need to provide access to their information, but should also make their information more accessible (see also de Terwangne, 2000, 710). In this way transparency is seen as a multiplication of access and accessibility. Thus, if one of the two items should not be realised, the government in question is not transparent.

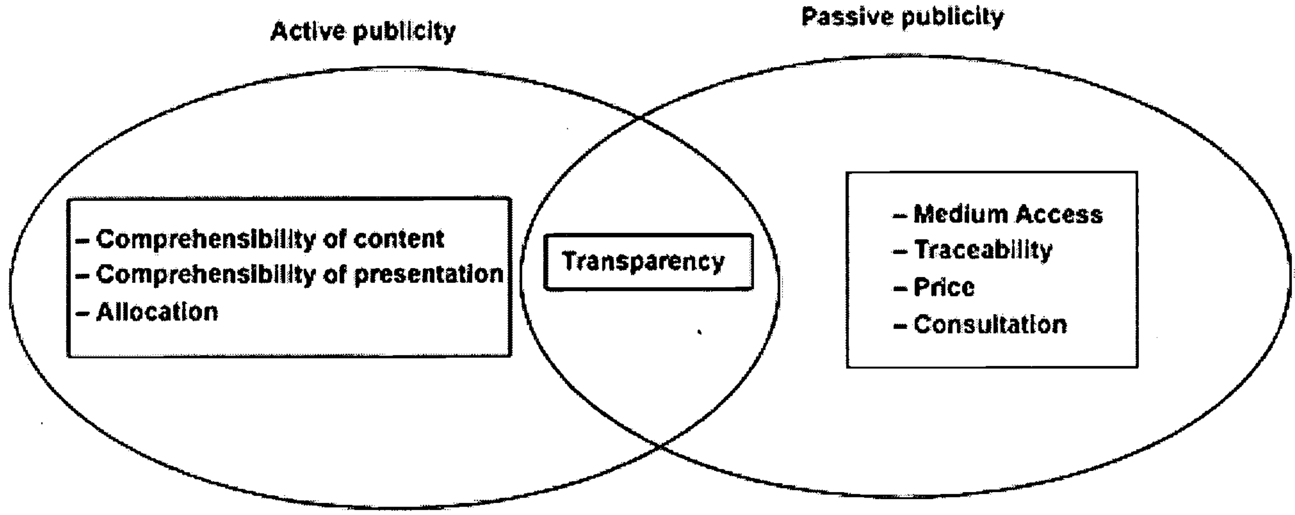

FIGURE 1: TRANSPARENCY-MODEL

4. 3. Access laws

4. 3. 1. Belgium

In order to adopt the Directive 90/313/EEC (see earlier) Belgian governments had to modify their legislation. The tradition in Belgium was one of absolute secrecy, unless explicitly stated otherwise. In Belgian access legislation an explicit difference is made between access to 'administrative documents' (see further) and access to other public sector information. The first aspect is regulated in specific 'civil publicity' legislation, the latter is covered by a diverse and fragmented set of regulations. We will discuss the first.

In 1993 an art24ter is added to the Constitution where the right of access to administrative documents is recognised for all persons (natural and legal). This article concerning civil transparency in Belgium is translated afterwards in different laws controlling the different layers of the public sector (federal, regional and local). These laws, however, provide that administrative documents thereby obtained may not be further distributed or used for commercial ends. In Belgian legislation a difference is also made between active and passive civil publicity (see earlier). The legislation defines the term 'administration' in a positive manner as well as, more importantly, negatively by excluding the legislative and the juridical powers. The term document is described in the most inclusive manner as "any information, in any form, which the administration possesses." Excluded from the general principle of public transparency are documents of personal nature.

As of 24 March 1995, the Federal government maintains an extensive Internet website in four languages (Dutch, French, English and German) at http://belgium.fgov.be. This 'umbrella website' contains pointers to all Federal departments. A wide variety of information is available, such as: general information on Belgium, decisions of the Council of Ministers, useful addresses of governmental organisations and initiatives regarding public sector information. The Communities and Regions also maintain their own websites. These are accessible through the Federal website by means of hyperlinks. No other special policies are being developed to stimulate the accessibility of public sector information.

4. 3. 2. The Netherlands

In the Netherlands the Government Information Act (entered into force in 1980, amended in 1991) compels administrative authorities to disseminate government information actively, and to provide information upon request. There are, however, exemptions from and restrictions to these obligations. These exemptions and restrictions are comparable to those under other general access laws (e.g. exemptions in the interests of the state, third parties and the protection of the decision making process).

The Ministry of the Interior has a co-ordinating role in developing public sector information policy. Under impulse of this Ministry steps have been taken towards the development of a general information policy. In June 1997 the Cabinet issued a memorandum "Towards the accessibility of government information, Policy framework for increasing the accessibility of government information through information and communication technology". The key topic in the memorandum is which public sector information should be made available electronically, for whom, why, how and at what price. In the Cabinet's view, so-called basic information of the democratic constitutional state (legislation and regulation, statements by the judiciary courts and parliamentary information) should be made accessible as much as possible since this category of information is generally speaking, public. ICT may be an important instrument in this. As far as electronic data files of administrative authorities are concerned, the Cabinet has noted in the memorandum that a policy needs to be developed governing access to file data, in particular the access by the private sector.

The Cabinet has since taken an active part in the public and academic debate on access and accessibility of (electronic) government information. This aspect is seen as a key element in the development of an 'information society'.

4. 3. 3. Sweden

Sweden has been an international pioneer when it comes to access to public sector information. Sweden has the oldest access law in the world (the 1766 Freedom of the Press Act, last amended in 1994) giving access to documents, including electronic documents, kept by a public authority. All documents drawn up or received by an authority are included. Access can be denied only with reference to a specific clause in legislation demanding secrecy (the Secrecy Act). In principle, this legislation also covers information held in databases and registers of public authorities. Access to information in data systems and registers is in practice limited to such data that can be extracted and delivered with routine procedures. There are special provisions in the Data Protection Act for a citizen to get information on what data are recorded concerning him/herself in public registers. In Sweden access to information is seen as a fundamental civil right. As a consequence public reaction is often very hostile towards regulations concerning the commercialisation of government information. The Government IT Bill, passed by Parliament in Spring 1996, outlines the direction in the Government policy for further opening up public sector to electronic access. The Bill stresses the power of IT to strengthen transparency, democracy and to create economic advantages for society, and sets out general guidelines for public and business sector access to information, as well as for the citizens.

In the Government Public Administration Bill of 1998 information service in the public sector is one of the main issues. As a basic principle pricing of public information should be based on recovery of distribution costs. The

Government also outlines the direction for further work in this field, including how to define national basic data and how to make information from public registers more easily accessible in electronic form. The authorities whose work is primarily dealing with companies and individuals should offer electronic services for self-service as a complement to traditional services.

4. 3. 4. Singapore

In any evaluation of the impact of IT on access to public sector information, Singapore presents itself as a fascinating and interesting case.

One the one hand, Singapore is internationally recognized as a premium example of the use of ICT's in the public sector. In 1992, the National Computer Board detailed a strategic statement, "IT2000: A vision of an Intelligent Island". One of the major goals of this policy document was to establish a broadband infrastructure of high capacity networks and switches throughout the island. This resulted in the creation of Singapore One (Tan, 2000) which is constituted out of two independent networks, one based on ADSL and the other on cable modem technology. Singapore One has the intention to connect all citizens, businesses and governmental bodies to a high bandwidth network.. Singapore also formulated an "ICT21 Masterplan" with the aim to develop further use of ICT's in Singapore over the next 10 years and to lead Singapore into the new era of the electronic world or e-world. The ICT21 vision is to transform Singapore into a dynamic and vibrant global ICT Capital with a thriving and prosperous net economy by the year 2010. The "ICT21 Masterplan" will map out strategies to attain the following three key objectives: 1. To develop the ICT sector as the key sector of growth in Singapore's economy. 2. To use ICT as a common platform to boost the performance of Singapore's knowledge-based economy. 3. To leverage on ICT to enhance the quality of living of Singaporeans in the Information Society of the future. E-government and an highly accessible public sector play a crucial role in this transformation process. Singapore has established a government portal and where most government services are online. Singapore's government has taken major steps to create an accessible public sector by creating a broadband infrastructure accessible to all and a single comprehensive web portal.

On the other hand Singapore is often seen as an 'illiberal (soft) authoritarian democratic culture' (Mutalib, 2000:1) build on 'the belief that Singapore moves ahead only by adhering to the government's values and ways of managing the state, and that such governing paradigms are not only to be maintained and buttressed, but doggedly pursued' (Mutalib, 2000:1). One of the primary aims of the Singapore government is to actively transform the island into a world leading e-economy. 'Singapore's policy makers are committed to the transformation of the island economy into an information hub, trading in ideas rather than commodities. Yet Singapore's authoritarian leaders have no intention of surrendering political control in the process' (Rodan, 1998:2). Former minister of education Peter Chen puts it this way: "The development of electronic public services is critical to setting the pace in proliferating the use of IT and creating an IT-savvy culture in Singapore. It will enhance the ability of the public to be increasingly familiar and comfortable with IT, which has become a critical component in the knowledge economy. Our people's openness to and skill with IT can offer a distinctive competitive edge to Singapore" (quoted in The Economist, 06/24/2000). With this in mind the e-government initiatives of the government could also be seen as a way of stimulating the transformation towards an e-economy, rather than a way to create a more open and democratic society.

5. Conclusions and discussion

From the overview of the different countries it is clear that they are making the step from access to accessibility by using government portals to disseminate information. Internet has played a major role in this evolution. Nevertheless this evolution is not translated into specific (legal) frameworks. It is striking to see that, certainly in the perspective of the European Union, the right of accessibility interferes with the development of the European information market. The central question is whether or not governments do have a responsibility. If the answer to this question is positive, the problem rises what this framework should be. We have presented the first steps that can lead to a solution. The question is how this can be translated into a legal framework and how far the responsibility of the government reaches. It may be clear that, although we didn't cover this in this article, this will have major implications for the concept of citizenship (the resident as a voter, as a citizen or 'citoyen' in the political meaning of the word and as a consumer or client of government's services (Bekkers & Depla, 1996:11; Bekkers, Zouridis & Korsten, 1998:107) and the citizen's relationship with government. Such a legal framework should cover different aspects: active and passive publicity, privacy, protection of an information industry, price-fixing and commercialisation of public sector information to name just a few. This is part of the work that will be done in 2001-2002 in our project.

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Endnotes

[i] See at: http://europa.eu.int/ISPO/docs/policy/docs/COM(98)585/index.html
[ii] http://conventions.coe.int
[iii] http://stars.coe.fr/
[iv] http://cm.coe.int/
[v] http://europa.eu.int/eur-lex/en/lif/dat/1990/en_390L0313.html
[vi] http://europa.eu.int/eur-lex/en/treaties/dat/treaties_en.pdf
[vii] http://europa.eu.int/eur-lex/en/lif/dat/1993/en_393D0731.html
[viii] http://europa.eu.int/eur-lex/en/lif/dat/1994/en_394D0090.html
[ix] http://europa.eu.int/eur-lex/en/lif/dat/1997/en_397D0632.html
[x] http://europa.eu.int/eur-lex/en/lif/dat/2001/en_301R1049.html
[xi] For more information on the 'making of' this regulation see http://www.statewatch.org/secret/observatory.htm
[xii] http://europa.eu.int/eur-lex/en/lif/dat/1995/en_395L0046.html
[xiii] The publication of this Green Paper was the subject of much political difficulties as it was first foreseen to be published in 1996.
[xiv] See http://www.s-one.gov.sg/overview/it2k01.html for more information.
[xv] http://www.gov.sg/

back to sessions

Abstract

This paper presents an overview of the literature concerning the different social as well as legal issues that are involved with the accessibility of government information. Based on this literature a theoretical framework is developed that should lead governments to make their information more accessible. This theoretical framework is used to compare the frameworks different governments are developing. The comparison is made between the policy documents and the legislation of Singapore, The Netherlands, Sweden and Flanders (Belgium).

back to index

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back to index

The Next Generation: Empirical Research, Ethical Issues, and the Implementation of Choreographed Intelligent Agents in the Pacific

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View Abstract

1.0 WHAT ARE AGENTS AND CHOREOGRAPHY?

Millions of people have been introduced to agents by using internet search engines and other automated software devices, which replace, enhance, and accelerate human processes. The Foundation for Intelligent Physical Agents has roughly defined such an agent as an entity that resides in environments where it interprets "sensor' data that reflect events in the environment and executes 'motor' commands that produce effects in the environment. (FIPA, http://drogo.cselt.it/fipa, 1998)

In less technical terms, an agent is smart software that autonomously and often repetitively performs computer or computer-like tasks on a person's behalf. An agent might automatically send e-mail birthday cards on the correct dates of each year, locate new research about a topic as it becomes available on-line, book your travel to Tokyo every month, or launch missiles at designated targets whenever specific airspace is invaded. Potentially, sophisticated agents may work as an individual's concierge, paralegal, operations director, secretary, assistant, travel agent, researcher, and similar roles.

Choreographed or **interactive** agents are entire systems of linked agents, which can perform more complex assignments such as functioning as a mailing house for a company. Such a multi-agent mailing system could simultaneously mail bulk messages or publicity, send auto-replies to in-coming messages, selectively forward replies, and at the same time add, drop, and correct addresses. Choreographed systems might also serve as the nervous system for an artificial intelligence complex or robot, sell and distribute products on-line, provide multiple options for someone who is "lonely" on-line, write hourly news updates, and eventually coordinate elaborate power grids, weapons systems, and internationally interactive databases. (Christians and Cooper, 1998)

1.1 AGENT EXPANSION INTO THE PACIFIC

Empirical research, especially that published in PTC PROCEEDINGS, the PACIFIC TELECOMMUNCITION REVIEW, and field work, such as by Ogden (1991), Varan (1993), Plange (1993) and in documentaries by O'Rourke (1987), and Gardner (2000) suggest that technologies introduced into the Pacific may have both expected and unanticipated socio-cultural effects. For example, Ogden (1991) noted that the impact of television in Palua and The Marshall Islands led to instances of young people disrespecting and ignoring their elders in ways, which disrupted traditional society. O'Rourke (1987) observed that a tiny island such as Yap, after the introduction of television, was socialized to depend upon unnecessary consumer products, and Varan (1993) noted that Cook Island students watching late night TV fell asleep in classes, that violent videogames replaced peaceful traditional children's' games, and that island girls began to aspire to unattainable and cosmetic ideals of female beauty.

If there are studied effects (too many to be fully listed here) of television, radio, VCRs, video games, and the internet within the Pacific, it seems both likely and logical that choreographed agents will have Pacific impact as well. Moreover, as early as 1998 the Foundation for Intelligent Physical Agents was hosted in Osaka, Japan, with participants from Comtec, Hitachi, Fujitsu, JVC, Matsushita, NHK, NTT, and Tohoku University in attendance. (http:// www.cselt.it /fipa.it /osaka). There can be no doubt that there are, on the one hand, key players in the development and implementation of agents in the Pacific as well as, on the other hand, entire countries, villages, and islands which are unaware of the possible pending effects of choreographed agents.

1.2 WHAT IS KNOWN EMPIRICALLY ABOUT AGENTS?

It is far better to have empirical and scientific knowledge about a new technology than merely anecdotal or undocumented reports. Fortunately, a growing scholarly and technical literature has emerged to surround agent development. Layton and Isbister (1996) have provided a sizable literature review of agent research in 2000 (www.research. microsoft.com/ research/ui/persona /isbister.htm). Their analysis of the literature concludes that there are primarily two types of substantial research, one concerning the more publicly widespread "filtering" agents, including search and other autonomous engines for users. The second type covers a wider range of agent bridge functions, which might assist users to obtain any large number of goals. It is within this second literature that the expressive qualities of "characters", and thus the thin line between "intelligent" software and human behavior are being discussed and debated. Isbister and Layton (1996) found that an important list of issues, which include trust, user control, customization, repair, security, privacy and especially anthropomorphism, are being discussed within the mushrooming literature.

Scholarly literature reviews are more important when their analysis reveals a summary overview. One of the best empirical overviews of agent research is presented by Nwana and Ndumu (1999) within their eye-opening paper "A Perspective on Software Agents Research." (http://agents.umbc.edu/introduction /hn-dn-ker99.html)

After assessing research from the final five years of the twentieth century, the authors conclude that despite much progress in the development of agents, serious problems still remain in the advancement of multiple agent systems. In short they conclude that insufficient work has been dedicated to the problems of ontology, legacy, and the context by which agents interact and fully understand each other. In other words, Nwana and Ndumu note how much research addresses the trees but not enough addresses the forest.

Therefore far more attention needs to be paid to holistic or systemic approaches to agent choreography if agents are to function in concert. Refinement of agent "teamwork" must become a theme of the current decade.

2.0 WHAT OUGHT TO BE EMPIRICALLY KNOWN ABOUT AGENTS?

Research to date seems far more focused upon the functionality, design, tasks, and technical requirements for software than upon the possible socio-cultural effects of agents. Hence, after a review of existing literatures and of research overviews it is the conclusion of this essay that not only are Nwana and Ndumu's recommendations valid — more systemic or holistic research is needed -- but also a campaign for predictive and preventive socio-cultural empirical research should be undertaken as well.

Before elaborating upon how the black holes in agent research might best be filled, it is important to note that there are already a few initial steps in that direction. For example, the entire discussion about whether or not Artificial Intelligence will ever be "alive" often considers the possible societal and moral consequences of having machines perform as humans. Moreover, there are scholars investigating the agent field such as Abe Momdani and Jeremy Pitt in England who are fully aware that intelligent agents are not autonomous but are owned, and consequently must be studied as part of society (see Pitt's Alfebiite Project at http://www.iis.ee.ic .ac.uk/ ~alfebiite/documents /). Such initial steps will beget others but are currently the exception, not the rule.

Given the dearth of agent effects research, it is valuable to study "next-of-kin" empirical research and analysis for its possible relevance if applied to new and relatively untested technologies. For example, although the effects of combining agents are largely untested, there have nevertheless been important breakthroughs in testing inter-activity or combination processes in such fields as toxicology and biochemistry. In such studies, as with Heisenberg's Uncertainty Principle in physics, it has been demonstrated that interaction (or, in Heisenbeg's terms, observation) of itself may produce discrete effects. For example, U.S. toxicologists have perceived.... A step toward recognizing multiple agents. The National Academy of Science Committee notes that two or more additives can act synergistically to promote high-tumor yield in animals, whereas separately they do not. (Hall, 61).

Similarly, in his landmark research text FOOD FOR NOUGHT (Harper & Row, 1974), Canadian biochemist Ross Hume Hall concluded that chemical additives used in food production might have one effect upon food if tested separately, but when tested in combination with other chemical additives might behave entirely differently. (Hall, 62) What is important about such research is the importance it gives to interaction.

A large bibliography within the history of technology such as by White, Giedion, Mumford, Innis, McLuhan, and others, has already suggested that technologies have specific effects upon their environments and audiences. For example, the likely effects of television violence upon audiences, as tested by Gerbner, Gross, Wartella, and many others, have been widely reported.

However, the combined effects of interactive media are minimally discussed. If some societies in remote

Pacific islands had no electronic media until the 1980s and 1990s (and some are still totally without), what does it mean for an island to now encounter multiple technologies -- television, the internet, agents, the VCR, the CD, satellite, the DVD, fax, and others -- simultaneously? The interaction of multiple media is important as it may create combined effects such as noise pollution, Wurham's "information anxiety" (the feeling of not being able to keep up with information), conflicting versions of truth, sensory ratio shifts, confusion, multi-cultural conflict, global connectivity, commercialization, social "progress", business competition, and other effects, some positive, some negative, some neutral, some mixed, and some unknown.

Choreographed agents present a web of software inter-activity within a larger complex of multi-media interaction. Therefore it is critical that not only the effects of agents be empirically tested, but also the effects of combined or interactive systems of agents be scientifically studied within the larger context of both a multi-media and a multiple media environment. Studies of effects and ethical issues spawned by new media such as by Cooper (1998) exist but the testing of how such new media will interact within various Pacific environments is a necessity of the near future.

2.1 ANTICIPATING SOCIO-CULTURAL EFFECTS AND ETHICAL ISSUES

Many positive effects of agents are inherently obvious and are the very reason that such new technologies are being implemented throughout the Pacific. These positive effects include 1) saving time 2) saving money after initial purchasing costs 3) saving labor 4) making task accomplishment comprehensive 5) automating mindless tasks 6) increasing global connectivity and 7) enhancing productivity.

However, it should be noted that each Pacific culture is different and some cultures may not wish to increase global connectivity or speed-up production nor disrupt ancient traditions. Moreover, the implementation of new technologies, like new drugs, creates hidden or unknown effects, some of which later prove negative, such as the radiation danger of computer monitors to pregnant women, the birth defects stemming from thalidomide, and the increased aggression in children who are heavy users of Western television.

Although no crystal ball is available to observe the full range of agent effects in each Pacific country, there are specific methods for anticipating possible effects, which are more scientific than others. To some degree new technologies may be tested before, during, or shortly after their implementation as was once the case in the United States by the Office of Technology Assessment. Associations such as Future and Emerging Technologies, which exist in Europe, may also be established for professionals and academics to compare notes (http://www.cordis.lu/ist/fetintro.htm#what). Professional organizations such as FIPA also allow professionals to establish over-arching standards and ethical principles among those developing agents. Additionally, interest groups within organizations such as PTC in the Pacific could be created to discuss the possible social effects of agents, or any new technology, in the Pacific.

Among scholars there are two specific approaches to anticipating possible socio-cultural effects which are grouped under the coined term "presearch", or "preventive research". The first of these approaches might be called "next-of-kin" studies, that is, previous tests upon similar technologies and tests of similar phenomena in other disciplines such as those already reported in toxicology and biochemistry.

The second approach might be called "attribute-based" predictive research, which means that if one may properly determine the essential attributes or functional specifics of a new technology, then one might predict possible socio-cultural effects by isolating and sometimes exaggerating that attribute. For example, one attribute of agent technology is that of autonomy. Autonomy declares that an agent may accomplish a task repetitively without further instruction. Such autonomy can potentially lead to a Sorcerer's Apprentice effect in which a process, once turned on, is not successfully turned off. For example, if the boss in the office sends out electronic birthday cards to all employees, after the boss dies the cards will continue to be sent via e-mail, which would signal to everyone that an agent rather than the boss had sent the cards. If an agent autonomously broadcasts warning messages to enemy ships which invade local waters, how will the agent know when countries have shifted their allegiance, have permission to trade goods, or are in negotiation with the host country. Hence one may predict that vendors, manufacturers, governments, and policy experts will need to anticipate socio-cultural problems based upon the attribute of autonomy and will need to constantly reprogram, test, and monitor agents .

According to the combined research of FIPA scientists and this research, other attributes of intelligent agents include 1) social ability 2) reactivity 3) pro-activeness 4) adaptability 5) mobility 6) temporal continuity 7) transparency 8) auto-replication 9) self-maintenance 10) auto-destruction 11) sustainability 12) multi-cultural presence and 13) camouflage/impersonation. (http://drogo.cselt.it/ fipa,) Unless there is sufficient research, the combination of these attributes mingled with the choreography of intelligent agents could, lead to predicaments such as

1) the Stan McGregor case in which an individual says "I am lonely" to his computer. Immediately but transparently to Stan, electronic choreographed agents simultaneously provide lists of contact information about religious leaders, psychologists, local arts and amusements, best friends, family, escort services, and others. Who is accountable if a pop psychologist or cult leader, listed in a manner so as not to be distinguished from all the reputable counselors, gives bad advice leading to suicide or if the escort service leads to death by AIDS or criminal activity? At this time agents cannot distinguish "ethical" and "accountable" from "unethical" and "irresponsible". (see Cooper et al, 1998, for debate about agent liability).

2) a listener writes an evangelist who uses choreographed agents to filter and answer audience mail with several different form letter replies selected by topic. Since agents cannot distinguish "tone" and hidden messages in the letters, but only respond to key words and phrases, the already disturbed listener, seeking advice from a trusted authority, receives the wrong generic letter, based upon using figures of speech, interpreted literally by the agent, and has a nervous breakdown or worse.

3) an agent conducting research on Lady Diana Spencer to help an author write a book gathers confidential information from data bases about another Diana Spencer living in Australia because it cannot distinguish between the two people nor respect confidential boundaries. The latter material about Diana Spencer's health conditions are published by the author without realizing the mistake and lawsuits regarding invasion of privacy, defamation, and violation of confidentiality are pursued.

4) choreographed agents trained to shoot missiles at hostile targets when a host country is attached, fire instead at their own cities and people because the combination of agents creates an unanticipated (Hall) effect or because enemy hackers cleverly change the target sites.

The attributes of agents make these and many other unexpected scenarios possible unless sufficient presearch is conducted. Moreover agents created in one culture may have additional unknown effects when introduced to other cultures. Hence the complexity is thrice increased by the multiplicity of agents, of interactions, and of cultures.

Consequently, the implementation of agents in the Pacific, especially when combined as multi-agent systems, and in countries where the internet itself is a recent immigrant, needs to be closely studied. Consequently, a series of recommendations are presented based upon the conclusions drawn from available empirical research, literature, technology studies, next-of-kin research, and from attribute based analysis.

3.0 CONCLUSIONS AND RECOMMENDATIONS

In most parts of the world including the Pacific most people are unaware of what intelligent agents actually are, even if some populations are using an agent prototype called the internet search engine. It is important that people be made aware of the nature and functions of agents so that they will know, for example, if a response received from a celebrity or government official came from a real person or was generated by a machine. Wherever agents are unknown, education about the nature and use of intelligent agents is important in and beyond the classroom.

Moreover, it is vital to conduct empirical studies to test the effects of linked agents in specific countries. There are hidden and long-term effects of each technology, which are often only discovered after the fact — once law suits and problems have occurred. Scientists conducting preventive research or presearch can take steps toward minimizing possibly damaging and as yet unknown effects. Councils of scientists, business representatives, parents, community leaders, government liaisons, and others, depending upon the culture, may wish to be assembled to consider new technologies prior to their implementation to make recommendations to engineers, manufacturers, and policy groups prior to the widespread use of new technologies.

Many positive and neutral effects may be anticipated from intelligent agents primarily in the areas of eliminating repetitive tasks and in refining and speeding up the processes by which such tasks are accomplished. Thus differing cultures in the Pacific may value or devalue agents to the degree to which each values authenticity, speed-up, physical and mental labor, surrogate or substitute automation, natural rhythms, cultural and individual privacy, and technical innovation. Each culture will have differing sensitivities to the degree that a technology might contribute to the preservation or erosion of traditional culture and language.

There are a growing number of resources available about intelligent agents. Perhaps the best introduction to a wide variety of scholarly and technical sources, many of which are listed in the endnotes references of this article, are listed at the UMBC comprehensive webliography (http://agents.umbc.edu/Publications and_presentations/). It is important that such sources and research grow in quantity, quality, and diversity.

It is crucial that available findings about the effects of solo and choreographed agents be quickly published and posted so that an unknown quantity, especially unknown within the context of Pacific daily life, may be better tested, adapted, and understood by the information rich and poor alike. Ideally, numerous positive and important functions may be performed by choreographed agents. However, potential negative and unknown effects cannot be ignored and must be carefully investigated through widespread and multi-cultural empirical analysis. A balanced and thorough inspection is essential.

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Abstract

This paper introduces agent choreography, as well as empirical research about agents and relevant empirical research literature. Recommendations regarding empirical research about the implementation and socio-cultural effects of choreographed agents in the Pacific are provided. In a related vein an analysis of the likely socio-cultural effects and germane ethical issues introduced by agents and by multiple agent interaction (cf. choreography) is presented based upon empirical agent research to date, the findings of empirical research in other disciplines, and research conducted about related technologies.

back to index

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back to index

INTERNET FOR PUBLIC SERVICE

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India

View Abstract

1. IT and Internet in the Indian Consciousness:

1.1 Mr Pramod Mahajan the Minister for Information Technology (MIT) of the Government of India once visited a remote village in the backward Marathwada region of the state of Maharashtra, Western India. There the village women demanded of him that a publicly accessible Internet Kiosk be provided. He asked them, "you do not have any assured and protected drinking water supply; instead of asking for it, why are you asking for a new fanged thing like Internet Kiosk?"

The village women answered, "we are used to living without water for the last 2000 years. We can now not live satisfactorily without an Internet facility for our community." They said they hear about it on the TV and radio every day.

Mr Gurucharan Das, the former Chief of the multinational company Procter and Gamble toured rural India. In Uttar Pradesh, one of the least literate and poor states accosted a boy who was grazing cattle and asked him what was his aspiration. The boy replied, "I want to go to a convent school."

Gurucharan Das asked, "why not the local school".

Cattle Boy: "I want to study English".

Gurucharan Das: "What for?"

The Cattle Boy: "I want to become a business man and a crorepati (billionaire) like Bill Gates (pronounced Bilgay in Hindi)."

Gurucharan Das: "Who is Bill Gates?"

Cattle Boy: "You don't know? He is the richest man in the world. And he is very young."

Gurucharan Das: "How do you know this?"

Cattle Boy: "I view the community TV set that is in our village. I learnt of Bill Gates and how he is becoming richer and richer through news on the TV. I saw his photo also."

These two narrations should show how intense the fascination of Indians for Internet and for Information Technology is.

1.2 For the past five years, Mr. Chandra Babu Naidu the Chief Minister of the South Central State of Andhra Pradesh has been evangelizing Information Technology in the following words: "you can lose all your wealth, all your money in the bank; you can lose your land for the debts you incur. You may lose your family members but you can never lose information and knowledge that you once gain. Information and Knowledge are the only wealth that can be never lost. Information and Knowledge are everything. They are available very in - expensively through Internet. You must learn how to use the PC. My government will put PCs in all the villages and schools and will connect them up to the Internet will introduce computer education in all the schools. Every service that the government has to render to the citizens will be available through the Internet. From the Internet Kiosks in your village you can get formation on any subject from anywhere in the world, just like you are able to talk to anybody using the village telephone. Those who can use the PC and learn English will get jobs for doing the work required by America and Europe and Japan and Australia. IT is everything ....." and this is the staple of his talk week of the week with the result that Andhra Pradesh which was nowhere on the IT and software map of India six years ago, is now the state with the third largest exports of software and also the state which is producing a quarter of India's IT and software professionals for work required abroad and in India also. The number of Engineering colleges in the state had gone up from 35 in 1995 to 164 for the academic year 2001-02. Courses for Bachelor and Master of Computer Applications (BCA and MCA) are offered in 450 and 220 colleges respectively. The state is adding to India's stock of IT and software professionals in a profuse and increasing manner. This is now emulated by the adjoining States. The government of Andhra Pradesh (AP) is executing projects to go all-electronic for which an electronic/photonic transport system connecting up all the villages and towns is coming up. The state has got 30,000 route km of optical fiber cables commissioned by the incumbent state-owned telecom enterprise, Bharat Sanchar. Three private companies and two state-owned electricity companies and railways are also putting in competitive electronic and photonic transport systems, linking up cities and also passing through all the main roads and streets in the large cities.

1.3 Now it is not only in Andhra Pradesh, but in almost every State of India there is a great awareness of the good that Internet and Information Technology and Telecommunications can do to the ordinary people not to talk of improving the economy and efficiency in businesses and Government. No Chief Minister of any State can refrain from referring to IT and educational excellence needed for India's development and for India to capture a sizable portion of the global IT and Information Technology enabled services market. The whole country realizes that tens of millions of jobs can be created by promoting IT enabled services for which optical fiber based broadband telecommunications transmission is being extended to cover more than 4000 administrative towns and cities and all villages with a population of more than 5000. IT especially, its applications for electronic governance, for dissemination of educational and market information to all villages is being taken up as a priority Government program. The Union Government constituted a committee of Parliament, "IT for the Masses". Its Report contains a number of wonderful recommendations for immediate implementation so that the mass of people can benefit from Internet and IT. Hundreds of start-up companies are developing applications that are useful to educational institutions, farmers, rural markets, literacy programs and for the services that Government has to deliver to the people. (some of these are annexed).

2. The Roll-out of Internet:

2.1 What has begun in AP is now being replicated in a competitive spirit in several states of India and in the federal government itself. The Telecom monopoly is being ended progressively; by now over nearly 100 companies are engaged in competitively providing wired as well as wireless mobile telephony. There is no limit on the number of companies that can provide interstate long distance and intrastate fixed that is, wired telephone service. The international voice telephony will be opened effective from April 2002. Over 400 private companies took licenses to provide Internet service. More than 100 companies are operating. There are over 20 international gateways (120 are licensed so far) using satellite earth stations, several of them in each of the big cities. Some Internet companies are using wireless in the local loop (WLL) to connect customers to their points of presence. Internet service has now gone to more than 400 towns and cities (which account for 70-75 of India's telephones) and also a few thousand rural towns. Private ISP companies are franchising the publicly used Internet Kiosks in the cities. All these are remunerative in cities and Metropolises like Delhi and Bombay each of which already have a few thousand each and other cities like Bangalore and Hyderabad are reaching a figure of 1000 each. In the State of AP, 1100 rural towns (third tier administration) are having Internet Kiosks by collaboration between the state government and the Federal government-owned incumbent telecom company, Bharat Sanchar. The Bharat Sanchar Nigam Limited, is required by the Government to put a publicly accessed Internet kiosk in each of the more than 4000 tertiary Government administrative towns. It is likely to complete this special task by the end of the year 2002. As many of these will not be commercially viable, the Universals Service Fund which is being developed by a cess on the gross revenues of all the licensed telephone companies will be used to subsidize the working of public Internet kiosks in rural areas. Government programs like Empowerment of Youth (for unemployed educated persons who receive a certain sum as outright grant and an equal sum, bearing low interest) include the setting up of public Internet kiosks in villages as a measure of self employment as well as to enable villagers (even if they are unable to surf on the Internet) to receive the benefits of Internet. India's policy is that just as telephone service is extended to all the villages by installing at least one public telephone for a community, Internet service should be available in every village also through a public Kiosks. In the cities the private companies will the do the job themselves as it is remunerative in the rural areas service will be rolled out as a public service obligation by the facilitative action of the State and the Federal governments.

2.2 Since the monopoly over Internet service of the government company (VSNL) was abolished in 1998, the number of Internet subscribers multiplied seven times and usage charges came down to a fifth. Government has provided a specially low tariff for dial-up access in rural areas. There is a 25% rebate for users of Internet in rural areas and where the dial-up access is overlong distance, the call is treated as a local call whatever be the distance to the nearest POP of the ISP. These are the proactive measures to make Internet service affordable and available through out the territory of India in the quickest of time.

2.3 India's (wired) telephone density is less than 3.5 per hundred people. (The mobile tele-density as on 31.10.2001 is 0.5 and is growing rapidly). However, national policies have seen that there is Universal Access to telephone. The mechanism is putting public telephones, operated by physically disabled people who are given a certain commission as remuneration from the collections made from the PTs in the villages and towns. 400,000 of the 600,000 villages have a public telephone; in the nearly 4000 towns and cities one public telephone is available at every not more than 500 meters distance of any residence/business. Their use is so intense that 30% of the revenues that the incumbent gets are from public telephones. This is one of the most successful ways of extending the benefits of telephone usage to the common people through out the territory of India. It is the Government's policy that just as the telephone is made accessible to all the people everywhere, the Internet also should be accessible. The mechanism is facilitating the up gradation of the nearly one million public telephones into Public Tele-Information Centers (PTICs) by equipping each one of them with a PC and giving Internet connection. Two things are happening simultaneously the private Internet services (PISPs) are competitively franchising Internet Kiosks in the towns and cities as these are remunerative. In each one of the cities with a population of more than 500,000, hundreds of public Internet Kiosks have come. These targets are being achieved in the progressive states in South India. In the villages where Internet service cannot be remunerated, public service obligations are imposed on the licensed private telephone companies. Indian and international aid agencies (ex: World Corps, Digital Partners etc., are reaching out to the villages to put Internet Kiosks). Certain states like Andhra Pradesh, Maharastra, and Karnataka and Tamilnadu, all in South India are promoting the roll out of Internet services into villages. Indigenously developed Wireless in the Local Loop (WLL) systems giving one telephone plus a 36 kbps data transmission or alternatively a 72 kbps data transmission capability are being deployed to connect Internet Kiosks in the villages to the nearest point of presence (POP) of whosoever is the Internet Service Provider. In one constituency, Kuppam (for the local State Legislature in Andhra Pradesh) all the 54 villages are thus connected by WLL to Internet. The National Bank for Agricultural and Rural Development (NABARD) is financing the provision of one Internet Kiosks at least per village in four districts in the state of Andhra Pradesh in a pilot project. By about the end of year 2002, about 4000 villages, that is every village in these four districts will be having a publicly accessible Internet Kiosk. Similar programs are being implemented in States like Tamilnadu, and Maharashtra.

3. Some uses of the Internet in Public Service:

3.1 Examination Results: In the State of Andhra Pradesh there is a Board for Secondary Education and another Board for Intermediate Education. Over two million students appear for the former and about 1.2 million for the later examination. The results announced by the Board used to be released to newspapers. That could therefore be available only the next day and they would reach the schools officially only after a few more days. Since the year 2000, the results are put up on the Internet, thus making them available no sooner than they are announced by the Boards. Even the marks of every candidate are also put up on the Internet and could be downloaded.

The states conduct examinations for entrance to professional courses like Engineering, Medicine, Business Management, Computer Applications etc. The results for these examinations are also put on the Internet. In the year 2001, counseling the students as to in which college and for what branch they could seek admission is also accomplished on the Internet. If they don't have an Internet connection in the home candidates can go to any Internet booth access an official counselor on line.

3.2 Markets for Rural Products: Internet is used for marketing rural and household industrial products. There is a programme Development of Women and Child in the rural areas (DWCRA). Ten women in the village can form one group. If they raise and pool together $20, government gives $ 20. This is called micro-financing. The women use their skills and produce products like toys, knitwear, preserved foods like pickles, lace work, painted and knitted curtains, etc., The marketing of these products was prohibitively costly. Now, these are all photographed and scanned and put on to web sites which can be approached through portals of supermarkets. Thus, the products of a village are now finding world-wide markets. Former President Bill Clinton visited India in 1998. He saw excellent lace curtains produced by DWACRA group in Andhra Pradesh on a web site. Not only did he like and buy some lace curtains, but he invited the leaders of that DWACRA group from a remote village of India to the White House. This event sent tremendous encouragement to all the DWARCA groups (in the State of Andhra Pradesh) numbering over 3000, (involving 3 million rural women who are mostly illiterate). Prosperous DWACRA groups are being helped to acquire a PC and an Internet connection to help them not only to manage their accounts but also promoting the marketing of their products.

3.3 Applications developed by small start-up IT companies are being extensively used by the sugar cane farmers and milk producer cooperatives in the villages of Maharashtra using extensive Intranets specially constructed by the National Informatic Center (NIC) (a Government of India department) in association with the State Governments' IT departments. Sugar and dairy farmers are having their individual accounts with the purchasers downloading them from the websites. The association of sugar mills and the dairy farmers; have put tremendous amount of information relating to cane-growing and cattle-rearing in the local language, Marathi. Touch screens enable illiterate people also to get information! Training classes have been held by the NIC and the diary farmers' association to enable farmers to use the Internet themselves.

3.4 House-wives in Business: A number of educated house-wives, who do not want to take up a full time job leaving their homes, are putting themselves in business by creating web-sites for merchandise. An example is that of house-wife Mrs Shalini in Delhi whose website is www.shalincraft.com. She has signed up with a number of cottage industrialists, artisans, crafts women, weavers, painters, whose products are famous all over the country. The photographs of all their products along with descriptions are on the website. She has her e-buyers in the USA, European Union, UK. She is making US $ 15,000 per month. This is an extraordinary amount for educated housewife sitting at home and doing business. As story spreads, the examples multiply.

3.5 Impacting the Government: Like Al Gore in his time as Vice President of the USA, the Chief Minister of Andhra Pradesh has an electronic mail correspondence unit in his office in Hyderabad. Any complaint or inquiry or suggestion or comment that is sent to the Chief Minister on e-mail is acknowledged to answer within 24 hours. Not only that it is so indexed that the sender can know as to what is happening to his email communications. The government promised to be SMART - simple, moral accountable, responsive and transparent. It is now putting up a government portal so that every citizen, can from any Internet Kiosk navigate to the appropriate government officer to get his matter registered and responded. Touch-screen operation for the benefit of illiterates is being developed. A few of these are in operation at the Secretariat, the seat of the State Government in Hyderabad. How good the e-SEWA is to citizens is presented in Annexure*.

3.6 Government Services for Citizens: 30 services like certificate of birth, death, and caste, payment of taxes, dues and charges for water, electricity, telephones etc., reservations for rail and bus travel; renewal of driving licenses ....can all be done not from different government offices to which citizens have to trudge (and get harrassed) but from multi-purpose service centers. Called e-SEWA , electronic service. The system is being extended to several places in a city and to several cities. Within the state of Andhra Pradesh it will be extended to 1100 towns in the next two years. The model for the service is Singapore Government's services which are accessible from several street-side kiosks.

A number of municipalities like those in Tiruvananthapuram (Kerala) and Vijayawada (Andhra Pradesh) are also delivering their services to citizens from different locations. Developers and entrepreneurship are proposing to make these services available from public Internet kiosks as distinct from the e-SEWA centers of the Government. This means the interconnection of the Internet with the Intranet of the State Government and the municipalities.

3.7 Electronic Post: India's postal system is one of the oldest and perhaps the largest in the world. About 10 billion post cards are handled every year by the Indian Post. Letters are written in several languages. Recently, the department introduced electronic post service (e-post) in 250 cities. A letter written in any language is scanned, converted into an e-mail and sent out to the destination e-post office, from where it is converted back into the original language text and delivered in an envelope. When the Internet is extended to all the towns and villages this is going to be the most appreciated poor man's service that the Internet is enabling.

3.8 Internet for Illiterate Kids in Slums. How imaginative actions of visionaries can benefit the most disadvantaged sections of people is illustrated by what happened in Delhi. The compound wall of India's largest private sector National Institute of Information Technology (NIIT) was being used as a public urinal. The head of the NIIT's research unit was distressed. A brilliant idea turned up. He cut a hole in the wall and housed an Internet connected PC in that hole. The result was miraculous transforming slum kids who can barely write their names into computer-savvy gigs. None showed them how to use the PC. They learnt by trial and error. The computer hooked up to the Internet had no key board, just two push buttons and a touch pad. The grown ups in the slum showed no interest but children aged 8 to 13 were deeply curious. Most of the kids thought it was a video game that had been put up for free. The Kiosk kids rapidly jumped from standard paintbrush-type applications to navigating the Net. They invented their own vocabulary, calling the pointer of the mouse sui, the Hindi word for needle; the hourglass damru, a hand drum. Now they are down-loading digital music files and listening to Hindi film songs. Their parents are asking them to find astrology and religious sites. "These kids have reached the same level of competence they would have by spending two hours a day at a computer training institute paying $100 or so." [Source: Time 2 September, 2001]

3.9 Battling Corruption: A great public service to which the Internet is put is the fight against corruption. India has been rated by Transparency International to be one of the top-most ten corrupt countries in the world. Public is seriously concerned and is groping for ways of exposing and fighting the corrupt. The Chief Vigilance Commissioner, a constitutional body created a web site wherein are posted the names and designations and the story of corruption of the very senior government officers investigation by the Union Government's Central Bureau of Investigation. Wide publicity is given so that people can get on to the web site to find the names of the corrupt and the charges that they are facing. This is indeed a very bold step. It is expected to deter government officers from being corrupt. One of the most famous cases of Internet facilitated exposure of corruption is that of a dot.com company, Tehelka which has created a great furor in the Parliament and the government. This dot.com journalism company carried out a sting operation and secretly recorded the conversations and the transactions of the corrupt which included the chiefs of some political parties and very senior government officials in the Ministry of Defence. The immoral acts, gratification from which tempted government officials to part with defence secrets and strike purchase deals were all recorded and the whole thing was posted on a web site -conversations and images in the act of receiving money and indulging in immoral sex activity. A Cabinet Minister lost his job and so did the chiefs of two political parties. It has led to a high power committee of the government investigation into the dirty deeds and corrupt actions.

3.10 Serving the "Tribal" Farmers: Information for the benefit of tribal people (like those called aboriginals in Australia, Indians in the USA and Latin America) is being given through Internet Kiosks in Dhar, a rural district town in the State of Madhya Pradesh. It is operated by a voluntary agency. The government of Madhya Pradesh is putting a tremendous amount of a variety of information in multimedia form on a website. Villagers who are mostly illiterate come to the attended kiosk, seek information and instruction which is presented in a multimedia form on the PCs at the Kiosks. What crops to plant, what fertilizer's to apply and when, which seeds are best and where they are available, what are the prices for various inputs to farming and for their produce; information about health and diet and sanitation, environment; welfare entitlements to people, jobs for the educated and the reservations that the government has made for the disadvantaged people, various certificates people want (nativity, date of birth, caste, land holding etc., are given to people. This project called Gjnan doot, Messenger of knowledge, is becoming extremely popular and is self-financing i.e., the voluntary organisation is able to meet its costs for running the kiosks from user charges.

3.11 Rythu Bazaar (Farmers Market): This is a unique scheme facilitated by the government of Andhra Pradesh wherein farmers growing vegetables all around the towns and cities are provided subsidized transport from specified pick-up points in villages to bring their produce for sale in the markets in the cities for which areas are earmarked. The growers sell directly to the consumers. The prices in the Rythu Bazaars are about 25% lower than in the vegetable markets run by intermediaries. All these markets are interconnected. Each market has got an Internet connection. Details of what had been brought in and in what quantity and at what price it is sold is posted onto a website. Information from over 200 markets is available. Information posted helps them to send their non perishable produce to markets which fetch better prices. The "farm" programme of the All India Radio broadcasts the prices. This has a wholesome influence on the prices in the traditional markets (non-rythu bazaar).

3.12 TARAHAT is the brand name of a company which put an Internet kiosk in one of the least literate districts in the State of Uttar Pradesh to serve illiterate people through an attendant. The company collected a variety of information about the population, their properties, professions, incomes, markets, educational institutions, businesses, fertility of the soil, rural needs like kerosene, sugar, soap, food-grains etc., schools and all this information is organized to be useful to the farmers, artisans and general public. It is made available at the TARAHAT centers. Cooperatives of the village artisans are given accounting packages. Such information kiosks connected to the Internet are becoming part of the economic and improving life of the rural folks.

4. Internet Kiosks for Self-Employment:

4.1 The publicly accessed Internet Kiosks are putting in several unemployed youth into business. They get a commission of 20 to 25 percent of the collection just like in the case of public telephones. They are good enough for them as it is more than the money emoluments they can get in private companies with their qualifications. A survey of the public IT kiosks in some cities of Andhra Pradesh reveals the following:

- Between 50-100 people visit everyday.
- Over 65 % are graduates and above.
- About 40% are women.
- The busiest hours of use are in the late evening and early nights from 1930 hrs to 2100 hrs.
- The users surf in the Internet for 50 to 60 minutes in a session.
- 65% are using the Internet for sending and receiving emails.
- About 10% are surfing for educational material.
- About 5% are looking for job advertisements.
- 2% to 3% are buying and selling shares (scripts).
- Surprisingly no one admitted to accessing into any pornographic sites.
- Each kiosk is collecting on the average about Rs. 50,000 ($ 1050) per month.
- The usual complaint is that downloads are very slow.
- About 20% are using it for chat. And the chatters are mostly between the ages 17 and 25. All users know English.
- The operator-franchisee has put his own capital for putting up the kiosks.

5. Internet for the Masses:

5.1 Internet for the Masses is a project of the Government of India, evolved by a special National Task Force. While the highly educated professionals would by development and export of software and IT products earn wealth for themselves and for the country, if the benefits for the IT do not accrue to the masses, there would what has come to be called the digital divide, not between the nations but within the nation itself. While adopting every measure for the able and the intelligent and deducted to perform and advance Government of India is putting enormous efforts to enable the ordinary people of India even in the rural and remote areas and even those who do not know English to derive the benefits from this extraordinarily facilitative technology. Extensive efforts are being put in to create content in the 15 major languages, this content will be for education, for farmers, for patients, for rural and small scale industrialists and of course, for all citizens who have to get a lot of welfare and services from the Government. Successful Internet companies, are sparing huge funds to take education and Internet to all parts of the country in the quickest of time. Thus, Governments which have realized that they have nearly missed the industrial revolution are bent upon not to miss the information revolution. Information on Internet will be utilized to leap frog into a knowledge based economically achieving society.

6. General Problems of Internet for Masses in India:

When elections were being held to the local Legislative Assembly in the State of Haryana, the IT evangelist Chief Minister of Andhra Pradesh was requested to campaign for a particular political party. When he was haranguing about the great benefits that Information Technology and Internet could confer upon the population, a farmer stood up and asked him, "Does the Internet work without electricity?" The Chief Minister was for a moment stumped! In many States in the country, in the rural areas electricity power supplies are erratic and available some times in the night only; then farmers switch on their motors of their borewells for irrigating their lands. Quite often the voltage is only 75% of the advertised 220 volts. This is a big problem in many states. The union Government is encouraging the development of photo-voltaic generation of power locally but such installations (which are servicing telephone exchanges) may be costly to serve the Internet kiosks.

Skilled persons are not available in the rural areas some the Internet kiosks are out of operation for prolonged periods just like some of the rural public telephone systems for annoyingly long period of time.

Since all the politicians are very solicitous of the rural voter (who constitute 75% of the total electorate in the country) there is constant pressure on the public policy makers to bring down the dial up access (to Internet) charges.

Governments of progressive states like those in Andhra Pradesh and Tamilnadu and Karnataka have put in place Government portals. Although they are now in English, efforts are on to put the information in local languages. As these initial programs certainly do not meet all the needs and requirements of the villages, but beginning is good and in response to the dissatisfaction of the seekers of information, service improvements are being made and additional content that is of great use is being identified and developed. What is important is the earnestness with which the Governments are making efforts; the enthusiasm with which a large number of small companies are coming forward. For example, one company has developed a system of digital picture houses. All pictures are digitized and could be delivered from a central place over broadband telecom channels or through compact discs. Such centers will also have Internet kiosks obligatorily. They can become commercially viable form a 50-seater picture house upwards.

There is some concern about inappropriate use of the Internet; example, access to pornography and hate sites and also, about the privacy of those who use the Internet. The Information Technology Act of India addresses these concerns. There could be excessive intrusion into privacy but these are risks in any open society.

India and such developing countries need not compare the Internet or telephone penetration and use on the basis of how many households out of 100 are benefitted. On the other hand, it is universal access that guides the policy of the country. About one third of the people are classified as below poverty line. There is no sense at this point of time to measure access to information by tele-density or Internet user density. What the country is aiming at is to provide community access through public telephone and public Internet kiosks preferably, combining both of them into one. In affluent towns and villages it will be the private entrepreneurship who will put these on a commercial basis; but in other places, there will be subsidies as a matter of State policy.

back to index

Abstract

Ninety percent of the buyers of PCs in India currently are saying that they are buying primarily to connect to the Internet. The percentage of PCs going into homes is increasing. In parallel, thousands of public Internet kiosks are being opened each having from 5 to 20 terminals. Those who cannot afford a PC at home, (just like a telephone subscription) are going to the public booths to get on to the Internet.

Studies are under way to find out what for people use the Internet, at what times of the day and night they use it, what benefits they are getting, and what type of social problems like, crime, fraud, and pornography are arising. Broadcasts (BBC, CNN, VOA, ...) are now available on the Internet. Cinema houses that are getting closed are having a new lease of life by using ICT. In the Villages connecting to the Internet, entrepreneurs can down-load digitized cinemas for local (small town, big village) show and feasible business cases are coming up as payment models are also being put in place. As private enterprise in education is encouraged and facilitated, the dearth of good teachers is being over-come by accessing lessons on the Internet. Delivery of computer education in rural schools in a very innovative way with least cost to the State is having the spin-off benefit of village folks with a little English knowledge, learning to use the computer for surfing on the net and for sending emails and looking for market Information.

Fertile brains, mostly young, individual entrepreneurs are developing variety of applications. When these gain a critical mass, then just as STD/ISD public telephones have annihilated isolation and distance, Internet use at falling prices due to competition and State encouragement and evangelisation would have profound effects, the chief of which is the plan to deliver IT-enabled services for global clients from small towns and villages through call centers and back office work; that is, teleworking.

The paper describes the various themes and services that are being developed and deployed though in small numbers but in several States in the country and the unfolding benefits, outcomes and problems.

back to index

T. H. Chowdary

Information Technology Advisor, Government of Andhra Pradesh & Director, Center for Telecommunications Management and Studies, India

T.H. Chowdary holds a Bachelors degree in Telecommunications. He held executive and managerial positions in Indian Government departments of Information and Broadcasting and Telecommunications. He was Deputy Director-General in the Department of Telecoms and then became the first Chairman and Managing Director of the VSNL, Indian Overseas Telecom Corporation. He visited over forty countries as participant in ITU and other international organisation conferences as speaker, discussant, Chairman and delegate. He was Governor INTELSAT, Washington and INMARSAT, London. He was President of the Institution of Electronics and Telecommunications Engineers (INDIA). He was UNO/ITUs Senior Expert in Guyana (1985) and Team Leader in Yemen (1990-1991).

Back in India, he resumed his work for the demonopolisation, liberalization and corporatisation of Indian Telecoms and for entry of private sector companies into the provision of telecom networks and services under a competitive regime. He heads the Centre for Telecom Management and Studies (CTMS) in Hyderabad, India. He has been editing and publishing the monthly Journal of the CTMS since January 1992. (So far 119 issues have been brought out).

Since May, 1997, he is the Information Technology Advisor to the Government of Andhra Pradesh, in the rank of a Minister for State.

He has been specially studying deregulation and restructuring of telecommunications service industry including its privatisation in countries across the globe. His special analysis has been in regard to competition, interconnection, licensing, universal access/service obligations, economics of private sector operations and sustenance of competition against the incumbent's market power. His work over a period of ten years form the basis for the National Telecommunication Policy of the Government of India in 1994. Following the NTP's enunciation and consequent licensing in India, he has been consultant for national and international telephone companies and Financial Institutions.

He was a member of an international team (June-July, 1995), which wrote the consultative Green Paper for the restructuring of TELKOM, South Africa.

He is consultant to several national and international electronics and telecom companies; Bank and Financial Institutions and is on the Board of Directors of a number of Corporations. He travels widely in India and abroad conducting seminars; as an invited speaker and adviser on subjects like demonopolisation, regulation, interconnection, competition, customer service, universal service obligations and funding; telecom economics and finance; new services and markets; rural telecoms; wireless in the local loop; informatisation of society, Information Technology for human and economic development etc.

In the past four years, as IT Adviser to the Government of Andhra Pradesh, (India) he is responsible for numerous electronic governance projects in the State. Andhra Pradesh is now held to be the model for other Indian states for electronic governance. Information Technology and Communications are also being used in Andhra Pradesh under his advice and guidance for education in the professional colleges, all of which are being fitted with electronic classrooms, V-SAT and optical fiber connectivity for interactive (audio and video) conduct of classes. The Andhra Pradesh State Wide Area Network (APSWAN) is a build-own-operative (BOO) project that has been completed. It provides optical fiber connectivity between the state capital and Districts and other towns on which information between the computerised Government offices passes and audio and video conferences are held. On this APSWAN 19 services to citizens by Government are delivered at multi-services offices located in different parts of the city.

Dr. T H Chowdary was also engaged by the Canadian International Development Association (CIDA) in its project for drafting the National Information Technology policy for the Government of Nepal.

He is the author of several books: A few are listed below:

- Are You Listening?
  (The story of his struggles in the DOT to deliver service and not merely administer rules)
- Right Number; Cheap Service, Telephones Unlimited
  (Play on how telephone services are administered by techno-bureaucrats and ministers)
- We the Telephone men in your Service
  (Delineation of the duties, functions and work of DOT's telephone employees)
- From America to Andhra
  (Plays with telegraph & telephone services as themes) (Telugu)
- The Tales the Telephones Tell
  (Telephone Cheppina Kathalu in Telugu-First persons narration of telecom persons while on duty)
- Telephoning Rural Areas of Andhra Pradesh
- Information and Communication Technologies into the New Millennium (Talks on All India Radio: August and September, 1999)
- Issue in Telecom De-monopolisation in India (compilation of 70 articles appeared in Computers Today from 1994 to 1998)
- P-Telcos in India - Why did India get them so wrong?
  Running Commentary on analysis of the liberalization, demonopolisation and independent regulation process for Telecommunications in India

He writes extensively in national dailies and professional journals on communications, education, science and technology and social issues.

Besides being a Fellow of Tata Consultancy Services and Satyam Computer Services, he is the Chairman of the Prajna Bharati, (an association of nationalist intellectuals), Andhra Pradesh, which operates from 25 cities and towns of Andhra Pradesh.

He has drafted the Information Technology VISION - 2020 for the Government of Andhra Pradesh (AP) on the basis of which a state-wide WAN based on 2 MBPS connectivity (Optical Fiber Cable) is being constructed. The VISION envisages, among others, Internet connections to all schools, colleges, hospitals and villages (as in telecottages of Norway). The Internet liberalisation policy was achieved at his instance, with the Chief Minister of the Government of Andhra Pradesh as its staunchest proponent with the Central Government, in Delhi. He is advising on the AP government's State-wide Area Network for Electronic Government and government-delivered services.

He is also Member of the National Task Force on Information Technology and Software Development which has been constituted by Government of India to formulate the draft of a National Informatics Policy on 22nd May, 1998. The recommendations (which are now the Government policy) that the Electricity Boards, National Power Grid Corporation, Railways etc., must be allowed to build highspeed, broadband, digital, photonic telecom infrastructure for data communication and that every public telephone (STD/ISD) can become a public tele information center providing various services like telephony, voice mail, email, fax Internet service and video conferencing are what Sri Chowdary has been campaigning for the last several years.

He has conducted various training programs on Information Technology and Telecommunications for senior managers/officers of AT&T, ICICI, IDBI, UBEST Technologies and other financial Institutions and companies.

He is the Founder Chairman of Telecom Users Group of India (TUGI) to focus the attention of the Ministry, the operators and the regulator for consumer interests. As Chairman of Telecom Users Group of India (TUGI), he is formulating the policies, work plans, guiding and managing the affairs, and representations to the Telecom Regulatory Authority of India (TRAI) and to the government. Initiating studies and surveys and over all management. He conducts meetings, seminars and workshops on various aspects of telecom deregulation.

This CTMS is a society waging an intellectual campaign for deregulation for telecoms, new telecom laws and for extensive use of Information Technology. He has written a (Telephones) Citizens Charter for Quality of Service for adoption by Regulator and by service companies.

He is involved in formulating the policies, work plans, guiding and managing the affairs, and representations to the TRAI and to the government, initiating studies and surveys and over all management.

He was conferred the Degree of Doctor of Philosophy (Honoris Causa) by Jawaharlal Nehru Technological University, Hyderabad at its 15th Convocation at Hyderabad on 12th April, 1999.

He was one of the eminent five Engineering Personalities who were felicitated by Institution of Engineers (India), at its Fifteenth Indian Engineering Congress, on 19th December, 2000, in Hyderabad.

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back to index

Stop Advertising, Start Doing! Connecting With Consumers in the Information Age

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View Abstract

1 Introduction

The Information revolution is having its greatest effect on industries whose primary business **IS** information (i.e. publishing and broadcasting). These information industries are, of course, also the ones that companies have traditionally relied on to connect them with their customers.

Traditional mass media, and the advertising that supports it, has been the best mechanism for connecting companies with consumers for decades. As new media usurps mass media, however, these traditional approaches to advertising are no longer the only solution. Companies today must consider the impact that the shifting media landscape is having on their ability to connect with consumers, and look for new ways to reach individual consumers in an environment characterized by personal media platforms, the proliferation of the Internet, and One to One communication.

While the Information Age is creating challenges for companies who see their traditional advertising models losing steam, it also represents an enormous opportunity for companies eager to connect directly with their consumers. New media models are giving companies what they've wanted all along ... direct access to their consumers.

2 The Traditional Media's Approach

Mass Media programming, and the advertising that supports it, have evolved as an effective mechanism for connecting companies with buyers for their products. Media programming is broadcast and delivered to millions of households around the world.

Television programming, for instance, exists in order to connect advertisers with buyers for their products. The sitcoms, soap operas and cartoons sent into our homes are there because the television studios think that these kinds of programming will attract the greatest number of prospective customers for Volkswagen, Tide and Captain Crunch. The more potential car buyers a television program can attract, the more money Volkswagen will pay to advertise there.

In other words, television programming, like most commercial media, exists to narrow the gap between companies and consumers. Media content is designed to create a channel between the company who does the talking, and the consumer whose role is simply to hear the messages and buy the products being advertised.

Even the companies themselves are left with a mostly passive role in this process. Rather than being able to play a role in defining media content, companies simply look for existing content that reaches their target audience and pay to insert their ads into it. Companies don't create sitcoms; instead they look for sitcoms that attract audiences that closely match their target demographic.

Until recently this has been a relatively simple proposition. Companies "could sponsor a popular radio show, or place an ad on one of television's few channels and be relatively sure their target audience was watching. Magazines also were a ripe market -- practically everyone read Life or Reader's Digest." (1) Today, however, this media arena is far more complicated. Niche magazines, cable television and now new media technologies are creating countless avenues by which companies can connect with their target audiences.

3 Impact of Media on Society

The mass media that has evolved to connect companies with consumers plays a significant role in society, as well as in business. As our primary source of information and entertainment, Mass Media programming inevitably has a considerable impact on the way we view the world and ourselves.

Television programming and advertising are usually designed to appeal to the masses. Carefully selected, mainstream voices are broadcast into our homes where we listen and watch as willing, but passive, recipients. As these passive recipients, television viewers and other media consumers are very rarely given opportunities to contribute to the media marketplace. Mass media, many would argue, has given the power to shape our ideas of the world to a small, corporate elite.

But times are changing.

4 Arrival of New Media Platforms

Today new technologies are challenging the mass media tendencies of television and its cohorts. After decades of holding a relatively unchallenged position as the most effective vehicles for reaching consumers, television, radio and newspapers are now being challenged by the proliferation of the Internet and other new media platforms.

Internet Radio, Napster and Multiplayer Video Games mean that media can be created by thousands of people and received by thousands more. One-to-Many broadcasts will be supplanted by One-to-One and Many-to-Many conversations, and these new connections will give people the opportunity to talk to each other, share information, and even buy from one another. This, of course, turns the traditional notion of mass media broadcasting on its head. Companies who find themselves suddenly able to connect directly with their customers may become less inclined to pay someone else for that access.

While some companies continued to invest in traditional approaches to advertising, others recognized that the media landscape was changing and experimented with new ways to reach their consumers. They bought Internet banner ads and interstitials in an attempt to apply traditional advertising models to the shifting media landscape but, as the recent dotcom crash has shown us, traditional advertising models don't work across new media platforms.

Companies believed they could connect with consumers in the same ways they always had, however the arrival of personal media and One-to-One communication make traditional advertising campaigns seem impersonal and contrived. Instead companies must explore new opportunities for connecting with consumers.

5 New Opportunities to Connect with Consumers

Forward-thinking companies will recognize that the shifting media landscape is creating exciting opportunities to re-think how advertising and marketing budgets are spent in the Information Age. They recognize a new reality, namely that delivering **mass** media messages to **large** market segments is no longer the most effective way to connect with consumers.

Instead of creating mass media messages, companies must acknowledge the individual consumers who make up their market segments and start speaking directly to them. Companies who speak **directly** to their customers and build **meaningful experiences** for the **platforms** they use will be the leading brands for the Information Age.

5.1 Direct Communication

Louis Gerstner, IBM's Chairman and CEO, makes a point of talking to his customers every day. He recognizes the importance of connecting directly with the individuals who drive his business. Companies like IBM can take advantage of new media platforms to build direct communications with their customers in ways never before possible.

Gerstner, and business leaders like him, go out of their way to connect with consumers. The personal connections they believe are critical to their success are no longer accomplished with glossy, "one-to-many" advertisements that ignore individual consumers in favour of the larger market segments they belong to. Companies can instead talk to the individuals themselves, and ask them for their input.

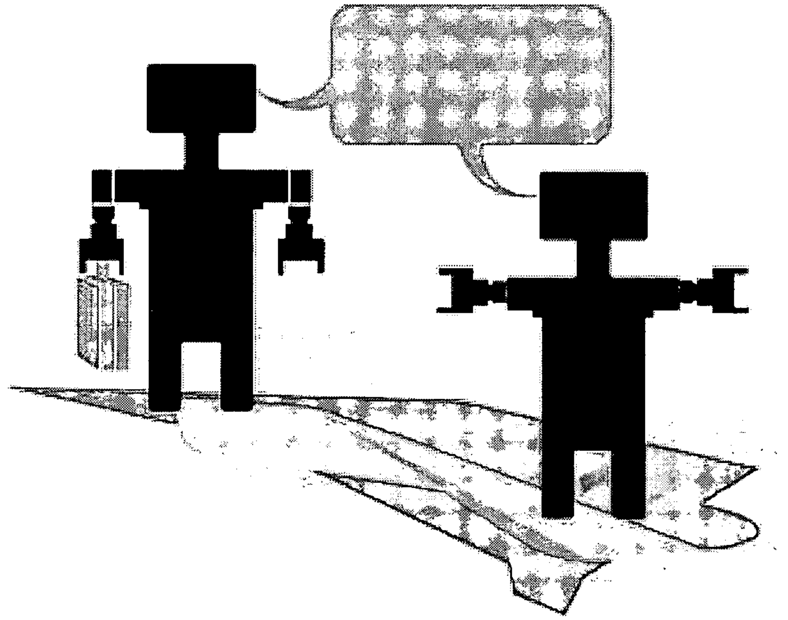

FIGURE 1. DIRECT COMMUNICATION BETWEEN COMPANY AND CONSUMER.

Young consumers, in particular, are often willing to provide feedback to companies but are rarely asked to do so. Companies work hard to understand their broad market segments, but find it very difficult to actually connect with the individual consumers who make up these market groups. MTV actually created life-sized bedrooms to see what a day in the life of an average teen was like, while other companies spend millions of pounds on research reports that decipher the latest trends in youth culture.

5.2 Social Media - Creating Meaningful Experiences

Connecting with audiences today means creating meaning for those audiences. Media-savvy consumers know when they're being advertised to and resent being spoken down to. They understand why advertising exists, and do want access to information about the companies they buy from, but they expect ads to be delivered openly and appreciate messages that have actual value for them.

Companies can benefit from the increasing savvy of their customers. They can build valuable, two-way relationships with customers if they start to spend their advertising budgets on media products and experiences that are defined by the audience, shaped by the audience, and that benefit that audience as well.

We call this social media.

As companies learn to create meaningful products and experiences for their consumers, Social Media will out-pace Mass Media in its ability to create effective connections between companies and consumers.

5.3 Personal Media Platforms

Consumers receive thousands of pieces of information every day. They receive advertising messages across hundreds of platforms, more and more of which are digital. As companies re-think their approaches to advertising they must ensure that the meaningful experiences they're creating for their customers are being delivered across the new media platforms those customers actually use.

In today's world of multiple media platforms, companies who rely on single channels to connect with their audiences will get lost in the clutter. The landscape is changing, and companies must learn to look beyond the traditional media platforms they're most comfortable with in order to succeed in this new media environment.

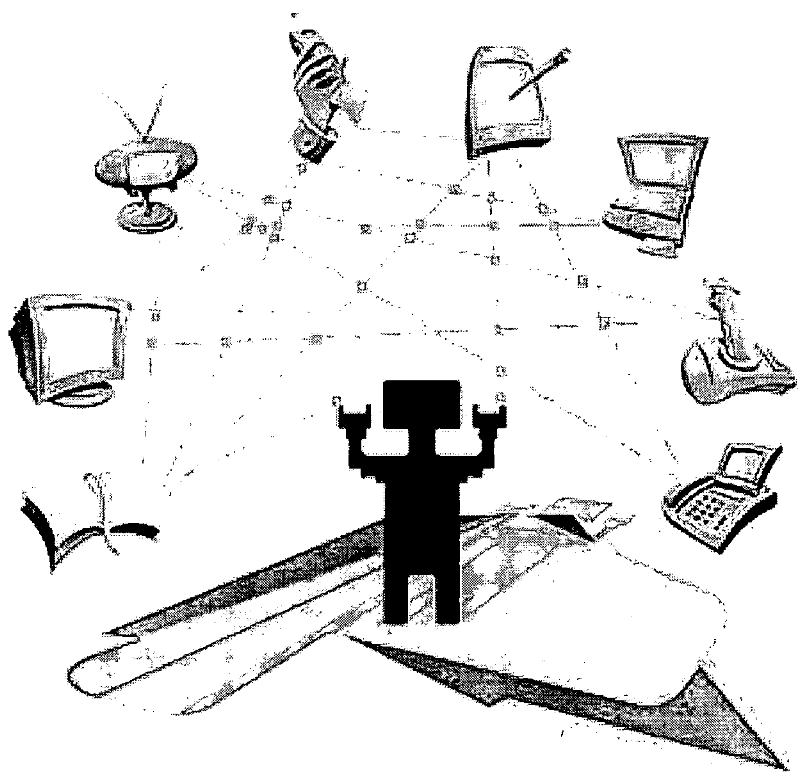

FIGURE 2. WE ACCESS INFORMATION ACROSS HUNDREDS OF MEDIA PLATFORMS.

6 Stop Advertising, Start Doing!

Companies who are ready to re-think their traditional approaches to advertising can start with some straightforward strategies for connecting with their audiences. Shifting some of their advertising budgets away from the creation of mass media messages towards the development of audience-defined products and experiences is an excellent start. By building direct dialogues with their customers, listening to what they have to say, and taking direction from them, companies will gain increased resonance and recognition in the marketplace. By making consumers a valued and integral part of their business, companies will build Social Media as a new mechanism for staying connected with their audiences.

The possibilities are endless. IKEA can create furniture design software and gives their customers a chance to share (and even sell) their personal instructions for assembling IKEA furniture. LEGO can create video games that incorporate the fundamentals of construction and give customers a chance to help with the refurbishment of buildings in their neighbourhoods. Book publishers can help students study for tests by sending sample test questions to their mobile phones and enabling virtual study groups where students can share their study tips and exam concerns.

Instead of relying on television studios to deliver its messaging to prospective car buyers, Volkswagen can create those connections itself. Software that lets you design the fuel-efficient car of the future, or multi-player racing games where players soup up their cars before embarking on a cross-country scavenger hunt, would give Volkswagen direct access to their consumers. Volkswagen gets fantastic first-hand information about consumer preferences and, in exchange, gives would-be buyers educational and entertaining products they can enjoy and learn from.

In this way Social Media will give companies what they have wanted all along - access to their customers. After decades of paying agencies, licensing companies and television networks for access to consumers, companies now have an opportunity to make those connections themselves. By re-directing their advertising budgets and delivering meaningful experiences directly into the hands of their customers, companies can become media creators themselves, interacting with their customers and building the products they need. Companies themselves can now close the gap that mass media channels were built to narrow.

7 Scenario

A large multinational, Big Brand Inc., with an impressive track record selling to young people, is seeing their sales plateau for the first time in 25 years. They believe this lack of sales growth is due to the fact that they're no longer attracting the key 16-24 year old consumers who drive trends across all demographic groups. In other words, they're just not as "cool" as they used to be.

Big Brand's Director of Interactive Services, Robert, has been tasked with driving the company's efforts to reconnect with young consumers. His informal advisory team includes Big Brand's President, Director of Marketing and VP, Product Development. The advisory team believes that the answer to their troubles lies in the development of a new Web site and has asked Robert to create something that young people will think is cool. Robert isn't convinced that this is going far enough. He's concerned that building yet another Web site will confuse their customers, and is also worried that using the Web to try to "be cool" will seem contrived.

Robert hires a small agency that specializes in creating social media. They work across multiple media platforms and Robert is hopeful that, with this expertise, they will be able to help him develop a strategy for connecting with young people. He's also hoping they can provide the research and tools he'll need to convince the rest of his team that they'll need more than a cool Web site to reinvigorate Big Brand's lagging sales.

The social media agency starts work by asking Robert what their young consumers are looking for. He isn't sure. While the company has an impressive market research department, they don't have access to real-time feedback about young people's likes and dislikes. In fact they don't know much about their day-to-day lives. Furthermore, the market research takes a long time to gather and goes through many layers of interpretation before ending up in the hands of company decision-makers. It seems that what Big Brand Inc. really needs is simply to find out, first hand, why young people aren't buying their clothes.

7.1 Direct Communication

Given the need for first hand input from young people, the agency recommends building an online communication channel as a first step in understanding their customers' needs. Robert and the agency work together for a few months, building real-time dialogue channels with young people. They take care to avoid creating an "us and them" relationship, and instead focus on fostering a truly bi-directional exchange that treats consumers as partners.

The 16-24 year olds who are contributing to the online dialogue seem happy to tell the company exactly what they think of their clothes and image. Their comments include:

- "Your ads are ok but I'd feel snobby wearing your clothes."
- "Buying your stuff is shallow."
- "I used to like your sweatshirts but I don't anymore - they're a rip off,"
- "You're total con artists ... everyone can see through your big budget propaganda."
- "You don't know what it's like to be me."

Robert uses this feedback as ammunition for the first presentation to his team of advisors. With the agency's help he puts together a presentation aimed at convincing Big Brand's president that a real shift is needed if they want to reconnect with young consumers. After a series of meetings the President agrees to let Robert develop a broader-based strategy for connecting with young people.

7.2 Social Media

Big Brand's first opportunity to build a meaningful experience for their customers stems from an idea posted to the online exchange by a young contributor.

Stephen is a 15 year old student who loves to play sports, especially basketball. He's on his school's basketball team and wants to help them get the funding they need for new uniforms for the upcoming season. Stephen is one of the young people contributing to the company's new dialogue channel and he submits a posting about his frustration trying to get sponsorship for his team.

Big Brand Inc. frequently provides sponsorship to local groups but this tends to come in the form of a single cash or in-kind donation. The company receives recognition for their donation, but the partnership ends there. Robert is up late that night, thinking about Stephen's posting, and wondering if this is the kind of idea that could form the basis of Big Brand's first social media project. He decides to talk to the social media agency about the idea the next day.

After a short briefing session, the agency is excited. They believe Stephen's submission can form the basis of Big Brand Inc.'s first social media project. They work hard to come up with a preliminary project plan that will shift some of Big Brand's advertising spending towards the development of a tangible product that can provide real value for young people. The agency presents their preliminary overview to Robert the following week.

The agency proposes that, instead of simply providing sponsorship to a few school teams, Big Brand Inc. should create the mechanism that allows young athletes across the country to find support for their individual teams. The company has an opportunity, the agency argues, to build on their strong brand recognition and trusted relationship with adults, to make an important contribution to young people's lives.

A concept is developed, tested out with the online channel contributors, and then presented to Robert's advisory team, including Big Brand Inc.'s President. In brief, Robert proposes the development of a Web site, sponsored and managed by Big Brand Inc., which connects young athletes with individuals and companies interested in supporting them.

Young athletes follow a simple submission process to create a screen on the site all about their team. Team statistics, photographs and upcoming tournaments are featured, and the team also has an opportunity to select the things they need for the upcoming school year from an online catalogue. The catalogue includes Big Brand Inc. products, as well as products from their partners (i.e. team uniform producers), so the team is able to scroll through the available clothing and gear, prioritizing what they need most and even asking to have their names on their basketball shirts, for instance. Big Brand Inc. decides to discount all products purchased by donors at the site by 25%.

Big Brand Inc. then leverages its brand and trusted reputation to create campaigns letting people across the country know about the site. Students themselves also help to promote the site by emailing their parents and friends the URL of the team page they've created. Donors can come to the site and search through the archives for a team or individual athlete they feel is most deserving.

Big Brand Inc. has created a secure online environment that allows donors to make contributions to the team of their choice. Big Brand Inc. issues tax receipts, orders the products donors have paid for, and ensures successful delivery to the teams. Along with their donations of gear, lucky recipients receive information about their benefactors and a special Big Brand Inc. package with tools for thanking their new sponsors. The package might include things like a digital camera the young athletes can use to film their first game in the new uniforms. It then has press release templates and customizable thank you cards the team can use to show their appreciation and, hopefully, generate some positive exposure for their supporters if that's desirable.

Robert and the Big Brand Inc. team are impressed with the idea. It's ambitious but, with a new retail channel being created as part of the development and a lot of clear opportunities to strengthen their brand, they know this is an important opportunity to do something tangible with their advertising budget. They give the project the green light and request careful monitoring of all the input and results so that Big Brand Inc. can generate learning for the future.

7.3 Summary

By helping teams get the clothing and gear they need, Big Brand Inc. will once again start to be recognized as a company committed to working with their customers. While this project will build significant brand value for the company, this value will also have meaning for young people rather than being viewed as shallow and transparent.

By using their brand to build a strong and reputable mechanism for narrowing the gap between companies and consumers, Big Brand Inc. can start to rebuild credibility with their young target audience.

8 Implications

As mass media technologies are supplanted by personal media platforms and two-way communications, traditional advertising models have new rivals. Consumers are accessing media messages across hundreds of platforms every day, and these new platforms are making it possible for companies to become media creators in their own right. In this shifting media marketplace, companies must replace advertising with action in order to resonate with their customers.

As companies learn to create meaningful products and experiences for their consumers, Social Media will gain recognition as an important trend in advertising. This bodes extremely well, both for companies in search of opportunities to make a more meaningful contribution to the communities that support them, and to the consumers who make up those communities.

The mainstream points of view long espoused through traditional mass media will have new counterparts in the Information Age. Social media empowers consumers by letting them define their roles. It gives the audience a long overdue voice and, by doing so, diversifies the voices that shape our media and affect our perceptions of the world and of ourselves.

9 Conclusion

Social media is emerging from people's renewed sense of responsibility to their communities and to the world. It is being made possible by the new media technologies that enable direct communication between companies and consumers.

In a world of multiple, personal media platforms and individual communication, forward-thinking companies will **Stop Advertising and Start Doing**. It is the companies who jump at the chance to talk to, empower and create value for their customers who will become the brand leaders for our Information Age.

Endnotes

[1] "Ambient advertising invades consumers." *The Detroit News*. Karen Talaski, October 21, 2001.

back to index

Abstract

As new media usurps mass media, forward-thinking companies have an opportunity to re-direct their advertising budgets and deliver meaningful experiences directly into the hands of their customers.

In a media landscape characterized by personal media platforms and One-to-One communication, companies can become media creators in their own right. By communicating directly with their customers and creating meaningful experiences for the platforms they use, companies can establish themselves as brand leaders in the Information Age.

back to index

Emma L. Smith

Emma co-founded her first company, The WebPool Syndicate, in 1995 and served as Vice President until the company's sale in 1997. Her second business, E-Think Consulting, provided strategic Internet support to clients including Nike and the Canadian Broadcasting Corporation. Today she is the President and CEO of At Large Media, a social media agency that creates products to narrow the gap between companies and consumers. Working across platforms including the Web, Wireless and Video Games, Emma believes companies in today's information economy have a unique opportunity to give consumers a voice in media and product creation.

In 1996 Emma founded the Wired Woman Society (www.wiredwoman.com), a Canadian non-profit organization for women in technology. She served as the organization's President from 1996 to 1999 and, in 2000, turned her passion for women and technology into Technology With Curves (www.technologywithcurves.com), a popular release from Harper Collins highlighting women's success reshaping the digital landscape.

Emma holds an honours degree in Communication, Culture and Society from Queen's University as well as a Masters in Technology and Policy from MIT where she studied Internet broadcasting. She was named one of Canada's Top Women in Technology in 1998, has been a regular columnist with the Globe and Mai, and recently received the prestigious Women of Distinction Award in recognition of her outstanding achievements in business and technology.

www.atlargemedia.com

back to index

Social/Cultural

Wednesday, 16 January 2002
1400–1530
South Pacific I - II

W.2.1 Education, Business and Technologies (View Abstract)

Chair:
BARRY BROWN, Professor, University of Saskatchewan, *Canada*

W.2.1.1 Using Broadband Technologies to Enhance Collaborative Learning for Schools (View Abstract)

DEBBIE KEMP, Business Development Officer, Marketing Division and JOHN SPENCE, Communications Research Centre Canada, *Canada*

W.2.1.2 Communication Technologies for Basic Education to Boost Literacy in South-Asian Developing Countries (View Abstract)

N.K. CHHIBBER, Secretary General, PTC India Foundation, *India*

W.2.1.3 Fibre Infrastructure for Schools of Tomorrow (Academic peer reviewed) (View Abstract)

ROSS KELSO, Senior Research Fellow, Centre for International Research on Communication and Information Technologies (CIRCIT) at RMIT University, *Australia*

W.2.1.4 Tailored Broadband Network Solutions for E-learning, Streaming and Multi-Media

Collaboration Via Satellite (View Abstract)

STEFAN JUCKEN, Area Director, Sales and Business Development, North America, ND Satcom, *USA*

back to sessions

Using Broadband Technologies to Enhance Collaborative Learning for Schools

Debbie Kemp and John Spence
Communications Research Centre Canada
Ottawa, Ontario, Canada

View Abstract

1.0 Introduction

As an Institute of Industry Canada, the Communications Research Centre Canada (CRC) performs research and development (R&D) in advanced telecommunications; broadband networks, radio science, satellite communications, terrestrial wireless and broadcast technologies. CRC also has a small group of staff dedicated to applications development using new and emerging communications technologies especially in the areas of socio economic importance such as tele-education and tele-health. As part of the applications development activities, CRC created the "VirtualClassroom" in 1996. This is a broadband, interactive virtual learning facility where students across Canada collaborate with students in other countries on projects of common interest. The goal of the VirtualClassroom is to establish CRC and it's partners as world leaders in the development and implementation of broadband communications technologies for interactive and collaborative learning.

Broadband communications have the potential to bring learners of all ages closer together, regardless of their location. High speed networks not only provide learners with access to media rich learning materials but more importantly a platform for exchange of ideas without limitations of time and place. It is important to emphasize that research and development of broadband infrastructure and applications are but a means to support innovative learning. Of greater importance is how to use these tools effectively not only to enhance existing learning practices, but also to enable new and valued practices. It is creating a "passion to learn". The ability to communicate with people all around the world and learning about different cultures is an education in itself. The various protocols, cultural diversities and/or barriers and the political environment all must be recognized.

2.0 VirtualClassroom Objective

The objective of the VirtualClassroom is to research, influence and manage the migration from a traditional pedagogical learning environment to new collaborative models of learning. Over the past five years, the program has continued to research and develop a broadband enabled learning environment. This provides the opportunity for students and teachers, from Kindergarten to Grade 12, to access broadband tools and applications to collaborate in a series of interactive broadband project based learning activities.

Participating teachers and students have expressed the need and desire to incorporate broadband tools on a regular basis into their daily learning activities. CRC's goal is to move from the concept demonstration mode to an "on demand" access to these tools for collaborative problem solving and knowledge building with other students across Canada and around the world. In the beginning, students were required to travel to the CRC lab in order to participate in a session. Now Canada has six school boards with schools directly connected to Canada's Advanced Internet Development Organization (CANARIE) which is a broadband research and education network. The schools are: Ottawa Carleton District School Board in Ontario (two schools); Toronto District School Board, also Ontario; Edmonton Public Schools in Alberta; Avalon East School Board in Newfoundland; Kawartha Pine Ridge District School Board in Ontario and Conseil Commission Scolaire au Coeur-des-Vallées in Quebec.

Past encounters and demonstrations have shown that broadband tools and applications provide an expanded and engaging collaborative space for constructive approaches to learning. However, further research and evaluation is required to refine the management process to create functional interdependence among distributed student teams. Using broadband technology to connect "brains to brains", to cultivate individual and collective intelligence requires the careful design of the whole learning environment. Broadband collaborative space for learning not only includes reorganization of the physical environment, but also the reorganization of the mental learning space of all participants in the learning process. CRC has put together a research and evaluation team to look into the pedagogical and infrastructure requirements as well as software and video mediated learning. The results will be made available to all participants in the research and evaluation component of the VirtualClassroom project.

2.1 The VirtualClassroom

As mentioned previously, the VirtualClassroom is a broadband, interactive virtual learning facility where students across Canada collaborate with students in other countries on projects that address common interest. The question remains, how does it work in reality?

Students and teachers meet virtually in rooms (either in research labs or schools) equipped with high end computers, cameras, microphones, proper lighting and audio controls and screens set up to simulate being in the same room. Broadband or next generation Internet networks are used to connect participants. The CRC Broadband Applications and Demonstration Laboratory (BADLAB) use CANARIE's CA*net 3 broadband network to connect to other regional, national and international, research and educational networks. From time to time, wireless technologies and satellite communications are also used to connect students to quality data, people and special events. Teachers and students together are provided with better access and potential interaction with quality information and experts in their defined learning environments. Students have the opportunity to interact with international experts located in a location that otherwise would not have been accessible.

The use of high speed networks allows students and teachers to interact in near real-time, using multi-point collaborative work tools that provide learners with the opportunity to debate issues and participate in desk-top collaborative work. The use of high speed video conferencing turns a passive learning experience into one that is highly interactive. The use of a shared whiteboard space enables collaborative work. Joint projects can be worked on simultaneously from different locations, using various software such as: CAD, PowerPoint and word processing packages. This interactivity increases the learner's engagement time and interest and the environment has often been referred to as "the next best thing to being there".

Collaborative learning and advanced tools move the focus of learning from an individual experience to a shared development of an enriched learning environment where teachers, students and members of the community contribute to each other's learning. The curiosity and energy students initially have turns the project into a collaborative learning experience and also aids in the individual's learning ability.

Working together in a virtual peer-learning community supported by mentors, students are challenged to solve global problems, to learn and understand about different cultures and determine how this influences their perspectives. To date, students in Switzerland, Germany, Austria, Ireland, Finland, Singapore and Italy have been connected to students in Canada, to interact in real-time to build knowledge experiences together. Topics students have collaborated on include: Water as a Scarce Resource; Civilizations and Technology; Effects of Globalization; World Conflict, Bio-Engineering and a Landmine Free World.

2.2 VirtualClassroom History

Oct. 2001	Finish and Canadian students studied music together
March 2001	Canadian students studied Landmines and how to have a landmine free world
Dec. 1999	We Are the World Series - Grade 1 & 2 students from Canada and Switzerland shared pride in their country through music and artwork And Students across Canada discussed "water as a scarce resource, year 2005
Jan. 1998	Canada joined a European ACTS project "SUSIE" with Ireland, Germany and Switzerland
Dec. 1996	VirtualClassroom became recognized as a G7 project
May 1996	1st VirtualClassroom session between Ottawa and Switzerland

2.3 Student-Led Conference Presentations

Mar. 1999	SUSIE Conference with Germany, Switzerland, Ireland and Canadian students.
Dec. 1998	IST'98 (Information Societies & Technology) Conference, Vienna with Canada, Austria and Switzerland - Discussion on "World Conflict"
June 1998	APEC - Tele-Ministerial 3 meeting, collaborative session between Singapore and Ottawa - "Effects of Globalization"
March 1997	Lifelong Learning Conference in Ottawa

2.4 Socio-Cultural Issues

With the advancement of technology, especially information technology, almost anything is now possible. Sending people into space was seen as an outrageous possibility not all that long ago...now it is a reality. Science and technology are rapidly changing the way we live and learn. The key is what are the social consequences of all this borderless learning? Will societies accept this change? Will cultures affect international learning positively or negatively? As leaders in using technology for a new way to learn, these issues must be addressed and dealt with in each VirtualClassroom session.

Coping with cultural and regional diversity, technological uncertainty, time zones, topic choice, language barriers, division of labor, interdependence and the generation of timely communications are issues that have arisen in virtual encounters to date. Issues are resolved as they arise. Communication among partners is the key. If communication breaks down, the more dominant partner will take over. Barriers are then erected, conflicts arise and division of labor becomes an issue. Early and frequent social communication is important to establish trust and a sense of belonging with the virtual community. It is through these sessions that relationships are built, understanding of one another's culture occurs and the acceptance of individuals as people becomes possible. Comments often heard from students after sessions with a new country are: "they're just like us, they dress the same, wear the same shoes, listen to some of the same music, etc." This illustrates how students recognize and acquire the knowledge that people are people, no matter where you live. As upsetting as this may be to the diverse cultural forefathers, reality is, the world is one, and once this is defined, independent cultures may once again blossom.

While one culture may see globalization as a positive and enriching aspect to learning, another culture may see it as potentially dangerous. Historical events and cultural differences of each participating virtual partner need to be understood to aid in understanding the human behavior seen today. Such knowledge allows the students to listen more carefully and knowledgeably to each other. One culture may see an aggressive debate as an enriching learning experience while another culture may see it as an embarrassment. Multi-culturalism can have a positive influence on self and group identity but may disrupt the larger society as a whole and may even lead to instability.

Instances have also occurred involving participant nations in which regional and political issues have become serious factors affecting VirtualClassroom encounters. Sessions have been cancelled or postponed due to local conflict or concerns about the safety of participating students. Students in Canada, some who live in a relatively non-violent nation, were made aware in a real life experience that other nations live a much more complicated and dangerous life.

For applications like the VirtualClassroom the technology must be: 1) affordable 2) intellectually accessible and, 3) available to use. Remote and/or rural communities do not usually have access to high speed networks. Some communities may only have one computer situated in a community building that is available for use by all citizens. SMART Communities are appearing around the world. These are communities that are making use of information and communication technologies in new and innovative ways to empower its residents. Better education, health care, business services and even business opportunities are created. These communities improve the social, economic and cultural development of its citizens, which in turn will create jobs and economic growth as well as improve the quality of life within these communities.

Canada is a multi-cultural country and Canadian students interact with numerous cultures every day. One VirtualClassroom participating school had 47 nations represented in the student body and real life experiences were shared during "The Land Mine Conference". These interactions are ongoing and will assist in breaking down some of the cultural barriers that are present in today's world. The breaking down of classroom walls, the linking of brains to brains, and the proper attention paid to socio-cultural realities may lead us towards a "new learning" model with fewer constraints. However, social and cultural differences will not disappear overnight. Understanding among various cultures remains a core consideration as broadband enhanced learning propagates, giving teachers and students real-time access to each other on a global basis. Understanding diverse cultures almost becomes a prerequisite to international learning.

3.0 LearnCanada

LearnCanada, lead by STEM~Net of Memorial University in Newfoundland, is a consortium made up of private industry, government and school boards. LearnCanada addresses professional development of Kindergarten to Grade 12 educators focusing on economic, teacher time constraints and geographic barriers. CRC is a founding partner in LearnCanada and leads two teams in the project: Infrastructure and Virtual Community Development. This project is targeted for completion by June 2002.

While the VirtualClassroom is student focused, LearnCanada is teacher focused however, both use broadband technology, high speed networks and tools to enrich the learning environment.

LearnCanada will create a powerful easy-to-use environment in which educators work with mentors and peers without requiring them to be simultaneously scheduled in time and place. It will transform professional development to a team based collaborative activity to share knowledge and experience, as opposed to ineffective fora such as one-day workshops. In LearnCanada, virtual communities of peers will learn together through the use of multimedia and broadband tools to observe each other working, share knowledge, make constructive suggestions and discuss common issues. These activities will accelerate learning for individuals and foster the emergence of best practices and new knowledge.

LearnCanada will evolve by utilizing broadband infrastructure, multimedia tools and middleware for professional development through virtual peer-learning communities and tele-mentoring within a portal/repository environment. LearnCanada will support tele-mentoring with the same methods used to support peer-coaching, including on-line meetings and workshops; live observation by learner of mentors at work and vice versa; annotation by mentors of captured video of learners at work and vice versa; and access to multimedia databases.

The LearnCanada team has a unique combination of capabilities, knowledge, experience and intellectual property in broadband infrastructure, multimedia for schools, research and development of software for learning, modern pedagogy and professional development practice, Canadian schools and curricula, evaluation of learning technologies and project management experience. The team is built around six school boards across Canada (3 in Ontario, one each in Alberta, Newfoundland and Quebec), and their educators will be participating in user-centered design, field testing, tele-mentoring, evaluation and their professional development intellectual property will be re-targeted for broadband multimedia applications.

LearnCanada outcomes will impact learning in Canada by demonstrating techniques for enhancing professional development of Canadian educators, facilitating adoption of innovative teaching methods and curricula and for improving and disseminating best practices nationwide. Improving educator's learning, leverages learning of their students. LearnCanada outcomes will also initiate similar approaches to professional learning and knowledge management within Canadian industry, government and other educational institutions and raise Canada's international profile in innovative learning and lead to export Canadian learning technologies and expertise.

4.0 Virtual Communities

Virtual learning communities differ from traditional brick and mortar learning institutions. The people participating in the community/models and systems are the resources, which hold it all together. The following characteristics are identified as necessary ingredients to develop and sustain a prosperous virtual organization or community:

- A clear and compelling vision
- High trust culture whereby risk of cultural integration becomes eliminated
- ¢ Information technology
- The creation of favorable conditions for learning
- Recognition that the principal resources are the people involved
- Maximum effort from all members must be devoted to finding the right incentives for all parties
- The concept of work is based on the assumption that independence is of central importance to all members
- Characterized as knowledge-intensive

- Possess an innovative character based upon a superior concept or model
- Ability to see and create synergies interdependently
- Value creation for and with members and partners
- The ability to articulate and communicate the need for change
- See and understand situations in new ways
- Leadership, empowerment and interdependence
- Quality partnerships
- Imagination
- Responsive to members needs and suggestions
- A set of values which in word and deed underscore the desirability of dialogue and diversity.

Community can be defined as "our shared sense of collective self". Belonging to a virtual community allows for intelligent discussions, exchange of knowledge, brainstorming, gossip, etc. all on an emotional level only. There is no physical element to be dealt with. If someone disagrees with a comment or becomes upset, the knowledge that a fist cannot come through the screen creates a "safety net" for participation. However, there needs to be a mechanism to deal with and resolve conflicts. Need to see and feel emotions. Multiple levels of communication are required including facial expressions, tone of voice and body language to complete the experience. A new form of etiquette needs to be established as the new global, virtual community, linked by computers, may replace the community we now go to today.

Learning within a virtual learning community is an evolutionary process enabled by advanced information and communication technologies. It implies virtual teams of learners who are located across time, space and cultures, facing the challenge of collaborating in meaningful learning real time experiences in face-to-face interactions. The advancement of high speed Internet connectivity, real-time video conferencing and Internet Protocol (IP) multi-casting is radically changing the way we learn, the way we work and the way we view ourselves within the global learning community. Virtual learning communities and organizations have evolved and they provide innovative opportunities to learn and create synergy.

5.0 Technical Requirements

The control centre for VirtualClassroom sessions is CRC's BADLAB. The mandate of BADLAB is to test and demonstrate Information Highway applications using various advanced broadband networks with extension via satellite and wireless technologies. A GigaPOP is located in the BADLAB which provides direct connectivity to Canada's CANARIE CA*net 3 network.

CRC has been granted the authority to use a Computer Supported Collaborative Work (CSCW) software application called "ISABEL" which has been developed at Madrid's Polytechnic University (DIT-UPM), of the Department of Telematic Engineering in Spain. Agora Systems, a spin-off company of UPM created in June '99 (http://www.agora-systems.com), is now in the process of commercializing ISABEL and CRC is contributing technical research and evaluation from the VirtualClassroom encounters to assist in further development of this software.

ISABEL's strength is the ability for multiple sites to be connected simultaneously over a broadband IP network using a high-end PC platform in a cost-effective manner. No special hardware is required since all functions are implemented in software on a PC configured with the Linux operating system. ISABEL terminals can be connected in a variety of topologies depending on the capabilities of the broadband IP network to support: IP unicast, IP multicast or a mixture of both. An ISABEL Flow Server is used to implement the function of a costly traditional MCU where only IP unicast is supported. The Flow Server can also be used to bridge unicast and multicast networks as well as regulating traffic over pipes of different capacities. ISABEL makes multipoint collaboration easy, effective and manageable with large number of endpoints. Effective collaborations with up to 20 sites have been tested and performed. ISABEL supports three services: tele-conference, tele-learning and tele-meeting. (http://isabel.dit.upm.es)

Over the years, many lessons have been learned to alleviate problems encountered when organizing high profile demonstrations:

- Technical testing prior to event
- Understanding roles of each partner
- Communication on a regular basis
- Formalizing a script and ensuring all material is received on time
- Lighting and audio needs
- Effective timelines
- Understanding the audience and purpose of session
- Rehearsals, rehearsals and more rehearsals

It has been proven that if the time is taken to ensure all the above have been considered and implemented, the success of a virtual session improves. The participation of the students becomes more animated and involved and the educational experience has more value.

The infrastructure of CRC's BADLAB will continue to provide the capacity to research and develop new concepts and applications for communications technology to support learning. Currently it is the research labs and some technically advanced schools that have access to high-speed networks. As computers become less expensive and more powerful, more people and institutions will have access to the technology. Once the technology becomes readily available and affordable, connectivity will be less of an issue.

6.0 Future Applications

In partnering with Telesat Canada, the Canadian communications satellite operator, 12 northern remote communities in Canada will be connected via satellite, providing two-way multi-media, broadband connectivity. The VirtualClassroom will be coordinating sessions between these communities with participating urban schools and at times, international partners. This initiative is part of the Canadian government's agenda of making Canada the most connected nation on earth and assist in closing the digital divide. It will provide an on-going educational and cultural exchange between remote and urban

Canadian youth. The connections will also be used for health and other community services.

"Grid" technology is on the upswing and it is CRC's intent to establish a national and international "Access" Grid on e-learning for high school use. The access grid management system will address the future needs of both teacher professional development and mentoring and student peer-to-peer learning. It will enable more collaborative work spaces and standardize the application.

7.0 Summary

Our ability to leverage the tools of communications technology to enhance learning will contribute more than any other factor to Canada's ability to prosper in the 21st century.
The need to develop human resources for the knowledge-based economy will drive technology innovation. Every effort to enhance our ability to increase and sustain both the number and quality of our human resources must be made. Technology is now available for multiple people to work collaboratively in real-time, over vast geographical distances. In the knowledge-based economy, survival now depends on the capability and capacity of knowledge workers.

VirtualClassroom and LearnCanada are contributing to the development of the human resources for the future. By using high speed networks to connect Kindergarten to Grade 12 students across Canada and the world, students are provided with a unique opportunity to interact in real time, using a shared collaborative work space over broadband networks.

LearnCanada will provide teachers with the tools with which they can go forward into the 21st century, while VirtualClassroom provides the opportunity for students to become world learners. These two projects now serve as test beds to demonstrate proof of concept of a new and innovative way of learning, which in time, may become a new model of learning. Collaborative, project based learning will supplement the one on one, teacher with student learning, not replace it. Advanced communication technologies will empower the youth of today by changing the way they learn and interact with cultures around the world. A virtual global community of learners will be built by breaking down some of the barriers to learning ...creating a global classroom.

The opportunities to enhance our capacity to learn through the tools of communications technology are unlimited.

For further information: http://www.virtualclassroom.crc.ca & http://www.learncanada.ca

back to index

Abstract

Broadband communications have the potential to bring learners of all ages closer together, regardless of their location. High speed networks not only provide learners with access to media rich learning materials but more importantly a platform for exchange of ideas without limitations of time and place. It is important to emphasize that research and development of broadband infrastructure and applications are but a means to support innovative learning. Of greater importance is how to use these tools effectively not only to enhance existing learning practices, but also to enable new and valued practices. It is creating a "passion to learn".

This paper will describe two projects in more detail, VirtualClassroom and LearnCanada. The use of broadband technologies to connect "brains to brains" to cultivate individual and collective intelligence requires careful design of the whole learning environment. Broadband collaborative space for learning includes not only reorganization of physical environments but also the reorganization of mental learning spaces of all participants in the learning process.

The objective of the VirtualClassroom is to research, influence and manage the migration from a traditional pedagogical learning environment to new collaborative models of learning. The use of high speed networks allows students and teachers to interact in near real-time, using multi-point collaborative work tools that provide learners with the opportunity to debate issues and participate in desk-top collaborative work. Working together in a virtual peer-learning community supported by mentors, students are challenged to solve global problems, to learn and understand about different cultures and determine how this influences their perspectives. To date, students in Switzerland, Germany, Austria, Ireland, Finland, Singapore and Italy have been connected to students in Canada, to interact in real-time to build knowledge experiences together.

LearnCanada addresses professional development of Kindergarten to Grade 12 educators focusing on economic, teacher time constraints and geographic barriers. In LearnCanada, virtual communities of peers will learn together through the use of multimedia and broadband tools to observe each other working, share knowledge, make constructive suggestions and discuss common issues. These activities will accelerate learning for individuals and foster the emergence of best practices and new knowledge.

back to index

Debbie Kemp

Debbie Kemp is the Business Development Officer with the Communications Research Centre Canada (CRC). Her responsibilities focus on creating working relationships, collaborations and partnerships and applications development leading to the licensing of CRC's technology.

Debbie is a Co-founder of CRC's VirtualClassroom project and a member of the Virtual Community workpackage for LearnCanada. She has been involved in numerous tele-health, and e-learning broadband applications and demonstrations projects. Demonstrations have included a number of "medical firsts" using HDTV, broadband and satellite technology to connect Ottawa Heart Institute specialists to specialists in Belgium and Japan.

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back to index

Communication Technologies for Basic Education to Boost Literacy in South-Asian Developing Countries

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View Abstract

1. Introduction

Roughly 350 million persons in South-Asian countries belong to 6-14 years age group. Nearly a third of which are left out of the formal education system. The average drop out ratio is almost 50 percent. There are others who have never been to a school. The term "elementary education" usually refers to the first eight years of schooling for all children in the age group of 6 to 14 years. In most countries, elementary education is divided into two stages: Primary (classes 1 to 5) and upper primary (classes 6 to 8).

The problem of low literacy rate in developing countries is mainly in villages and in small habitations in remote areas where three- fourth of the population of these countries live. Most of the villages have only one school with limited capacity to admit students due to constraints of classrooms, teachers and other basic facilities. Despite education for primary classes being free, compulsory and in some states free day meals provided to the students, the village schools are unable to attract children. A large number of smaller villages with population less than five hundred do not have a school and the children of such villages do not find it convenient to walk few kilometers to attend school in nearby village.

One of the greatest changes caused by Information and Communication Technology, facilitating the people around the world to communicate regularly sharing their information, ideas and aspirations remains unavailable to these unfortunate illiterate masses. It is not only the availability of telephones and computers but basic education is necessary to harness the advantages of Internet revolution. To provide minimum basic education up to class X to the underprivileged children in these countries, there is a need for additional 10,00,000 schools. The immense infrastructure burden of this task makes it next to impossible. One has to look for, therefore to alternative and innovative modes of education.

Majorities of the people living in rural areas are not aware of the power of e-education and how it can help them to learn and get elementary education. Moreover, very little work has been done towards developing content for imparting elementary education to rural and tribal children.

In areas where telephony or cable TV services are available, Internet or Intranet could be exploited to supplement school education for children and also for illiterate adults. No doubt the teacher has a very strong impact on the personality of the child during the early developmental stages. But carefully made instructional material, specifically trained facilitators and in partnership with local NGOs through virtual classrooms could deal with the situation more effectively.

2. Education and Telecommunications

One of the areas, where telecommunication can be helpful in improving the living standard of vast majority of people in developing countries is education. Increasing recognition of the importance of the telecommunication, information technology and Internet in all around development of knowledge and economy has brought a new concept of virtual learning. The world of electronic learning has given shape to new knowledge economy, which is a billion-dollar industry and is growing fast. The ever improving development of Internet, fast spreading use of computer multimedia technology, increasing availability of network bandwidth has given new working concept to the modern distance education.

In developing countries not all schools even in metros and big cities have computer networks and equipment that are up-to-date. However more and more students are learning on computer systems (where available) at schools, at work, at home or at computer training institutes. Distance learning by some of these traditional-aged students as well as many older adults is becoming popular, particularly with those who cannot afford or have missed campus education.

Distance education has so far been mainly developed and is imparted for secondary school and university level education. Not much developmental work has been done for primary and upper primary school e-learning. There is thus a need to restructure e-education to assist schools, teachers and students for boosting literacy in rural and sub-urban areas.

The new telecommunication techniques with convergence of technologies and web based Internet must be exploited to achieve faster access of quality primary education. Some of the areas, where telecommunication can be helpful in improving primary education in developing countries are as given below:

- Improvement in quality of instruction.
- Teacher shortage. Overcrowded classes. Single teacher can manage more students.
- Going to school could be made attractive and stimulating to the child. Drop out rate is expected to fall and completion rate will improve.
- Effective teaching aids and extra curriculum. Substitute for text- books.
- It can add art and craft skill, color and music.
- Better teaching methods in place of copying and cramming.
- Standardization of teaching.
- Difficult habitation pattern can be covered faster and economically.

Distance education is normally imparted through following means:

(a) **Corresponding Courses**. Printed lessons are sent to the students who enroll with such institutions. Contact classes are held for a week or so in a year and finally examinations are conducted. This mode of distance learning has been in use for higher education for a very long times, when computers had not appeared and is still used for those students who have no access to computers.

(b) **Synchronous Form (Virtual Classroom / Virtual University)**. Here studies are conducted via video conferencing, audio conferencing, live chat and other real time technology. Learners over rely on the instructors to provide them with the learning experience.

(c) **Asynchronous Form**. In this mode of learning studies is through self-study, the Internet e-mail, web browsing.

(d) **Combined Synchronous and Asynchronous Model**. Learners develop a high degree of self-discipline; maturity and self directed learning, once they get adjusted to the system. Both synchronous and asynchronous facilities must be available.

In developing countries, following requirements are essential, before e-education becomes practical and its benefits reach the common man living in villages and remote areas:

- Availability of reliable and affordable telecommunication infrastructure including Internet.
- High PC penetration. At present PC penetration in villages is negligible.
- Availability of human friendly distance education platform with course contents in local languages specifically prepared for elementary education.
- Effective cyber laws.

The technology should be such that it makes the teacher's job easier, allowing them to interact with students in a familiar manner, and also provides them facilities that allow them to investigate new ways of teaching and learning. No work is known to be in hand to develop a model to help developing countries to improve literacy through telecommunications

3. Telecom Status in Developing Countries

South-Asian countries have a population of 1.4 billion and telephone density is merely three per hundred, which is one of the lowest in the region. The present number of Internet connections in India, Pakistan, Bangladesh, Sri Lanka and Nepal, the main countries of South-Asia is about six million, but this is mainly confined to metros and big cities. There is hardly any Internet service in villages as even all the district headquarters are yet to be covered with Internet service. Cable TV is, however, very popular even in villages. India which is the largest country in South-Asia, having a population three times the combined population of the rest of the countries in this region has an overall telephone density of 3.8 per hundred of population. India has the seventh largest telecom networks in the world with nearly 38 million telephone lines and the annual growth rate is 24 percent. But 80 percent of these lines are in urban areas and about

30 percent of the population have no access to basic telephony services. The Government has the target of increasing the Tele-density from the present 3.8 per hundred to 7 by the year 2005 and 15 by 2010.

Economic reform process in India started in early nineties in a significant way and considerable progress has been made since then. Licenses to private operators for basic and cellular services were given in 1994. The new telecom policy has made the conditions for entry of private operators and foreign investment simpler and encouraging. Telecom Regulatory Authority of India (TRAI) and Telecom Dispute Settlement and Appellàte Tribunal are in place. The Communication Bill 2001, that is expected to be an Act soon, will further encourage competition and speed up growth of telecom infrastructure in the country. The Government and the Regulator in India have been fairly liberal to bring and encourage competition in Internet services. There is no license fee for an ISP and no restriction on tariff. International gateways and backbone networks are also permitted to private operators as well as to infrastructure providers.

While availability of telephony and Internet services in urban areas is reasonably satisfactory, the rural areas are badly neglected. In India, the rural telephone density is just one line per hundred of population and 30 percent out of a total of 6,07,000 villages, do not have any telephony services. The Government has set a target of rural telephone density of four lines per hundred of population by the year 2005.

Rural communication is expected to improve as Universal Service Obligation (USO) Fund is being created for achieving faster telecom network coverage for telephony services in villages. The New Telecom Policy envisages provision of low speed data service to about 1,82,000 uncovered villages by the end 2002 under Universal Service Obligation. The new village public telephones would actually be Public Tele-Info Centers (PTIC) having Internet capability.

Internet penetration in India is presently very low, as there are only 5 million Internet subscribers with annual growth being about 70 percent. One of the causes of low Internet user base is the high cost of PCs. Manufacturer's Association of Information Technology (MAIT), the apex body representing the IT hardware training and services is working out a plan for mass production of PCs that are as affordable as color TVs. The focus is on two kinds of PCs - a thin client based PC for educational institutes and cyber kiosks, another for house segment. With less than 5 percent being comfortable with English, local language content is essential.

In ideal conditions for reaping the benefits of IT for economic development, delivering education and health care throughout the country, the first requirement is the extension of a broadband telecommunication network of optical fiber and wireless access system up to village level. In developing countries this type of network is presently coming up in metros and big cities only. The government and the industry do not have financial resources to build broadband networks in rural areas, at least during next 5-7 years.

4. Various Education Schemes in India to improve Literacy

In developing countries where telephone density is so low and parts of rural areas are without any telephony services, it is not strange that most of the schools have no telephones, no cable television, while not to talk of broadband services. Even in metros and urban areas, except for the public / convent schools, the government run schools lack basic amenities like drinking water, toilets and shortage of teachers.

The Department of Education created a number of centrally sponsored schemes with grants to assist states in developing elementary education. One of the earlier schemes is a joint ISRO (Indian Space Research Organization) and UGC (University Grant Commission) project to set up studios for educational programs, to beam TV programs and educational broadcasts into villages. 'District Primary Education Program (DPEP) is another scheme launched in 1992 for primary education, aimed at serving the rural poor. Recently a program for education for all, named 'Sarva Shiksha Abhiyan' (SSA), launched in year 2000 for the universalization of elementary education has till date been introduced in 220 districts out of the total of 593 districts of the country. The target is to bring all children in the age group of 6-14 years to schools/alternative schools by end 2003, provide five years of primary education by 2007 and eight years of elementary education by 2010. To make it operational in a mission mode, the program will be implemented in partnership with state governments and local bodies with thrust being on community involvement and ownership. All the existing Central Government sponsored schemes in elementary education will converge with SSA. An amount of US $ 100 million has been budgeted for the current year, it is estimated that a total of US $ 15 billion will be required during the next decade for making the elementary education universal in the country through SSA. However no specific plan for use of new tools and technologies through electronic medium is there even in this program.

The Government of India started a non-formal education program, meant for school dropouts, for children from habitations without schools, working children and girls who cannot attend whole-day schools in tribal areas in 1991. The scheme also provides for steps to facilitate lateral entry into the formal system of children passing out of the non-formal system. In this scheme, local youths with 10th class pass were appointed teachers after basic teacher's training. As there is no infrastructure and due to lack of funds and monitoring, this scheme has not been able to achieve the desired results.

The Indira Gandhi National Open University (IGNOU) through the use of technology (television, radio and IT) is incorporating open Flexible Education System. It has launched a unique distance learning project called the Virtual Campus Initiative (VCI) incorporating web-based methodologies. IGNOU is also broadcasting on national TV channel 'Gyan Darshan' (Knowledge Vision), one-hour educational program for high school students. The channel studio is situated inside the campus. Within a short time, IGNOU is going to launch a radio FM channel that will start operating in 40 cities around the country. There is also a plan to make use of Internet in a larger way, by setting up Internet nodal centers at all its 26 regional centers via satellite. The regional centers will be connected to all the 700 centers of IGNOU located in various parts of the country. In some states, regional TV channels broadcast education program in local language for primary classes, but being one way broadcast and not very many schools having TVs, its usefulness is limited.

The biggest advantage of open learning system in developing countries is that it can cater to a large segment of students living in remote and rural areas. With the proper blending of technology with the existing learning tools, open learning system can be made really cost effective and suitable for a large intake capacity at much reduced capital investment as compared to the conventional system.

Government of Andhra Pradesh has recently started a scheme along with Ministry of Communication to provide Public Internet Centers in every sub-district (Tehsil). Bharat Sanchar Nigam Limited (BSNL), which is a government owned incumbent fixed telephony operator and ISP, does not charge for Internet use in rural areas and gives 25 percent rebate on dial up access charges in rural areas. But it needs to be extended to primary and middle schools with proper designed e-learning program for primary classes.

5. Suggested Model

The fact that elementary education in rural areas of South-Asian developing countries is far from universal is no secret. The increase of literacy rate is so slow that absolute number of illiterate persons is rising year after year. Most of the villages have only one school with limited capacity to admit students due to constraints of classrooms, teachers and other basic facilities. The latest figures given by the Government of India of villages having no school is 40,000. Despite improvement in physical access, only 533,000 of the total 1,059,000 hamlets in India have primary schools. Spread over more than I million habitations in small population sizes, it is impossible to provide schooling facilities in each of these habitations, especially in tribal dominated pockets of Madhya Pradesh, Andhra Pradesh, Orissa, West Bengal and Bihar. Even in small cities and towns, state governments or municipalities run schools lack basic amenities, resulting in high drop out rate and completion percentage is very low.

The quality of rural schooling is often inadequate, as reflected in low level of learning achievement and high dropout rate. Teachers are not trained for the challenges of teaching young children, teaching multiple grades, or in teaching in small rural schools. Textbooks are often too difficult for students and sometimes for teachers to read and supplemented instructional material are in short supply. The quality of these enormous key resources could be substantially improved.

A teacher for basic primary education, particularly for small children, is a must. However with the help of structured lessons if made available to a teacher in multimedia format, it will help him to handle more students effectively and make both teaching and learning interesting.

Internet and through it, World Wide Web is the main path for asynchronous delivery. This can be further distributed to rural schools over the normal fixed line connection. In order to provide a rich multimedia presentation to the schools, systems such as Adoptive Multimedia Education Enabler could be used effectively. The system would forecast the students needs of a particular class and then slowly pass on data through low band width circuit to a remote server so that lesson can be retrieved locally, when teacher wants to take a class. Apart from the training to the teachers, low cost computer terminals with big screens, and arrangements for maintenance including redundancy are equally essential. Internet over cable TV is another option, but it is still not popular even in urban areas.

Elementary education system in South-Asian countries is one of the largest systems in the world, with over 200 million enrolments in the age group of 6-14 years involving over one million schools. It is therefore necessary that before introducing any major change having financial implications like introducing use of Internet/Intranet as a supplemental instructional material, a pilot project be built. For this purpose a Task

Force could be constituted having members from UNESCO, World Bank and ITU, who normally carry out a number of projects concerning literacy, education and rural communication in developing countries. Such a pilot study be carried out in selected areas in consultation with the governments of the countries in the region and results analyzed. Local licensed basic service operators, V-SAT service operators and Internet Service Providers should also be involved in this humanitarian task.

The villages in developing countries can be divided into two categories for the purpose of providing e-education facilities in schools for faster increase in literacy rate:

(a) Villages already having school(s) and basic telephony services are available in the village. Sub-urban areas can be included in this category.

(b) Villages with or without a school and no telephony service available.

In states like Maharashtra and Andhra Pradesh where dedicated networks are already operational or are in the process of being installed for e-governance/disaster management, Internet as well as Intranet facilities can be conveniently extended to the schools in villages of the states. Each state will have to develop its own web site in its state language. Some smaller habitations, which are not covered by the existing network will have to be linked with terrestrial radio or V-SAT terminals. Village Education Committees be allowed to look after the schools in the area and at least one qualified primary school teacher is given responsibility for supervision and interaction with teachers in cluster area. Schools in sub-urban areas could be provided an Internet connection from the PSTN network and the ISP of the area.

In states where no dedicated network for e-governance / disaster management is planned, a virtual network linking the concerned schools be established and Internet as well as Intranet facilities be provided.

In villages, where telephony services are not yet there, Public Tele - Info Centers (PTIC) through V-SAT terminals be installed and the schools be brought into the network. The challenge facing developing countries is to create mechanisms so that communication technologies, like satellite communication covering multiple geographic locations having same local language in the region are consciously used to boost literacy. Once the lesson contents in local language are available on screen, an initiator or instructor may still be necessary to guide the students at a community center or primary level school. Such a system is also suited for adult illiterates, who hesitate to attend regular schools even when schools are there. By using the new communication facilities, the education for the vast poor people can be made learner-friendly for children as well as for adults.

6. Conclusion

Universal primary education of good quality is a step towards good high school education, which in turn is a key to boosting economic growth, while also improving equity in the newly liberalized economy. In developing countries where literacy rate of rural population is less than 50 percent and that of female literacy is as low as 20 percent, there is a need to do things differently to boost literacy by making primary education accessible and attractive. Recent telecommunication advances have done a great deal to improve creation and transfer of multimedia and can therefore, be effectively utilized to bring about a path-breaking shift in the concept of education. This is possible only if key priorities focus on the need for reliable and affordable telecommunication and information infrastructure to be developed jointly by private and public sector. Telecommunication/IT equipment prices and tariffs are falling and this will help in keeping the capital costs and operational costs within reasonable limits.

In states where separate telecommunication networks have been planned/provided for e-governance as well as for disaster management, e-education can be extended to primary and middle schools with marginal cost increment. In rural and remote areas where no telephony services are available satellite communication (V-SATs) can provide effective and economical telecom services for extending multimedia information access network. Use of foreign satellites for Ku band terminals should be permitted and encouraged for rural telephony by offering duties/tax concessions. However course contents in local languages is the critical requirement. Pilot projects with the financial and technical help from UNESCO and ITU could be tried out in tribal areas that will prove a concept and further improvements affected with the results/feed back from such pilot projects. Use of telecommunications in improving elementary education will indirectly help in development of rural telecommunication to maintain quality and reliability of the networks and generate revenue for the telecom industry.

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back to index

Abstract

Illiteracy amongst its vast population is one of the major causes of slow social and economic progress in developing countries. In India alone, having a population of one billion people, there are over 90 million children out of schools and such children are potential child laborers. In addition there is an equally large number of adults as illiterate. Telecommunication infrastructure for higher education, health, governance and business is already being developed in these countries. Basic education schemes to eradicate illiteracy can be integrated with the telecommunication services, expected to be available in all the villages within next few years. As primary education for 6-11 year age group children has to be teacher centered, the use of e-education facilities would be mainly to improve quality and access of education.

back to index

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back to index

Fibre Infrastructure for Schools of Tomorrows

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View Abstract

1. Introduction

In response to the Australian government's Strategic Framework for the Information Economy (NOIE, 1999) and in particular to the strategic priority to "deliver the skills and education Australians need to participate in the information economy", the education and training industry developed an Action Plan, which included 'Infrastructure' as a Key Action Area:

All parts of the education and training industry need access to advanced telecommunications and information technology infrastructure including high bandwidth at an affordable price. (DETYA, 2000)

This arose from the concern that, although the education and training sector's bandwidth requirements were noted to be high and growing, the rate of growth would be determined to a significant extent by the pricing regimes of telecommunications carriers. Further, limits on access to information and communication technology infrastructure were seen to be a key impediment to the sector's participation in the information economy.

Surveys showed that whilst many Australian schools are now providing students with access to computers at a ratio of five to one or better, most schools are connected to the Internet with no more than 64 kb/s of bandwidth that is expected to be adequate for perhaps 60 or more computers. This situation is against a backdrop of sector's bandwidth requirement expected to rapidly grow as the Internet features more frequently in everyday teaching practice and as "bandwidth-hungry" real-time audio- and videoconferencing, plus the capacity to download large files, become more frequently demanded.

Concurrently, the Australian Department of Education, Training and Youth Affairs ('the Department') became aware of certain overseas communities who were taking greater responsibility for providing the bandwidth they need rather than depending so heavily on telecommunications carriers. The Department sought to become better informed about such innovative approaches, as they may suggest better ways of providing bandwidth to meet the future requirements of the Australian education and training sector to support its teaching and learning activities.

A project was therefore initiated to describe and review the experience in Canada, the USA and Sweden in developing such innovative approaches, and then provide a preliminary assessment of their applicability within Australia. A subsequent phase could then examine the prospect of undertaking a small-scale trial to test a potential model and identify relevant issues to be addressed.

This paper draws upon some of results of the investigation supporting the initial project. (Kelso, 2001)

2. Methodology

An initial desktop survey was made of available reports of plans, implementations and operations of relevant high bandwidth networks within Canada, the USA and Sweden, followed by confirmation of the most appropriate people and organisations to subsequently meet in those countries. A fifteen working day overseas visit was then undertaken during February and March 2001 to meet the identified people and organisations, following a structured approach in order to access and appreciate as much information of relevance as possible in the limited time. This entailed a focus on the following issues:

· Services and applications - initial/future, outcomes for education and training;
· Costs, financing and funding - imputed/real savings, long term viability;
· Challenges/barriers - technical, regulatory, competitive/market;
· Management - technical, project, operational; and
· Technology options.

Upon return to Australia, the gathered data was analysed and any new leads/unclear information or any missed persons followed up. Specific advice was also sought at this stage regarding relevant legal and regulatory, technology and macro cost issues. The study conclusions were reviewed by a 13-member steering committee that met on six occasions.

3. The Initiatives

The most common approach used by schools to access bandwidth is that of purchasing managed capacity from carriers, often under bulk-buying arrangements. In contrast, the high bandwidth initiatives examined in this study appear to be exceptional even in their own countries and have only come about due to a mix of opportunism, foresight and a determination to excel. Ten innovative bandwidth initiatives were taken as case studies, based on information gained through research and personal interview. They included:

· Alberta SuperNet (Alberta);
· Commission Scolaire des Affluents (Quebec);
· Public Sector Network (Ontario);
· Austin Independent School District (Texas);
· Connecting Minnesota/Minnesota Integrated Network (Minnesota);
· Iowa Communications Network (Iowa);
· Spokane Educational Metropolitan Area Network (Washington State);
· Tacoma School District (Washington State);

· Stockholm Schools (Sweden); and
· Kanal Tierp (Uppsala County, Sweden).

The initiatives shared the following common goal and strategic approach:

Goal	To access low-cost but high bandwidth telecommunications service.
Strategy	To create an arrangement that avoids the need to pay tariffs to telecommunication carriers for managed bandwidth services.

Beyond that common aspect, each initiative varied according to the local circumstances and this is reflected by whoever was the relevant sponsor and the nature of access permitted. The sponsor was either:

· A state government desirous of creating a network that shares traffic either with a number of other public and/or non-profit agencies, or with a number of public and private users or user groups; the government typically acts as the anchor tenant in terms of telecommunication traffic levels, with schools and other educational institutions being the most significant component; or

· A municipal government or group of schools (belonging to a school district) which pools its resources, typically by converting their ongoing operational expenditure on tariffed services from carriers into once-off capital expenditure that buys long-term access to 'dark optical fibre' which is then operated for the enjoyment of just that user group.

One of the better documented initiatives, that of the Commission Scolaire des Affluents (the school board of Affluents) is examined here more closely as it epitomises the classic approach of deploying dark optical fibre for educational application in Canada. Dark optical fibre is 'unlit' and enables the controlling party to carry any type of traffic and terminate the fibre any way it chooses, rather than accept managed services from a carrier.

4. A Case Study: Commission Scolaire des Affluents

The school board of Affluents was formed from merging the two school boards of des Manoirs and le Gardeur. The amalgamated board administers 75 education centres housed in 70 buildings, encompassing 54 primary, 15 secondary, 2 adult, 2 professional schools and 2 administrative centres. In all, there are some 3000 PCs of which 80% are used for teaching purposes. Affluents serves 40,000 students across 10 municipalities. The area is on the mainland immediately north of the island city of Montreal, in the province of Quebec, Canada.

Apart from a single fibre optic link and a small microwave radio network between a few schools, existing telecommunications service was being met with managed services from a carrier.

The new pedagogical requirement was for Internet access to all schools, sharing of software and databases plus online access to the pedagogical software and applications. Administratively, all schools needed to be networked - with emphasis on provision of an e-mail system plus a variety of human resources management systems. The technical requirement was to support multiple transmission types (video, voice and data) including distributed video transmission that called for bandwidth capacity of at least 10 Mb/s accessible by each user. Above all, the one network had to support rapidly increasing throughput, be easily upgradeable and support multiple physical connections by interfacing with local area networks.

The Affluents School Board decided that optical fibre was the only medium without capacity limitations, and that Fast Ethernet was the least expensive technology in terms of maintenance and upgradability. All network installation and management costs were shared with three other partners, viz. the municipalities of Terrebone and Repentigny, plus a post-secondary college. QuebecTel, a CRTC-approved carrier, technically owns the street-laid cable that was provided as 'dark' fibre.

CDN$1.5 million was committed to network capital and CDN$1.3 million in operating costs for the school board's share of the dark fibre network. By means of an Indefeasible Right to Use (IRU) agreement, it now controls 179 km of fibre (six strands) linking the 70 school sites, with 20% underground and 80% installed on power poles. LAN access within each school is now to Ethernet 10Base-T standard, reticulated via twisted copper pairs with a capacity of 10 Mb/s. The schools are linked by fibre operating under Ethernet 100Base-F standard with a capacity of 100 Mb/s and connected to two administration centres. These centres then connect to the Internet via a 1 Gb/s (1000 Mb/s) capacity link.

A post implementation review of this dark fibre network was based on the following assumptions: (SECOR, 2000)

· All costs are shared four ways;
· Individual school LANs are pre-existing and their costs are 'sunk'; and
· Eight of the 40 LAN technician positions were surplus to requirement.

Based upon carrier offerings, the best available alternative technology considered was ADSL, however the cost benefit analysis also scoped a "wait and switch" alternative strategy. The fibre optic solution was found to have an absolute benefit advantage over ADSL and break even after 44 months or just under four years. After that time, the school board would have fully paid for the fibre network and it would be in control of a private optical fibre network with effectively unlimited transmission capacity.

5. The Strategic Decision

The ten initiatives focussed on accessing increasingly higher bandwidth telecommunication service at a cost considered to be attractive over a period of time. In all but the instance of the Minnesota Integrated Network, this has been achieved through arrangements that avoided direct payment to carriers for bandwidth-managed services.

Upon closer examination, it was evident that in each instance the relevant sponsor was willing to act in a manner that was exceptional even in the state or country of origin. These actions were strategic in that they were designed to pre-emptively address future needs both technically and economically, rather than incrementally satisfying only current needs. Five primary factors were found to be common to the success of all initiatives.

5.1 Rapidly Increasing Telecommunication Demand

The initial driver is invariably the need to cope with a rapidly increasing demand from students and teachers for access to the Internet (typically the World Wide Web) as well as material containing moving images that are as near as possible to real-time presentations (which may or may not be accessed via the Web or even the Internet). In addition to traditional video material of a broadcast nature, the requirement for interactive video (including video conferencing) greatly increases the demand for bandwidth as the application moves from group (i.e. classroom) to individual student access. Collaborative studies and distance education can be large consumers of telecommunication bandwidth.

In many education and training jurisdictions there is also a focus on steadily improving the number of computers that students can access, which underpins the growth in bandwidth demand.

5.2 Technical Suitability

A necessary pre-condition is the pervasive deployment within schools of a widely accepted LAN transmission protocol such as Ethernet, and LANs designed to readily handle increasing bandwidth demands. LAN expenditure should not be part of the business plan for creating a high bandwidth wide area network or WAN. The emphasis on a protocol such as Ethernet is important as it maximises acceptance by IT staff who require less re-training. Also it minimises the adoption of traditional carrier technology and the associated mode of business thinking that can inhibit innovation. Each school LAN acts as an aggregator of telecommunication traffic. The exercise is then one of interconnecting a number of similar campuses to achieve greater traffic aggregation through creation of a WAN. The traffic may comprise a mix of data, Internet and telephony services.

Access to affordable optical fibre is the most common factor for a successful WAN. This can be realised in two ways:

· Access to an unlit or 'dark' fibre network offering limitless capacity to cater for future bandwidth-hungry applications; or
· Truly open access to a managed bandwidth service that does not favour vertically integrated carriers.

Both avenues rely on an industry environment in which bandwidth is regarded as a commodity.

5.3 Financial Underpinning

Sufficient funds are required for either upfront capital expenditure to purchase access to dark fibre or to make annual lease payments. Depending on the jurisdiction and local circumstances, fund sources are variously loan borrowings, budget appropriations, non-repayable grants or specific tax raisings. Whilst lease payments may appear to be less demanding, they do rely on the munificence of a third party that in turn must make the upfront expenditure.

Despite the attractiveness of a short payback period, it is essential to identify and capture the savings and present them in a business case format acceptable to the practice of each local jurisdiction. Such exercises are complicated by the fact that each initiative delivers greater bandwidth than the arrangement it replaces, and dark fibre presents opportunities for new applications that may not be conceivable in the previous bandwidth-constrained environment. It can therefore be quite difficult to make 'before' and 'after' cost and capability comparisons on an equal basis.

5.4 Third Party Involvement

A pivotal third party is generally required to facilitate access to affordable high bandwidth network capacity. In many instances in the three countries visited, these involved governments at one level or another - often a local or municipal government, but sometimes a state government. These entities can directly intervene as one or more of:

· Implementers of a strategic vision favouring entities such as education and training institutions;
· Providers of capital expenditure, either directly for a particular private network or communally for a public open-access network;
· Controllers of rights-of-way underground along highways and/or aerially via electricity utility poles;
· Licensed owners of network infrastructure.

Although not common, a privately owned utility or carrier may decide to favour the education and training sector, either in the public good or for a perceived strategic advantage. Other partners in any dark fibre condominium are also facilitating third parties since their involvement in sharing expenditure directly improves any business case justification for each entity.

Regardless of the avenue made available, all these third parties serve to reduce the financial risk to the benefiting party and in some cases are pivotal to the very creation of the high bandwidth network.

5.5 Further Beneficial Elements (Regulatory, Fibre Swapping, etc.)

Depending on local circumstances, there can be a number of other elements that lessen barriers to success and/or improve the overall business case justification. However, they must generally be identified at the time of business planning and actively exploited for maximum advantage. They include factors such as:

· A telecommunication regulatory regime that doesn't discourage the creation of private fibre networks or inhibit who may comprise the users of a shared public/private network;

· The ability to swap fibres with other parties so that the reach of a network can be extended;
· Access to affordable rights-of-way (underground or aerial) or to affordable radio spectrum;
· Access to a contra-deal, particularly one involving fibre swapping or forbearance of a right-of-way charge in lieu of fibre capacity;
· Lack of interest by incumbent carriers in making attractive counter offers; and
· The ability to access or install aerial cabling, which incurs a lower cost of construction.

6. Conclusions

Optical fibre constitutes infrastructure of the most basic type and one that provides unparalleled capacity for innovative applications. Direct control of fibres, through ownership or perhaps a lease agreement, offers the key to affordable high bandwidth in the future. The cost of bandwidth for the carriage of additional education and training traffic is then almost zero into the foreseeable future.

Unfortunately, the market will not offer tariffs that reflect such costs. Success with the first demonstration business case in Australia has the potential to markedly change the perceptions of all stakeholders.

Provided cable construction and operation costs are shared with, say, three other parties under a condominium-type arrangement, economic evaluations indicate payback periods of between three and four years for education sector dark fibre networks within the countries examined.

Traffic aggregation is the key to economic viability of any wide area network initiative. The exercise is a trade-off between the increased cost of fibre cabling as more traffic sites are captured, and the increased savings resulting from such sites no longer having to pay individual service tariffs to a carrier.

A payback period that is acceptable for Australian conditions will be required and the risks quantified as much as practicable. Nevertheless, the first implementation may encounter greater barriers than subsequent projects due to increased difficulty in attracting a minimum of two to three other partners and likely higher costs of a pioneering exercise. Initial allowance should be made for this.

A commitment of upfront capital expenditure will clearly constitute the major component of the risk taking and, at least for demonstration networks, federal government seed funding could overcome any initial reticence of educational and training bodies to commence to deploy their own optical fibre infrastructure.

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Endnotes

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2 For a thought-provoking article on such issues, refer to Denton, 1999.

3 In these terms there is a close parallel between each school campus and a multi-storey office building - for equivalent traffic levels, one could perhaps imagine two classrooms per storey. The LAN then concentrates all external traffic to one point at the ground floor or basement, from which the WAN connection out into the neighbourhood is made.

back to index

Abstract

There is a crucial need in Australia's education and training sector for access to advanced telecommunications and information technology infrastructure, and particularly that delivering high bandwidth at an affordable price. However, the take-up of bandwidth is being retarded by the pricing regimes of telecommunications carriers coupled with their inflexible delivery models.

A large majority of Australian schools are currently starved of bandwidth, having only single line access to the Internet. Disparities in access and cost between urban and rural and regional areas also present key equity issues as well as issues for regional and industry development. Such limits on access to ICT infrastructure are a key impediment to the education and training sector's participation in the information economy.

This paper draws upon a study sponsored by the Commonwealth Department of Education, Training and Youth Affairs to improve our knowledge about innovative approaches to meeting the future requirements of the Australian education and training sector for high-speed online communications. Following a review of a successful case study of a group of schools in Quebec, Canada, the paper then discusses the success factors considered to be common to a number of equivalent high bandwidth initiatives examined within Canada, the USA and Sweden.

back to index

Ross Kelso

Ross has had an extensive career in the telecommunications industry spanning research, engineering business planning strategy and regulatory aspects. He also worked for a few years in Europe for ITT (now Alcatel) and has served as a staff officer in the Directorate of Electrical and Mechanical Engineers, Australian Army.

Since 1997 at the Centre for International Research on Communication and Information Technologies (CIRCIT at RMIT University), Ross has authored, co-authored, or contributed to many publications including: The Law of Internet Commercial Transactions (Issues Analysis and Literature Review); Accessing Directories of Information Technology, Multimedia and General Software Companies, Products and Services; Designing for Australia's Online Future: Australia's Progress Towards Effective Use of Online Services; Re-transmission over Cable TV Networks; National Approaches to Meeting the Communication Needs of Rural and Remote Users; E-mail for All; The User Perspective on Government Electronic Service Delivery (ESD) and Deaf Australia Online II: Final Report.

During 2000 and 2001, Ross travelled to Canada, the USA and Sweden investigating innovative bandwidth arrangements that may be suitable for Australian schools and technical colleges. This work culminated in publication of the report Innovative Bandwidth Arrangements for the Australian Education and Training Sector -- Stage 1: Assessment of Overseas Approaches.

Ross also managed the International Telecommunications Management subject for the APESMA MBA course at Deakin University for three years from 1998. He was elected a Director of the Internet Society of Australia in December 2001.

His qualifications include a Bachelor of Engineering with Honours and a Master of Engineering Science both from the University of Queensland, and more recently a Graduate Diploma in Media, Communications and Information Technology Law from the University of Melbourne.

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back to index

Tailored Broadband Network Solutions for E-learning, Streaming and Multi-Media Collaboration via Satellite

Stefan Jucken
ND SatCom
USA

View Abstract

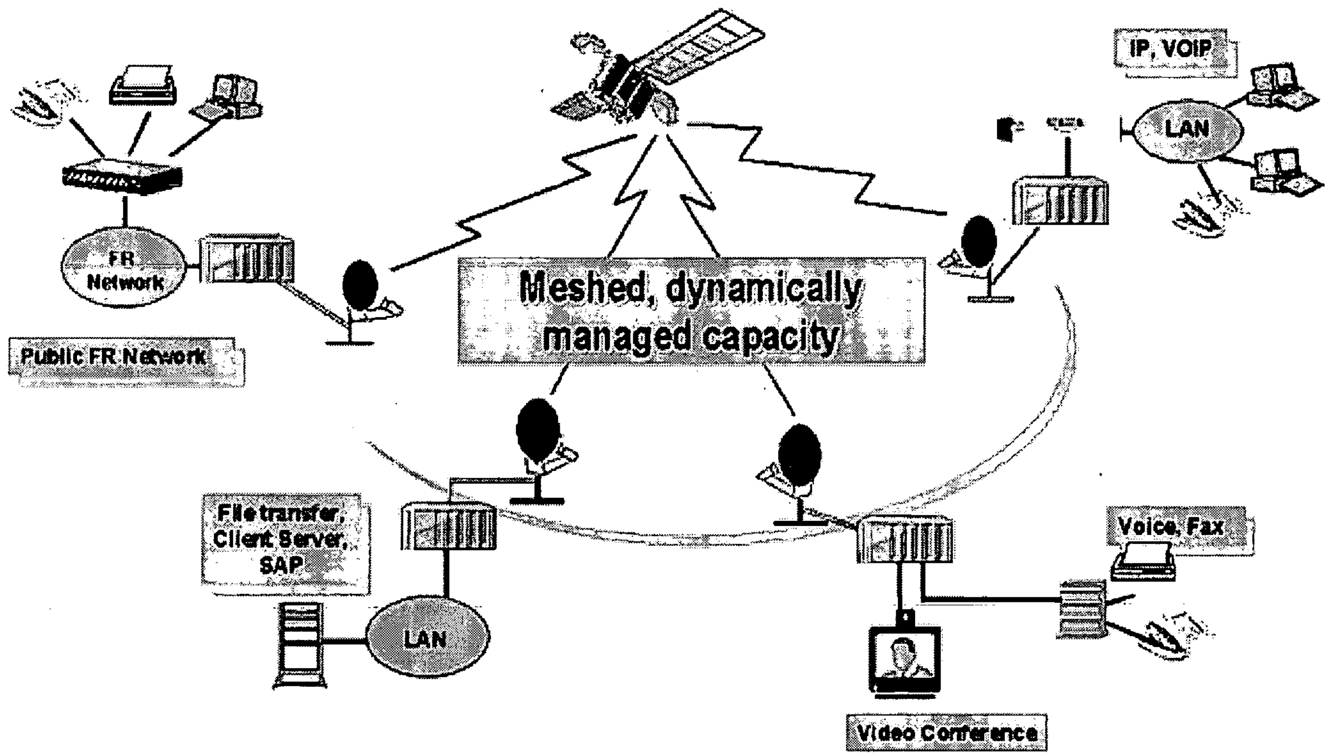
1. Trends in SatCom Corporate Networks

There is no doubt about the important role broadband satellite networks have today. The increasing number of installed terminals as well as the fact that a considerable portion of well known enterprises and organizations in the world supplement and complete their telecommunication infrastructure with satellite solutions, is a clear indication of this development. Satellite network solutions are increasingly being chosen by customers to meet their burgeoning requirements for global communications, particularly for data, collaboration and high speed Internet access.

MF-TDMA (Multi Frequency Time Division Multiple Access) VSAT (Very Small Aperture Terminal) systems support broadband applications up to several Mbit/s per site. The systems allow high speed, hub-less communication between remote sites. This means that any station can be reached via a single satellite hop connection. Since no central hub is required they are in particular suited to scale from small to medium sized networks, which optimizes the required infrastructure investment. A MF-TDMA system provides Bandwidth on Demand through a fully dynamic bandwidth allocation scheme. Space segment capacity is automatically assigned to a station requiring transmission capacity in the most efficient way possible. By classifying different quality of service categories, voice as well as real time data and non real time data are transmitted simultaneously with guaranteed service quality. Standard user interfaces such as Ethernet and Frame Relay, voice/fax, serial synchronous and asynchronous connections are available and ready for applications based on these standards providing a unified network infrastructure. IP applications such as File Transfer, Mailing, Web access, IP Video or Voice over IP are supported via this infrastructure as well.

FIGURE1: BROADBAND MF-TDMA DAMA BASED SATELLITE NETWORK.

Broadband MF-TDMA DAMA based Network



2. Satcom Solutions for Corporate Networks

Each market, industry or sector has a range of communication applications, which are often specific to that particular area. Adaptations and amendments are necessary to cope with the various requirements from these different user sectors. Indeed additional equipment to deal with the dedicated requirements for specific industries needed to be developed or integrated. Suppliers have to be sensitive to the specifications and environments of such "vertical markets". A MF-TDMA system as the product platform has the technical capability and flexibility to fit to any customer's need.

Below, a selection of vertical markets is described where MF-TDMA system based solutions have been implemented successfully leveraging their key technology benefits.

Distance Learning, Tele-education, providing a solution, which covers all of the rich multimedia requirements including interactive video conferencing systems, virtual class rooms, digital libraries, internet access and collaboration. Here a detailed case study of a private school and university is provided.

Telemedicine: private and public medical institutions use the technology for the collection, storage and dissemination of medical data (patients database access) in full accordance with privacy enforcement laws. Pathologists rely on the transmission of digitized images from microscopes or macro pictures in high resolution. Reliable remote diagnosis can be performed by specialists using high resolution video applications providing professional real time advice over large distances. Here as well a detailed case study of the first European Telemedicine project using this technology (Galenos) is provided.

Air Traffic Control, interconnecting control stations with remote radio stations as well as VHF equipment. This solution is able to interconnect VHF Radio voice circuits on point-to-point basis through standardized interfaces to various telecommunication equipment and adapts the specific characteristics of the VHF-Radio equipment to the peculiarity of satellite networks.

Defence & Security, transportable MF-TDMA stations are being used by military and security forces when sent abroad and to locations where terrestrial infrastructure is not available or destroyed.

Disaster Recovery, used by organizations, corporations and service providers as a fixed back-up network in case of emergency, or as a mobile solution on a case by case basis, as a transportable station realized as fly-away or mobile earth station with fully automatic satellite pointing capabilities. These earth stations include a MF-TDMA system as the networking core, providing broadband capabilities.

Embassies, introducing a secure sky concept ensuring highest privacy and security standards for any voice, video and data communication via Frame Relay providing a global network with any to any communication capabilities.

Media, supporting broadcaster or media companies with a MF-TDMA system and DVB IP overlay network to exchange their video content cost efficiently between their studios and SNGs offering bandwidth on demand with premium quality of service.

Formula 1 & Events, offering a flexible transportable broadband solution based on a Fly-away concept supporting the exchange of very high amounts of data between the headquarter and the local engineering team at the circuit as well as voice and video communication.

Maritime, together with stabilized antennas broadband communication links can be set up enabling high speed internet, voice and video communication for cruise ships as well as the marines.

Oil & Gas, used to interconnect headquarters of Oil & Gas companies with their remote platforms in the sea or desert. There is an increasing need to support higher bandwidth serving basic applications such as voice, data and high speed internet . A MF-TDMA system supports all common legacy protocols such as SCADA , X.25, HDLC as well as client server applications such as SAP.

Wireless Communication, interconnection of GSM base stations or VHF radio stations with the central office of the telecommunication service provider. Together with a certified signaling converter a MF-TDMA system is able to provide a SS7 interface and connect those stations which might be located in rural areas cost efficiently to the central stations or among other base stations directly due to the meshed network capabilities.

The following section provides an outline of two successful implementations in the tele-education/ University collaboration and Telemedicine sectors using MF-TDMA based satellite communications technology.

2.1. MF-TDMA Systems for Tele-Education / University Collaboration

The user is a private educational institution founded in 1892, that offers pre-school, elementary, junior high, high school and college-level classes to students world-wide. They have 12 schools located throughout Spain, Chile, Ecuador, Hungary, Panama, Costa Rica, Paraguay, England and the Dominican Republic. The user also operates 3 Universities in Ecuador, Chile and Spain. The goal was to provide a vanguard education with an international emphasis. The primary objective was the academic excellence of the students. The map displays the world-wide distribution of the schools and universities:

Tele-Education/University Collaboration

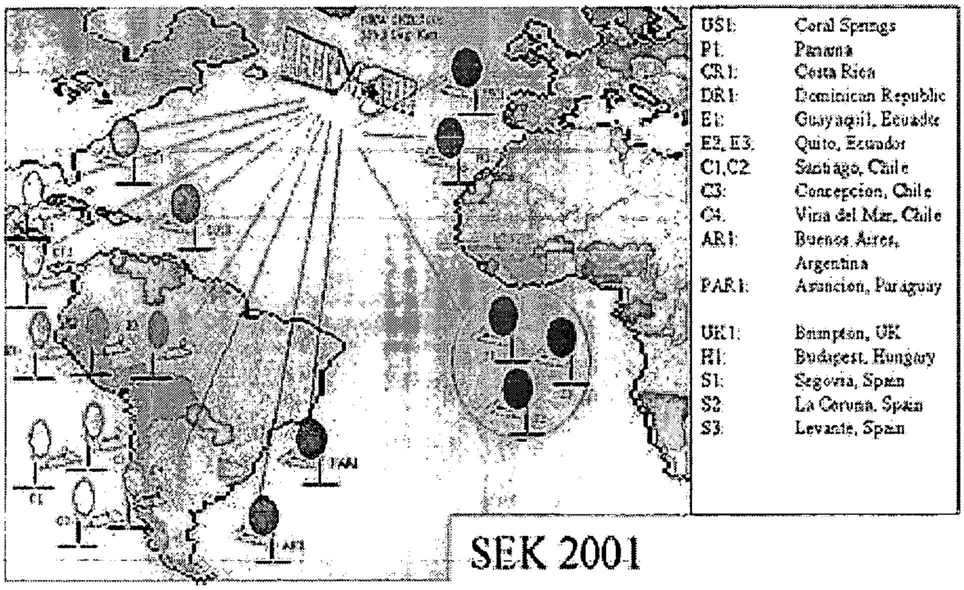


FIGURE 2: TELE EDUCATION / UNIVERSITY COLLABORATION

As a truly international educational institution, the user emphasized on the cultural exchange of their students and on international collaboration between their schools and universities. As an innovator in the technological field, the institution was looking for an advanced and cost effective telecommunication platform, which was suitable to base their own educational technology on. They decided to implement the SEK2001 system using an advanced MF-TDMA satellite communication system, which fulfills and exceeds all of the rich multimedia requirements:

- Fully meshed interconnection of all the sites via satellite for **telephony, video, LAN and data services**.
- The **"Virtual Classroom"** allows the students to attend and actively participate , in real time events that are held thousands of kilometers away.
- The **"Digital Libraries"** make it easier for the user to have access to millions of books, documents and databases from all over the world.
- The **Internet Server**, located in the United States, allows the students to access their programs of study from home. In this way they can review or intensify their study work according to their individual progress. (tele-education)
- The **Interactive Videoconference System** offers teachers and students of the different study centers the possibility of undertaking team work, the exchange of information and the possibility of collaboration on the same project .... regardless of the country where they may be.

All these resources permit the students to be at the forefront in technology, which is a main competitive differentiator for the international institution in the educational market. However it is important to state, that all this exists without ever substituting the teacher. The technology allows for the teacher to maintain the human relationship and the affective-emotional component, without which there would be no educational transfer.

THE SOLUTION

The network solution is based on an advanced MF-TDMA technology. It was the perfect and most cost effective answer to the requirements of:

- LAN interconnectivity
- Corporate telephony
- Internet backbone connection to US Internet Point Of Presence
- IP-Multicasting for H.323 Video Conferencing, T.120 application sharing and collaboration
- High speed distributed database access
- Meshed, hub-less topology guaranteeing minimum latency
- Dynamic, fully automatic bandwidth allocation
- Single, versatile, flexible and future proof communication platform
- QOS guaranteed for real-time applications (voice, video)

In a network, where the sites are geographically spread over such a vast area like the Americas and Europe, a satellite-based solution was a must for keeping the cost structure down, anyhow.

The network is operational on a 1024 kbps carrier on the New Skies 806 satellite @319,5° east, using the western and eastern C-Band hemi beams covering the Americas and Europe.

The first implementation stage contained the network operation center in the USA, the school in Santiago de Chile and the university in Segovia in Spain. This kernel network was used to proof the concept and the functionality of all applications.

At the present three additional sites in Ecuador are active in the network (2x Quito, 1 x Guayaquil). The next implementation phase will incorporate the sites in Brimpton/UK, Eiris/Spain, Levante/Spain followed by San Jose/Costa Rica, Panama, Asuncion/Paraquay the Dominican Republic and Budapest/Hungary. At the final implementation stage, the network will interconnect all of the shown 17 sites.
The earth stations design is mainly 3.8m antennas with 20W C-Band transceivers or, where there is a regulatory restriction in antenna size 2.4m antennas with 60W C-Band transceivers.

With the exception of the Internet access the network topology for all the voice, video and data application is full mesh. Each station uses 1 satellite Indoor Unit with 2 FR interfaces: One FR-interface is used for the interconnection to a voice mulitplexer and further on to the local PABX, the other one is connected to a Cisco Router for the interconnection to the LAN and an H.323 video codec from Polyspan.

This video codec can be used for point to point and point to multi point video conferencing. In the "virtual class room" environment, the video and audio signals from the teacher are up linked and multicast to all participating sites, that means all students can see and hear the teacher. Each student however, is able to send a question to the teacher, who can "grant the floor" in turn to that site or student. At this point , all the participating parties see this student on their screen and can listen to what he has to say. At the same time, all participants can work on and share documents and contribute to the class being held.

Using a single TDMA satellite carrier, this is the most effective way to implement a highly interactive multi-site video conference in a tele-education environment.

"SAPIENTIA QUOD FACIENDUM FACIAM" - It is knowledge that empowers us to do, whatever has to be done - The

MF-TDMA technology was key, that this institutional institution is able to live up to their motto.

2.2. MF-TDMA Systems for Tele-Medicine Applications

The GALENOS project (**G**eneric **A**dvanced **L**ow-cost trans-**E**uropean **N**etwork **O**ver **S**atellite and Claudius **GALENOS**, Greek philosopher and physician 129AD) is funded by the European Union Commission (DGXIII), the German Federal Ministry for Education and Research and industrial partners and organizations. The target is to proof the performance, capabilities and cost effectiveness of the MF-TDMA technology for mission critical broadband applications in a telemedicine environment. Two aspects are covered by the project in this sense:

- the social cultural aspect (improvement in health care by adoption of modern communication technologies)
- the commercial aspect (cost effective provisioning of a broadband communication infrastructure, which is complementary to terrestrial solutions not exclusively in crisis regions or in areas with poor telecommunications infrastructure.)

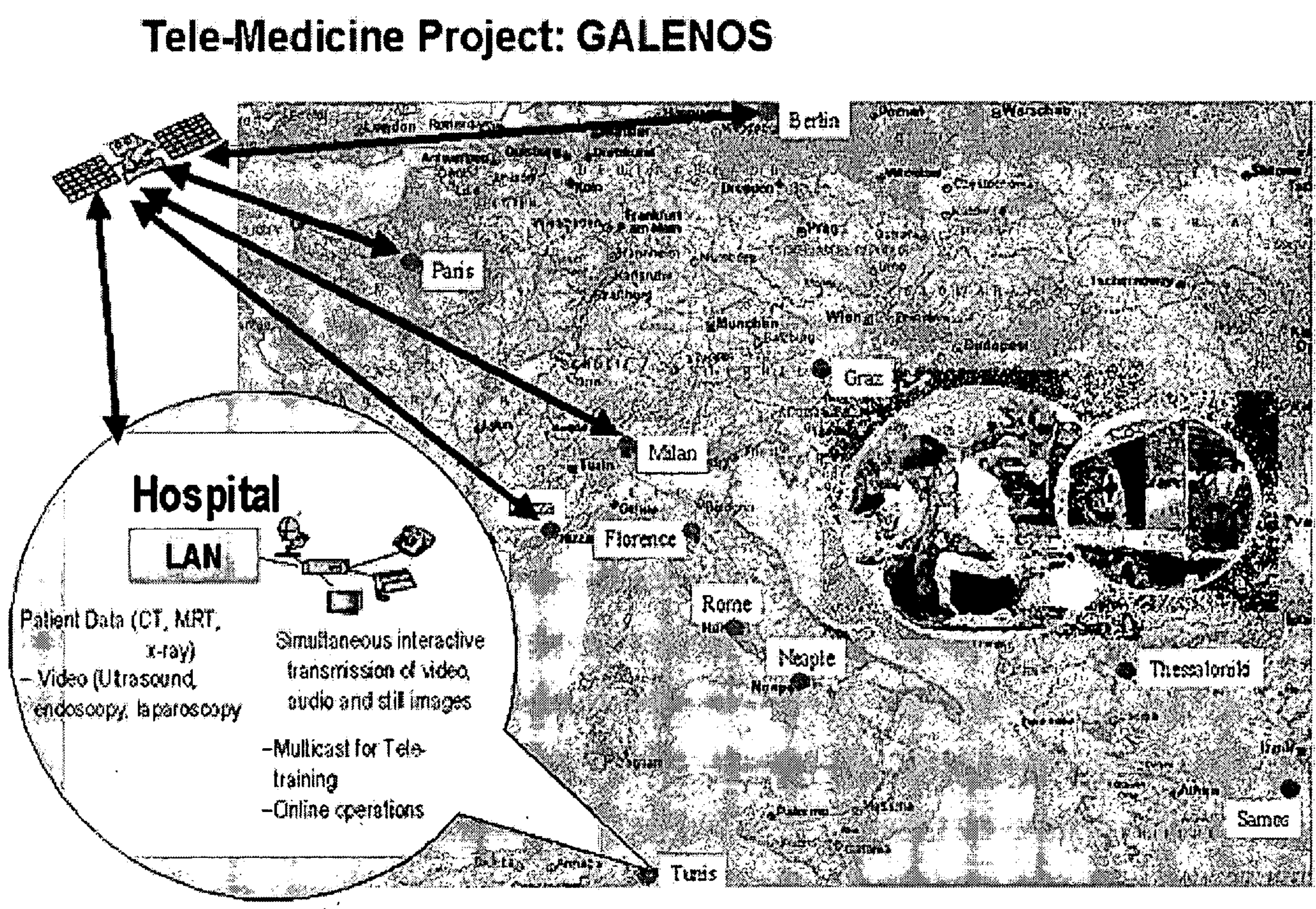


FIGURE 3: GALENOS TELE-MEDICINE NETWORK

GALENOS is the first trans-European network for telemedicine. A Eutelsat satellite links 14 clinics in six different countries : Bulgaria, Germany, France, Greece, Italy and Tunisia. The system uses a combination of the latest laser, video, communication and computer technologies to support a range of telemedicine services such as off-line access to stored data as well as interactive on-line tele-consultation between specialists. The satellite based MF-TMDA technology allows the simultaneous interactive transmission of video, audio and still images.

Telemedicine allows specialists separated by long distances to collaborate closely with one another and offers the possibility of high quality data transmission. Typical example include patient data on investigations carried out by computerized tomography (CT) and magnetic resonance tomography (MRT), X-ray images, video sequences of investigations using ultrasound, endoscopy and laparoscopy as well as on-line access to operations in real time.

At the target site data can be turned into visible three-dimensional images of organs, blood vessels, bones etc., using special monitors. So, a surgeon working in what is called the "Operations Room OP 2000" can consult one or more outside specialists via digital live-video transmissions by satellite or high-speed data transmission (Frame Relay or ATM) allowing him to offer his patient better medical treatment and aftercare.

These new technologies are also changing the way doctors are trained and kept up to date. Until now, the only way for student doctors to get experience was by "training on the job". However, in OP 2000, a surgical team can see, learn and train themselves how to carry out highly complex and delicate surgical procedures with the help of a variety of simulation techniques.

The OP 2000 research project is part of the GALENOS activities and driven on the application side by a medical research team of the university hospital of Berlin-Buch, Germany

The Solution

In this case as well the MF-TDMA technology was selected as the best fit for the following requirements of the end user:

- Distance Independent cost (wide area coverage of Europe and Northern Africa)
- Deployable in areas with poor terrestrial infrastructure (used during the Kosovo Crisis)
- High transmission capabilities (up to 2 Mbit/s per site) for real time applications
- Symmetric/asymmetric interactive services
- simultaneous transmission of broadband data, video and audio signals
- Pay per Use capabilities
- Insurance of privacy and secrecy of patient data record
- Flexibility to support future broadband applications in the medical sector
- Scalability and growth potential

The satellite network is implemented using a Eutelsat Ku-Band transponder with a total network capacity of I 4 Mbit/s with 2 multi-carrier at 2 Mbit/s each. The actual size of the network is 14 sites. The network is an open platform where other hospitals and university end users could join. They can choose their own software and hardware for telemedicine applications as deemed necessary. Some of the university hospitals plan to launch commercial tele-consultancy services to remote areas such as the Far East.

3. Satellite versus terrestrial

This section of the paper discusses the advantages and disadvantages of satellite or terrestrial based solutions for broadband corporate networks as well as their relationship.

It could be seen, that the broadband corporate network market is very diverse. The applications for e-learning, streaming and multi-media collaboration are mainly driving the requirements. The focus here is on video as the most important real time, broadband application in today's corporate networks which is the most challenging at the same time.

The requirements range from guaranteed end to end performance, support of symmetrical (video conference) and asymmetrical configurations (video broadcast) as well as line oriented (H.320) or packet data oriented systems (H.323). The video quality plays a very important role and drives the bandwidth requirement. It can range from comparatively low rates of 64kbps to very high resolution requirements of several Mbps and broadcast quality. Another service trend in the video collaboration field are multi-site, continuous presence mode video conferences which impact on the requirement for high amounts of bandwidth. Furthermore the transmission network plays a very important role for the video services like bit transparent leased lines, Frame Relay or ATM networks, private or shared IP networks as well as the Internet.

The strength of a terrestrial solution clearly is the vast amount of bandwidth, which could be made available. The excess capacity in terrestrial networks today is ensuring quality of service for real time applications over IP. The other alternative to more bandwidth is to manage priorities for real time IP traffic throughout the network. This is the present research focus of a whole industry.

Terrestrial based network alternatives for video transmission comprise the following:

- POTS/ISDN
- Leased lines
- ATM/FR
- VPN's
- ADSL/VDSL
- Cable networks
- Internet

Video conferencing service providers today mainly use POTS/ISDN circuits. Leased lines are very expensive and provide the interconnection on a dedicated basis only.

ATM and Frame Relay networks provide more networking flexibility. From a cost prospective however it has to be recognized, that these services tend to be on the high side. The user has to deal with the design and cost of the access line to the network POP. This access has to be able to support high data rate traffic and there are numerous so called "local loop" or ."last mile" issues which could arise. If there is the need to support a meshed interconnectivity between the network nodes, small or private networks become costly very fast. Multipoint connections are very inefficient if implemented in such an environment and the complexity and cost of the network interconnectivity increase drastically with every additional network node.

DSL is an access technology which is developing more and more but still far from being available in broad geographic areas.

Terrestrial networks provide access to high bandwidth services generally if the locations are within main residential or industrial business areas. The price level increases outside this areas due to a bad relationship between usage volume and cost to develop the networks. On the service side terrestrial networks are suffering end to end performance due to the fact that international connections are established by numerous independent network providers.

- Video services over the internet depend highly on the availability of bandwidth and how the internet can be accessed. Using a dial-in access supports only very low data rate video applications, whereas a DSL or cable modem access brings quite satisfactory video quality.

Satellites in the contrary have limited bandwidth capabilities compared to terrestrial fiber networks. However satellites provide inherent capabilities, which help to provide very cost efficient alternatives to terrestrial communication means, specifically when it comes to video applications.

Satellite beams are able to cover large regions or even continents, and provide therefore distance and location independent cost. They were used from their inception for TV-broadcast services. Each and every earth station in the satellite footprint is able to receive the satellite signal and is interconnected instantaneously with the other stations in the network. These inherent capabilities are very well inline with today's requirements of IP Multicasting and video services. High quality video conferences can be implemented at any location. Thus video broadcasting (DVB or IP) as well as rich media content contribution and distribution or multipoint continuous presence mode video conferences are performed most economically using a satellite based solution.
Satellite communication links are highly available (> 99,x%) and end to end performance can be guaranteed since most often only one satellite service provider is involved.

Last but not least, corporate satellite networks can be deployed very fast using VSAT's (Very Small Aperture Terminals) at any location and do not involve a large infrastructure.

Figure 4. summarizes the comparison of a video Satcom solution and a terrestrial based ISDN solution. It is clearly visible, that the advantages are on the SatCom side concerning multi-point and long distance services with a seamless performance in all geographic areas.

Terrestrial vs Satellite Network Access

Weakness-Strength Analysis

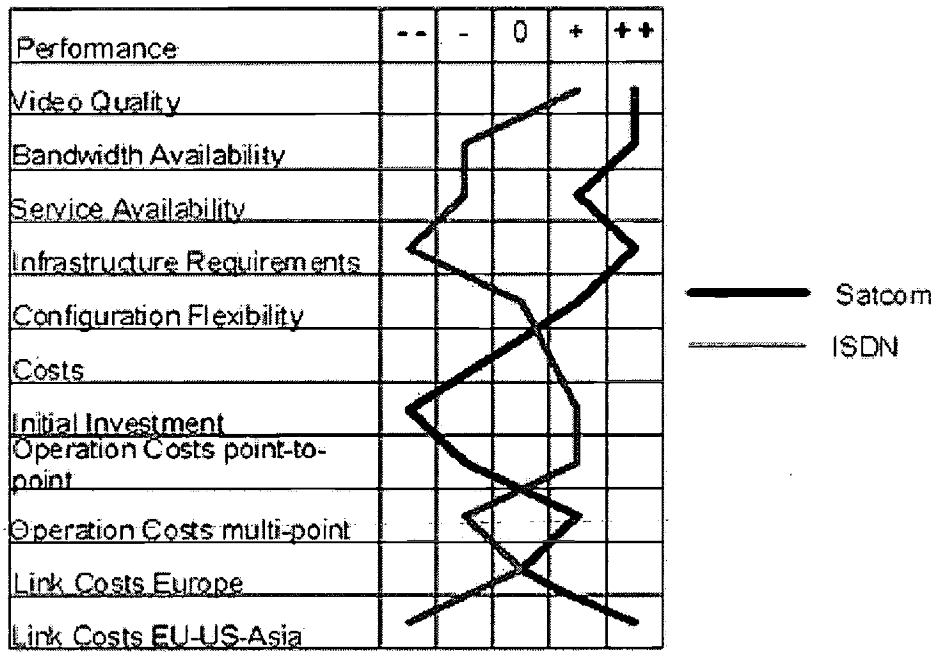


FIGURE 4: COMPARISON OF TERRESTRIAL VERSUS SATELLITE BASED VIDEO CONFERENCING SERVICE

4. Conclusion

Satellite broadband solutions have been implemented in a broad range of industry segments, organizations and institutions. Each of these so called vertical market requires a tailored solution for their specific environments and conditions.

Satellite Networks based on MF-TDMA technology offer already today the flexibility to support broadband capacity of several Megabits per second per site or even more using a DVB overlay network. These networks are extremely efficient in terms of bandwidth usage due to a shared bandwidth pool, as well as highly flexible and scalable. The network provides a unified platform to support all kind of applications such as voice, video, IP and other data applications such as SAP. Those systems are field proven and are used in numerous vertical markets. They can be deployed very fast specifically in areas with no or only a small telecommunication infrastructure. Since they support in a cost effective way a vast variety of corporate network services such as voice video and data for applications such as tele-medicine, tele-education and video collaboration, they play a very important role on a socio-cultural background.

Theses networks can help to provide or improve health care services in a very cost efficient way to workers on an oil platform or inhabitants of a small village in a remote location in Alaska. They are able to facilitate the intercultural exchange of students in different nations and the collaboration of international research teams at universities worldwide.

Abstract

The increasing demand for content rich multi-media communications combined with the convergence of technologies such as IP, FR/ATM and DVB, create rapid changes in the requirements for enterprise network solutions. The challenge is to scale the communications systems to provide flexibility and future proofing, while maintaining costs. This paper describes, how innovative satellite based solutions can help to achieve this goal. Geo-synchronous satellites provide inherent benefits for delivering multi-media content. Conventional and most recent satellite networking technologies will be compared with benefits and features to encompass the marketplace as a whole. The solutions delivered for satellite networking will be presented capturing the requirements and expectations from the various end customers. On the socio-cultural background two network examples will be presented showing a tele-education and a tele-medicine application.

In conclusion, the applications for , e-learning, streaming, video conferencing and telemedicine will be compared to conventional global networking alternatives including frame relay public networks and the internet.

back to index

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Mr. Jucken obtained a master degree in electrical engineering from the University in Saarbruecken, Germany in 1991. He has over 10 years experience in the satellite communication field and worked in various positions in this industry in development, systems engineering and project management. He represented the Daimler Chrysler Aerospace Division (DASA) in the Globalstar Program in San Jose, CA from 1996 until 1997. He served as a member of the technical assembly for Satellite Earth Stations and Systems (SES) of the European Technical Standardization Institution (ETSI).

Currently, he signs responsible for the North American region for ND SatCom as the area director of sales and business. Most recently Stefan presented during the 11th international conference on Contingency Planning, Business Continuation and Disaster Recovery by IDRA and the ISOG Broadcaster´s Meeting of the International Broadcasters Association.

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back to index

Business & Applications

Wednesday, 16 January 2002
0845–1015
South Pacific III - IV

W.1.2 Business Models for Tomorrow

Chair:
JOHN SPENCE, John A. Spence & Associates, *Australia*

W.1.2.1 Broadcasting on the Internet: Making it Happen (View Abstract)

SHARAD SADHU, Senior Engineer, Asia Pacific Broadcasting Union

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W.1.2.2 Business Models for Tomorrow: Generating Revenue from Wireless Data Applications at Entertainment (PowerPoint Presentation)

LAURIE KAN, CEO, i100 Limited, *Hong Kong SAR, China*

W.1.2.3 Maximizing Profitability with Bundled Products and Services (View Abstract)

STEVEN CHOU, Vice President & General Manager, The Americas and CELEST LEE, iSoftel Ltd, *USA*

W.1.2.4 The Digital Divide -- How Developing Nations can Jointly Pursue Telecommunications and Internet DevelopmentThrough voice Over Internet Protocol (View Abstract)

STEVE OTT, Executive Vice President, Global Sales, ITXC Corporation, *USA*

BROADCASTING ON THE INTERNET: MAKING IT HAPPEN

Sharad Sadhu,
Senior Engineer, Asia-Pacific Broadcasting Union

View Abstract

INTRODUCTION

Use of the Internet as a medium of delivery for aural and visual content has made strident advances in the last few years. 'Radio' and 'TV' services on the Internet have become its main attractions. At the current stage of its evolution, the traditional broadcasting business is well developed, possessing content creation resources and dedicated delivery networks. Inspite of this, the broadcasters are actively engaged in putting out services on the Internet. The main objective of this deliberate push is to make use of several outstanding features of the Internet, something which traditional broadcasting networks cannot match. Nevertheless, broadcasting on the Internet - webcasting - is no match for two outstanding attributes of traditional broadcasting - excellent quality of service and content delivery in a 'one-to-millions' mode. Gratefully, enhancements on Internet capabilities are taking place at a rapid pace and its handicaps are bound to be overcome sooner than later. Only then the Internet will transform itself into a medium suitable for webcasting services.

CORE COMPETENCIES OF BROADCASTING BUSINESS

Broadcasting industry is quite well established, having several core areas of strength. Broadcasting business models are time tested and there is rapid adoption of highly efficient digital technology in the industry.

Content Feeds the Media

Content creation is a powerful asset with the broadcasters. It places them at a huge advantage with other delivery business operators, such as the Telcos. Captive production facilities persistently generate more by the day. Captive archives - 'content refrigerators' - contain enormous multimedia resources and help feed the ever demanding delivery media.

Powerful Delivery Systems

Broadcasting networks deliver in a highly efficient 'one-to-millions' mode. A versatile infrastructure of broadband delivery networks is in place comprising terrestrial and satellite based systems for national and international coverage. Correspondingly, a huge population of captive TV and radio receivers is in place at the consumer end. To get an idea of its spread, the number of TV sets today is far more than the total number of telephones and PCs.

- Almost every second person in the world has a radio set.

Wireless networks being the medium of choice, broadcasters have access to a substantial portion of the frequency spectrum resource in the most favoured bands. Using broadband channels for content delivery is a strong point with broadcasters and its importance has only now been truly realized. Access to frequency spectrum also provides the broadcasters with a 'spectrum-bank' for future applications.

Business Plans Ensure Revenues

Broadcasting business has established internationally recognized brand images. Revenue streams are wide spread and well maintained and commercial operations are based on consumer demand.

WHY BROADCASTERS HAVE TURNED TO WEBCASTING

The broadcasting industry has all going for it. But contrary to expectations, broadcasters have not turned away from the Internet, a competing delivery medium. Instead, the broadcasting industry has been quick to harness the potential of the Internet, making use of it to carry multi-media content. Currently, webcast content comprises a major portion of the Internet traffic. What are the compelling factors which have made it necessary for the broadcasters to adapt to this new delivery medium? There are several such factors. For one, the Internet has some outstanding features unmatched by the broadcast delivery media.

Internet Offers Unprecedented Access

The Internet delivery provides worldwide access across all borders and over different types of networks. Multimedia content can be injected in a scalable manner, providing quality options at the receiving end. Interactivity offered by the Internet is perhaps its most valuable attribute, providing immense possibilities of communication between the recipient and the source. Internet usage is growing rapidly, currently around a billion people having access to several hundred million PCs.

Migration of broadcasters to the Internet, in view of its compelling features, is no great surprise. What is notable is that broadcasters are using Internet features to further their strategic objectives.

Anywhere - Anytime Reach

The traditional broadcast networks - off air delivery, cable and satellite - do not provide a worldwide presence in the true sense. The Internet provides broadcasters with carriage for content to offer 'Anywhere' services, potentially available anywhere. For one, using the Internet niche programming is now targeted by broadcasters to specific expatriates who may be anywhere in the world. Foreign TV.com is one such example that gives access to TV stations of various countries. Webcasting has provided a truly global audience to the broadcasters (1).

The 'Anytime' access feature is probably more powerful. Internal carriage offers this unique feature of streaming content files anytime required by the consumers. The audience is no longer bound by the necessity to receive broadcasts in real-time.

Webcasting Catalyses Interactivity

The interactivity feature, enabled by the Internet, has spawned an entirely new range of services that broadcasters can offer to audiences. Though broadcasters have experimented with interactivity over the traditional terrestrial and satellite networks, the Internet provides, at once, ease of operations and versatility. The new genre of life-style services, e-commerce, interactive programming and VOD content downloading are some such applications.

Business Promotion

The Internet is being effectively used for programme and brand promotion by broadcasters. It empowers them to address global audiences and look for new revenue resources. The Internet facilitates exposure of brand images to a substantial population of eye-balls, an asset that can be converted into additional revenue. Of particular value are the one-off events such as sporting and cultural events where the Internet not only promotes the pay-per-view offerings but also provides additional material supporting the coverage. Potentially, webcasting can generate additional revenues through pay-per-view, advertisement inserts, subscriptions and packaging services.

For anyone wanting to reach a world audience, the economics of webcasting makes a compelling case given the right business model. It offers avenues to communicate through video and audio with a vast audience at a modest delivery cost. Admittedly, advertisers are still wary of committing big budgets to advertising on the web but once quality content is on offer, the opportunities would be unlimited.

Consumption of Services

Internet radio is pretty popular, currently around 5000 professional Internet 'radio-station' offer programming. Amateur Internet 'radio-stations' vastly outnumber the professionals. According to a survey on radio programme streaming, Internet-only 'radio-stations' generally stream around 300,000 to 500,000 hours every month (2).

WHY INTERNET NEEDS TO BE BEEFED UP

Webcasting: Key Requirements
There are several key requirements for realistic webcasting on the Internet, most crucial among them being:

- **High bandwidth**: Higher bit-rate handling capacity, since video files require to be transmitted at high data rates even after high efficiency encoding.
- **Streaming**: A basic characteristic of classical broadcasting operations, obviates the need for long duration Internet downloads.
- **One-to-many access**: A single programme stream serving a large number of consumers- 'one-to-many' (millions). Such multiple-access capability, as we will see later, is the key to webcasting.

Broadcasting is a very efficient delivery system utilising a radio-frequency channel to stream aural, visual and textual content to an unlimited number of receivers within its footprint (coverage area). Clearly, broadcasting is a one-to-millions operation. As against this, the initial development of the Internet network envisaged only one-to-one communication. This aspect is reinforced by its basic building blocks, the PSTN, last mile links including the ADSL, configuration of most of the web-servers and most functionalities of the Internet Protocol. Thus the networking attributes of the Internet make it unsuitable for classical broadcasting operations.

Webcasting: Bitrate at a Premium

Current Internet capacities of the Internet to carry webcasting services are clearly not sufficient for the visual content. The problem lies in the set-up of the Internet, its operating protocols and the way it is being used. All data on the Internet is packetised, each packet having a destination address. The IP protocol attempts to find the best path in the network to carry individual data packets from the source to the destination. However, all packets of a file or a stream do not necessarily go over the same path, in fact never, reaching their destination via various paths in the network. In the process, some packets may be lost, delayed or corrupted, though mechanisms (TCP) are in place to recover or get the missing/corrupted packets re-sent from the source. The delay is basically because of limitations in bit-rate handling capacity.

As a result, at the receiving end the data packets arrive more slowly than required for a real-time play-out. The rate (which varies) at which the data packets arrive, actually determines the definition (clarity) of a video clip frame and its refresh rate, or the bit rate of aural content that can be played-back. The current inability to meet the minimum required data rates is the main constraining factor in achieving acceptable quality for broadcasting content on the Internet. Under the circumstances, in order to have a meaningful product at the receive point, the definition and refresh rate of the visual clip has to be appropriately restricted at the source.

Over the last few years, the Internet has seen augmentation in both infrastructure and operating software, in an effort to create a network more amenable to delivery of broadcasting content. What new enhancements have been effected in the Internet to facilitate operation of webcasting services and how these measure up to the webcasting requirements? These issues have been examined in the following sections.

Extranets: Building Bandwidth into Internet

Current technologies claim that at least a bit-rate of around 1 Mbps (700 kbps) is required for streaming a reasonable quality video on to the consumer. However, with the higher bit rate, an associated requirement is of ensuring continuity of data packet transfer over the Internet. With the congestion situation currently obtained, this is simply not practicable. That is where the extranets provide an elegant solution.

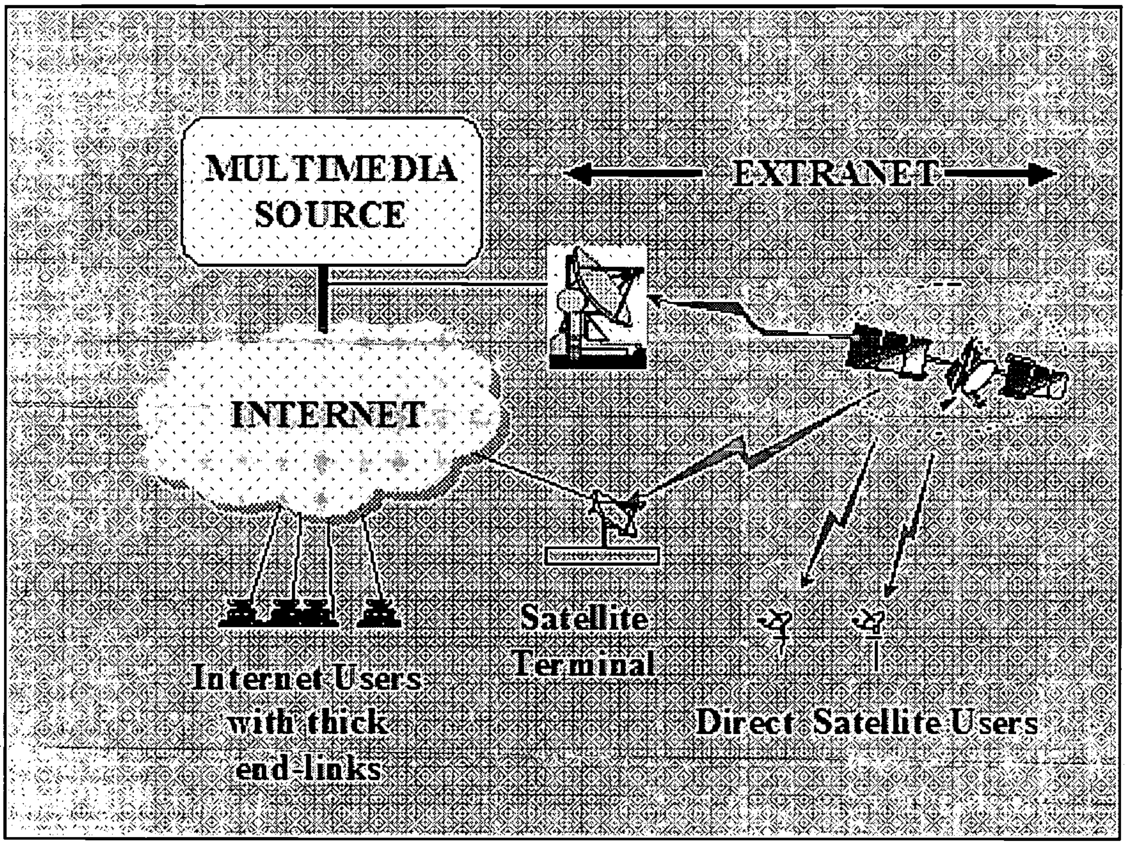

FIG 1: BROADBAND EXTRANET USING SATELLITE LINK

Extranets are broadband links external to the Internet. These links carry Internet data directly from the source to the edge-of-the-Internet near the consumer. Using dedicated satellite links, and other media, the extranets bypass the core sections of the Internet and thus ensure relatively error-free data delivery at high bit rates. For webcasting purposes, extranets offer links for broadband visual/ data content in the forward direction, generally using DVB/IP format and relatively narrow links in the reverse path.

For instance, extranets provide 50 times faster and relatively error-free broadband data carriage on a point-to-multipoint basis, in effect bypassing the congested core of the Internet. This results in elimination of packet delay and packet-loss related data degradation.

Satellite delivery of IP data is not without its drawbacks. For one, necessity for packet loss error acknowledgement severely restricts the data throughput because satellite links have an inherent round trip latency. This restriction has been overcome with techniques like selective acknowledgement, TCP spoofing, caching and use of fast recovery algorithms (3).

Streaming Multimedia Content

Downloading of video content files on the Internet is impractical. Despite efficient encoding, which significantly downgrades the picture content (and the bit rate), video files require a large amount of data capacity, around 10 Mbits for a minute of video in most encoding formats such as Indeo, QuickTime and Cinepak (4). A two hour movie would need 1.2 Gbits. With a 56 Kbps modem line access, the transfer would need about 5 hours of uninterrupted downloading, something impractical. Streaming of content files is a more practical solution that has emerged in the last few years.

Streaming involves sending content continually in a bit stream from a server to a client over a network such as the Internet. In fact, it mimics the delivery mode used in classical broadcasting. A single master stream emanating from a content provider is processed in a streaming web-server which emits the program as data packets and feeds them into the network. At the receiving end, the client PC reassembles the packets and plays the program as it is being received.

The key of the process is to encode (compress) the original content and render it capable of being streamed to over narrow or broadband pipes to users. Streaming techniques and protocols developed include powerful compression and error protection algorithms that ensure content availability and error free reception. Among streaming protocols that run over the IP layer, the RTSP (real time streaming protocol) is used for streaming multimedia files and works with the RSVP (Resource Reservation Protocol). RTSP breaks information to appropriate size packets - as per available bandwidth - and works with RSVP to set up and manage bandwidth. It can provide a particular level of service and improves packet delay and jitter, both determining the quality of the received product (5).

Several encoders, including Windows Media Technology (Microsoft), RealVideo 8, RealAudio 8 (RealNetworks), QuickTime 5 (Apple) and Pinnacle, offer proprietary solutions for encoding, streaming and client viewing. Some vendors are starting to offer 100% MPEG-4 compliant products (6). Typical video encoding rates range from 20 to 500 Kbps, with 1 Mb/s and above expected in the near future.

An interesting encoding technique, Thin MPEG, reduces data rate of the stream and claims to create smooth audio and video streams by handling jerky motion of low bit rate frame sampling. This makes it possible to deliver MPEG quality video over lower bit-rate connections or even congested networks (7). High quality MPEG video can be streamed at low data rates (300 Kbps) and can be played back by any MPEG compliant software player.

Window Media Format 7 claims a compression ratio of 10,000 to 1, promising enjoyable TV quality at 500 Kbps data rate and near-DVD quality at 750 Kbps. The encoder employs MPEG-4 compression (8).

Multicasting to Many

The one-to-many distribution requirement for webcasting applications has been, to a certain extent, attained through multi-casting technology. In the multicasting mode, a single data packet streaming into a multicasting relay server is replicated into a number of identical packet streams, each addressed to a requesting downstream relay server. At each of the latter, the incoming stream is once again replicated several times, depending on the client requirements. This repetitive process generates a large number of streams (a few thousand), each directed to a specific consumer. A gateway server is the central point of contact for incoming consumer requests to a multicast system.

Prior to development of multicasting, it was required of the source server to generate and stream as many copies of the content stream as the number of requesting clients. This method, now obsolete, limited the number of clients that could be serviced simultaneously (limited by the capacity of the source server). Secondly, and most importantly, so many streams going through the Internet would resulted in severe congestion.

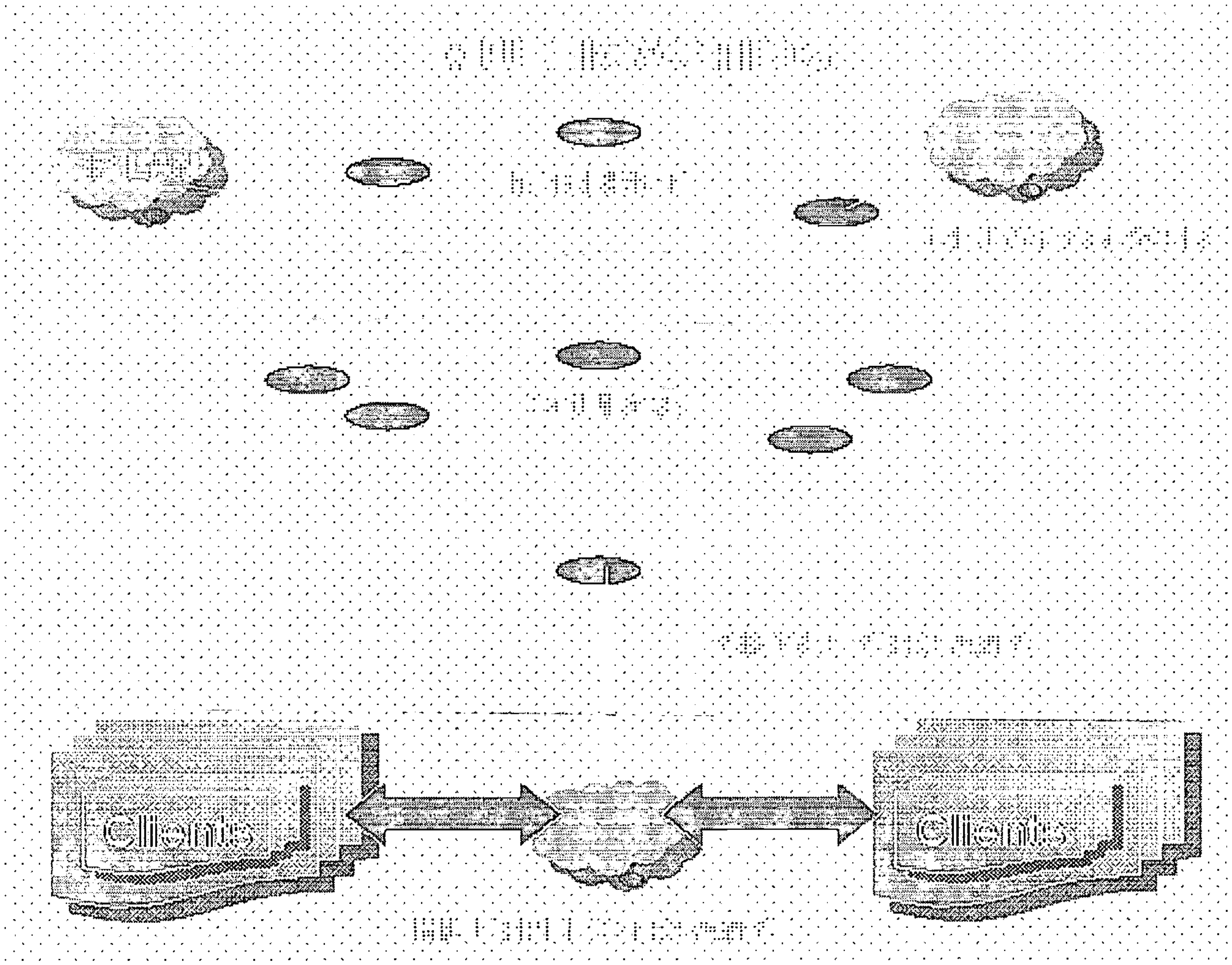

FIG 2: MULTIPLE STREAMS ARE GENERATED NEAR THE CLIENT END

As an interesting example, ChainCast has a technology for a peer-to-peer networking where individual users tuning into a radio webcast essentially act as servers and distribute content along to other users, as in a chain (9). One user can route a stream to several other players in the network. This means that content owners don't have to stream individually to each listener, but rather to a small group of users.

Last-mile Link Dictates Consumption

On the consumer side, operating on the high-bandwidth last-mile connections using xDSL (4 Mbps) technologies and cable (512 Kbps) modems is becoming increasingly affordable. Broadband ISPs offer portals to provide faster Internet data to home users. Similarly, broadband wireless is expected to bring better quality video to handheld appliances. As the broadband becomes widely available to homes, quality of video may no longer be a concern.

To facilitate home consumption of multimedia content, new devices have emerged which pipe Internet MP3 streams to home entertainment systems (10). Broadband Music Player, Kima, AudioTron and the Rio Digital Audio Receive are among such devices. Devices providing similar services derived from video streaming are in the pipeline. While awaiting broadband penetration to increase, one emerging trend is to create a home entertainment server connected to the Internet via a broadband modem that would handle both audio and video downloaded media and send these to simple and inexpensive client terminals throughout the home.

In the short term, the audiences for video webcasts are to be found only in places with high speed Internet connections. Currently, broadband links are available to only a small portion of the consumer base. Most others (70%) use 28 Kbps modem connections and many even connect at lower data rates. In an optimistic scenario where streaming head-end and the core IP network is broadband, the last-mile link to the consumer is the crucial element for Internet audio and video users. Modem connection speeds, and PC performance, remain the key barriers to reception quality of broadcasting content. While a last-mile link and modem capable of reaching speeds of at least 28 Kbps, a reasonably equipped PC, and the necessary software may provide an acceptable level of audio quality, video broadcasts at these data rates are virtually unwatchable.

SERVICE QUALITY AND COST

End Product Quality

Webcasting entails several significant compromises in content quality. But, even with the current enhancements, performance for video carriage is well below the requirements. Though the situation for streaming of aural content is relatively well off, frequent interruptions leave much to be desired.

Significantly, codec manufacturers claim enjoyable quality for video at a bit rate of 500 Kbps and near-DVD quality at 750 Kbps (11). For audio content near CD quality is claimed at 48 Kbps and CD quality at 64 Kbps. However, these values are indicative of the performance of the codecs themselves rather than of the overall quality derived from the network. It could be assumed that currently, in the most optimistic scenario, the following quality levels of live video (and accompanying audio) can be derived.

With telephone modem (56 kbps):	240 x 160 line/5 fps
With high speed network, ADSL (300 kbps):	320 x 240 line/15 fps
With satellite link (1 Mbps):	400 X 300 lines/30 fps

Webcast Reception: At What Cost?

By and large, broadcasting services are free-to-air, subscription services being the exception. The reception of the broadcasting services does not involve any significant expense. In contrast, reception or consumption of content webcast on the Internet involves a definite expense. It might look insignificant on the first sight, but is actually quite substantial. There are two cost elements; Internet access time charge and the telephone line/local access to the ISP charge (cable connections are generally exempted).

For instance, if the access charge per hour is US$ 0.20 and the line charge is US$ 0.30, it results in an hourly charge of about US$ 0.50. Considering that broadcasting content is watched over relatively long periods, the total cost accumulated over a year could be as much as US$ 350 for a 2 hour daily viewing, quite a high recurring expense. Reception costs on the wireless Internet networks will be significantly higher.

Reception or consumption cost will emerge as an important consideration when streaming services improve in quality and the long term viewing/listening becomes a variable proposition. This issue, hardly flagged in the prevailing Internet euphoria, would need serious attention in the near future. The acceptability or otherwise of long term consumption of broadcasting content on the Internet will, in all probability, be determined by the reception cost factor.

SUSTAINABLE WEBCASTING: ARE WE THERE? - NOT YET

The answer to this pivotal question is not straight forward as mixed signals are emanating from the webcasting industry. To cite a few, it is reported that an Internet radio pioneer, NetRadio, is shutting down operations, a jolt to the Internet radio industry (12). As against this, AOL has unveiled its radio service, Radio@AOL, offering music and sports programming and even a CD player. Deutsche Telekom is offering audio/ video services through its T-MediaBroadcast so that Internet broadcasts can be tailor-made to suit individual needs (13). Sometime ago, the first Internet radio receiver, Kerbango, ceased production. A provider of streaming services for terrestrial radio stations, Radiowave, has shut down operations recently, reportedly due to lack of advertising (14). The National Basketball Association in the United States offers live streamed video of its games, becoming the first sports league to do so (15). The webcast also offers new fan services enabling them to customise replays during and after the game. A UK producer is bringing gameshow products to the Internet to achieve interactivity. The hit show in 67 countries, Who Wants to be a Millionaire, is now being developed for the web, wireless and interactive TV (16). JAGfn.com webcasts developments on Wall Street for financial savvy audiences. According to NetValue, Internet users in the US spend an average of 60 minutes daily using streaming and in the UK 14% Internet users access streaming at home (17).

In the Asia-Pacific, broadband platforms appear to be doing good business - Speedcast, KOOL Movie, SHARKSTREAM and numtv.com among them - targeting end users, content providers, ISPs, cable operators, SOHO and corporate users (18). One of these has partnership with 20 local service providers in 14 countries, another has 300,000 subscribers and yet another has 20,000 paying subscribers. Most carry full length movies, financial and business content, entertainment, text, TV channels, education and sports, some on a 24 hour basis. Interestingly and importantly, a particular movie was streamed 130,000 times. As a major development, the iPSTAR satellite - designed for efficient broadband applications - will soon provide low cost, high speed broadband Internet services throughout the Asia-Pacific region at download speeds of up to 10 Mbps. This broadband system has a nominal capacity of over 50 Gbps and will effectively overcome prevailing last-mile constraints. This will certainly catalyse further growth in multimedia Internet applications.

Converting PC into TV

Networking constraints, productive business models, lack of a critical mass of consumers and advertising revenue still hold the industry back. Effective business modeling is essential to success. Many industry experts believe that the basic idea behind iCrave was attractive but what it lacked was a sound business model (19). If the broadcasters and ISPs get together, it would be a potent combination in looking for new business opportunities. Broadcasters have the brand awareness and "contents refrigerators", and the ISPs have subscribers looking for better content. For instance, having an archive that can be searchable or accessible in a random personalized way is a valuable solution. For one, broadcasters always have lot more footage of events than they put on air. Web sites could make use of this material to provide a lot more visual detail that may be of interest. Any meaningful consumption of content on a PC has to be 'lean-forward' and very interactive.

ASIA PACIFIC SCENARIO: WEBCASTING TO THE FORE

Broadcasters Establish Web-presence

This is a boom time in Internet delivery of broadcasting content and related services. In this region, almost every broadcaster has established web-presence, offering streaming products such as news stories, songs, music, video clips and archival items. Their websites are innovative, featuring commercials, programme related audio/video clips, games, lotteries, fan-clubs, free e-mail and e-commerce. Sports and special event coverages are always big draws, the Sydney Olympic coverage resulting in millions of site visits.

Re-purposing of the content, to make it suitable for Internet listening/viewing, is not yet a widespread practice with the broadcasters in the region. While some have crafted niche programming out of current favourites, many offer bits and clips from their on-air programmes.

FIG 3: WEBSITES ARE FULL OF ATTRACTIVE FEATURES

Several networking constraints still remain. As most websites are hosted in the United States, connectivity is cumbersome. With the bandwidth crunch, quality of end-links and general congestion on the Internet, the received video content is at best a series of barely comprehensible still frames. Reception of aural content, though intelligible, suffers interruptions. On the whole, considerable improvement is still required.

CONCLUSIONS

While broadcasting business is going well, the broadcasters still see the Internet as a tremendous opportunity to supplement their services. Several network related constraints, which restrict the quality of visual content carried over the Internet, are being overcome through innovative technologies. Carriage of aural content is more productive in comparison. Consumption of broadcasting content involves a significant cost element and this is likely to become a crucial factor for long term consumption. The broadcasters in the Asia Pacific have seized the Internet opportunity by establishing their web-presence offering a variety of services, including commercial services.

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back to index

Abstract

Internet is increasingly being used to deliver broadcasting content, either in its native form or in re-purposed formats. Broadcasters are establishing web presence in rapidly increasing numbers. Streaming audio is the most common service offered, generally real-time news, music and topical programming. Though broadcasters offer video streaming services, the Internet bandwidth crunch and the quality of the local link leave much to be desired. The silver lining, however, is provided by the advertising opportunities and a new genre of innovative services offered.

Has webcasting leaped beyond the take-off stage? This is a significant issue and the answer is not entirely positive. Video streaming is still in the making. Though multicast services currently address increasingly larger audiences, these are far short of the "one-to-millions" broadcasting experience. It is the synergies created between the broadband extranets and the Internet that promise exciting possibilities in the near future.

Cost of reception will be an important factor for long-term consumption of such services. Traditional broadcasting services cost next to nothing to receive. However, costs on account of charges levied by the ISP and Telco service providers are significant for over a period of time.

Internet presents a watershed-opportunity to the broadcasters, something that cannot be allowed to let go by. Powerful features of the Internet, such as cross-border reach, 'Anytime and Anywhere' access, interactivity and scalability must be employed by the broadcasters to reach audiences they have never been able to address. Something in that direction is happening in the Asia-Pacific region where many broadcasters have taken the lead and have come up with several impressive webcasting solutions.

back to index

Sharad Sadhu

SHARAD SADHU, presently Senior Engineer in the Technical Department of Asia-Pacific Broadcasting Union (ABU), has more than 32 years' experience in broadcast engineering. He has previously worked as Director Engineering, in Doordarshan, the Indian TV network, where he planned and integrated several TV studios, TV transmitters, satellite earth stations and TV distribution services.

He holds a Bachelor's Degree in Electrical Engineering.

Mr Sadhu's current position in the ABU has given him extensive exposure to international developments in electronics and broadcasting technologies, facilitated interaction with senior executives of broadcasting networks internationally and has given him a wide perspective in his field.

He has presented papers at several international conferences, including at BroadcastAsia. He has made contributions at international forums like the International Telecommunication Union (ITU) and the Asia Pacific Telecommunity on frequency planning and standards setting.

Mr Sadhu has considerable interest in the new delivery technologies, both digitally delivered and Internet based.

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back to index

Business Models for Tomorrow: Generating Revenue from Wireless Data Applications and Entertainment

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Telecom operators are all too aware of the p falling ARPU in the voice market and see data as the way forward. Numbers of worldwide wireless data subscribers are predicted to grow from 170 million in 2000 to over 1.3 billion by 2004. In Asia, the outlook is even more favorable, given the potential in some countries for wireless data services to leapfrog wire line Internet access.

The question is: what are the killer applications for optimizing this wireless data boom? Mobile entertainment applications and services stand out as the key drivers of customer demand and revenue. Figures from one Japanese wireless operator show that although generally entertainment accountsed for a third of wireless data services, it generatesd half of the access time demanded by their customers. Wireless games are a vital part of the mobile entertainment offering, and promise to be even bigger. The global wireless gaming market will increase massively in the next five years, from US$953 million to US$17.5 billion.

Asia Pacific is the world's largest market accounting for 87% of 2001's global wireless gaming revenue. Valued at US$827 million this year, Asia Pacific revenue forom wireless games isare expected to exceed US$10 billion by 2006. Japan, Korea and Chinese Taipei take the lead in the development of wireless games, . Bbut China is a market not to be overlooked, plargelyartly because of its sheer population size.

In addition to creating its own games, operators in China are also quick in teaming up with established overseas developers to bring in and adapt popular games for local consumption. Wireless entertainment and games are looked upon as an attractive source of revenue.

Already China has one of the world's highest mobile phone penetration rates, and limited wired infrastructure, increasing disposable incomes and the drive for a market economy lead forecasters to estimate there will be 300 million wireless Internet subscribers by 2005. Wireless usage focused in affluent business centers is already attracting large-scale commercial investment, and competition will extend far beyond the realms of the two current key players. In China, as in Japan, entertainment and games will be crucial aspects of wireless success.

Current available wireless games are numerous, but the challenge is to sustain and prolong the life span of existing games, and also to develop killer games that retain appeal on a in wireless platform, with the support of faultless technology.

Developing and marketing "killer" content and games must go hand-in-hand with strong distribution channels, which often require the clinching of alliances and partnerships. Complementary wireless game ventures linking content developers, distribution leaders and wireless business experts are not uncommon.

Mobile data and wireless games are essential components in any MVNO offerings. The collaboration of telecom and MNVO operators is said to be a critical partnership in driving customer usage.

Content, once again, is back into the limelight, withand wireless entertainment and games asre powerful drivers.

back to index

Laurie Kan

Co-Founder, President & Chief Executive Officer, i100 Limited

Laurie has successfully established a proven track record in creating, building and investing in cutting edge IT businesses in Asia over the past 19 years, and is now channeling this expertise and experience into delivering one of the world's first virtual carrier GPRS businesses. Profiled on the covers of numerous industry publications and quoted by leading news sources, Laurie's visionary understanding of telecommunications, information technology, the Internet, and their commercial implications, makes him one of the most accomplished managers and entrepreneurs in Asia's IT industry.

A technology pioneer in Greater China, Laurie established Microsoft Hong Kong, and was head of Microsoft operations in Hong Kong and Southern China for 7 years. He also founded sina.com, and was the President of Timeless Software, leading it to listing on Hong Kong's GEM. As Chief Operating Officer of China Internet Corporation (now Chinadotcom), Laurie led the joint venture with PointCast Asia. He also developed and managed sales channels across North Asia, including China, Hong Kong, Korea and Chinese Taipei, as Area Sales Director at Compaq, and established regional operations for Apple Computers.

Laurie serves on a number of committees, including the Information Technology Committee of Hong Kong's Industry & Technology Development Council, the Hong Kong Chief Executive's Commission on Innovation and Technology, and the Advisory Panel for Hong Kong's Industrial Technology Centre.

Laurie graduated in business from Hong Kong Baptist College and from Stanford University's Executive Program. He has spent considerable time in both the US and Singapore, and now lives in Hong Kong, where he is well known for his contributions at industry events around the world.

http://www.i100corp.com

back to index

Maximizing profitability with bundled products and services

Chou Steven and Lee Celest
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View Abstract

1. Development in Telecommunications Technology

The rapid increase in the number of new telecommunications service providers, domestically and internationally, stems not just from regulatory changes but also from the emergence of new telecommunications technologies, such as VoIP telephony and the convergence of voice and data networks. These innovations give new entrants/competitors alternative means of reaching consumers and businesses. Consequently, new competitive service providers can bypass the traditional service providers to provide local and long-distance phone services.

The use of the Internet as a new communications medium is bringing about changes in the design of the traditional public telephone network. A combination of networks is used to provide users access to the Internet. This combination involves the public telephone network, with its traditional switching and routing technology, and new high-speed data networks that use new switching and routing technology, first used in the Internet. This new switching and routing technology is based on the ability to separate voice and data messages into packets of information. This combination of traditional switched and new packet-based network technologies allows service providers to provide voice and data services over such converged networks, including the provision of VoIP telephony.

While VoIP-based telephone calls are currently of a lower quality compared to regular connections, the significant cost savings have, nevertheless, made this lower quality acceptable to many consumers and businesses.

Technology, meanwhile, is helping to increase call quality. Without sacrificing the cost advantages, the quality of a call is expected to continue to improve and this should lead VoIP telephone calls to become a standard mode of communication. According to IDC, VoIP minutes are expected to grow at a compound annual growth rate of approximately 94% from 2000 to 2004 - from about 10 billion minutes in 2000 to about 135 billion minutes in 2004. This will be driven by the move by companies to converge their separate voice, video and data networks onto the IP platform, declining bandwidth prices and telecom market deregulation.

1.1 Challenges faced by Service Providers

Bundling products and services has, thus, become one of the most effective ways for a telecom provider to retain and expand its customer base in recent years. These needs have also driven service providers to employ creative and innovative solutions to deliver new value and differentiated portfolios such as local service, wireless service, unified messaging, one-number-follow-me service, prepaid and postpaid options, VoIP routing and more.

Acquiring a comprehensive platform has never been easier - but only if you know what you are looking for. To make things more complex, the wide-ranging capabilities and offerings are creating an environment that is increasingly more complicated to plan for, implement and manage, such as

- Maximizing the operational efficiency and life cycle cost effectiveness of their telecommunication systems.
- Many businesses lack the resources to handle their day-to-day telecommunication needs, while simultaneously providing the expertise required for special situations and projects. These resource voids can negatively impact the timeliness and/or quality of a project.
- Tailoring, applying and leveraging the leading technologies to satisfy the unique needs of customers, employees and suppliers.
  Understanding next gen technologies, and how they can help your company generate new revenue, is key to the success in today's highly competitive marketplace.

2. A solution to address these challenges ...

Rapid technological and market developments have given providers a window of opportunity to offer new, flexible solutions that delivers value and can compete successfully against traditional, larger telecommunications solution providers. It is now more important than ever to provide key competitive advantages such as:

- Integrated, comprehensive product offerings that have:
  - Enhanced programmability, flexibility & scalability for converged voice and data services
  - Open architecture, platform independence
- Products that give service providers more choice and control over their service offerings, networks, platforms
- Technologies / tools that provide rapid time-to-market capability that is so essential in services marketplace
- Ability to bring together communities of service providers, ASPs and enterprises to drive next-generation carrier solutions

The Applications and Core Technologies highlighted in the above diagram are iSoftel's solution to address to the challenges faced by the service providers.

The Applications, inclusive of a comprehensive prepaid/postpaid management system, convergent billing management system, call center management system, and mobile data value-added service, today represent a comprehensive set of enabling solutions for telecommunications service providers' unique requirements and specific market demographics. Leveraging on Core Technologies, via a graphical interface and an object-oriented scalable billing (OSB) system, thus provides an open architecture approach, with solutions that have compatibility with international telecommunications protocols and leading technology platforms.

Both a graphical interface and OSB are designed to empower users to adapt to changing technology and service requirements quickly and with minimal costs.

A graphical user interface with "click and drag" functions give the telecommunications service providers a user-friendly interface to quickly and easily configure the switching and routing of voice and data traffic.

OSB in turn gives telecommunications service providers a customer care and real-time billing system that is modular and highly scaleable. The benefits take the form of flexibility and allowance for future expansion and faster time-to-market in the case of software changes to cope with changing service requirements. With OSB, a prepaid/postpaid management system is, thus, positioned to be able to meet large and sophisticated carrier requirements. It is designed to meet the large and sophisticated carrier's requirements with respect to performance, scalability and operability.

- To add powerful functionality for enhanced support of wireless standards and technologies
- To boost overall system performance to support multi-million subscriber installations
- To integrate the existing prepaid with this new postpaid functionality

2.1 Telecommunications Services supported by a Prepaid/Postpaid Management System

It is important that a prepaid/postpaid management system's switching and routing capabilities are platform independent and are able to work with anyone or a combination of the following switching systems.

- VoIP Gateway (such as those manufactured by Cisco)
- Server-based
- Switch-based: Switch-based solutions are based on open-architecture and expandable switching systems, manufactured by switch manufacturers such as Lucent.

This system enables service providers to provide a range of services to their customers, such as:

1. pre-paid mobile, ISP or calling card services;
2. convergent billing;
3. long-distance telephone resale services;
4. international telephone callback services; and
5. enhanced services like one-number-follow-me, voice VPN etc.

Telecommunications service providers are also able to effectively manage these services through:

1. real-time invoicing;
2. subscriber account management services;
3. call monitoring;
4. administrative support services;
5. the ASP model; and
6. distribution channel / private label management.

To address the emerging Voice over Internet Protocol (VoIP) telephony market, it is also imperative that your choice of prepaid/postpaid management system is capable of handling both voice and data traffic. Telecommunications service providers, therefore, are able to manage and provide real-time analysis in respect of both voice and data traffic.

A solid prepaid/postpaid platform enables telecommunications service providers to provide the following services:

- Pre-paid calling card services
- Post-paid services for home and corporate customers
- International callback services

2.2 Telecommunications Services supported by a Call Center Management System

Call centers integrate a customer's computer system with its telephone system to provide seamless, real-time process handling. Typical users will include customer service centers of banks, credit card companies, mobile telecommunications operators, technology product companies, public bodies etc.

An ideal call center management system should be web-based and support customer inquiries via voice, fax, email and Internet access. Various modules like automatic call distribution, interactive voice response, computer-telephony integration and interface with databases make it a highly flexible system that can cater to a variety of needs and different scales of call center operations (from a few agent seats and to hundreds of agent seats). These modules are combined to create customized telephone answering, routing and information delivery and reporting options.

2.3 Telecommunications Services supported by a Mobile Data/Value-Added System

In today's rapid telecom market, there is a need to offer differentiating services as a result of increasing competition among mobile network operators. As competition intensifies, mobile network operators have to seek ways to differentiate themselves by offering services beyond voice, which may include mobile data and value-added services.

A mobile data/value-added services platform provides mobile network operators with ability to offer these differentiating data and other new revenue-generating, value-added services - in particular mobile commerce.

There is currently a wide range of VAS application modules available, including: M-Trade; M-Banking; GPS locator; voicemail notification; and email notification.

While these VAS applications currently operate on GSM mobile networks and use the SMS protocol, these capabilities will be extended to the CDMA platform and will also be made to integrate with evolving wireless technology standards such as WAP, GPRS, Bluetooth and 3G. The addition of WAP capability will enable the Group significantly to expand its product offerings for WAP compatible mobile networks.

2.4 A Convergent Billing Management System

A convergent billing management system needs to be able to handle a heavy volume of call traffic - both voice and data - and information related to those calls. Billing inquiries need to be processed in seconds. Enhanced filter capabilities can also enable the service provider to sort records and create reports based on almost any criterion.

With a solid convergent billing management system a service provider can generate separate running invoice numbers from CDR invoices, support on-demand bills for a specific range of customers or all of them, produce customized invoice comments based on payment terms, display payment history with payment cut-off date. The system should be able to produce bar codes, OCR, and ZIP bar codes on invoices to assist in organizing payment. It should also support a customer-specific billing cycle, with multi-level and multi-tier record generation, and customized invoice dates.

As mentioned above, with OSB technology, a convergent billing management system needs to be easily and quickly customizable by the users themselves.

back to index

Abstract

In today's highly competitive telecom arena it is more important than ever to focus on profitability. This means concentrating on the proper integration of back office software, including OSS (operations support systems) and BSS (business support systems). Today's service provider is seeking out vendors that can provide these essential elements, preferably in an open environment, in order to effectively roll out services and stay on top of profitability.

back to index

Steven Chou

Steven Chou, vice president and general manager for iSoftel, the Americas, manages the company's U.S. division, working directly with sales and development to accelerate the company's expansion into the U.S. marketplace. Mr. Chou was formerly business development director for Lucent Technologies, where he worked closely with sales to identify and close Excel Switching related business, primarily targeting Tier II and Tier III tandem and international gateway carriers offering turnkey solutions. Prior to Lucent Technologies, Chou held management positions with ACT Networks, GTE International and AT&T.

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back to index

The Digital Divide: How Developing Nations Can Jointly Pursue Telecommunications and Internet Development Through Voice Over Internet Protocol

Steve Ott
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(View Abstract)

1. VoIP Providers

Global wholesale VoIP providers have services in place that facilitate carriers' entrée into VoIP. These services enable more carriers to quickly take advantage of new opportunities. As they build out their own domestic and international VoIP networks, government-owned incumbents and next-gen carriers alike are engaging experienced wholesale VoIP providers in the process. Partnerships can range anywhere from comprehensive technology transfer to a turnkey solution whereby the carrier outsources its domestic and international network to the VoIP provider. Carriers around the world no longer have to build their own global networks in order to offer VoIP services, but can instead connect to the global network of a VoIP provider and gain immediate access to a global footprint. Carriers can then focus on customer acquisition, market share, and the buildout of their own domestic networks.

As carriers bring down their costs with VoIP, retail rates come down, and teledensity, traffic volumes, and revenues go up. By using the Internet to deliver basic telephony and long distance services, capital-restricted, developing nations can leapfrog developed countries that are encumbered by legacy telecommunication systems. VoIP is one of the most powerful economic development policy tools available to developing nations as high-quality, low-cost communications have a proven track record of fostering both economic growth.

2. Pressuring Bodies, Lack of Infrastructure, Lack of Capital

Regulatory organizations like the World Bank and the International Telecommunications Union (ITU), citizens looking for consumer choice and lower prices, and corporations looking to profit from new markets are all factors pressuring nations to change their current market conditions.

These bodies have varying motives for pressuring marketplaces. Regulatory agencies have proven that

with increased teledensity, developing nations can grow their internal markets considerably. Businesses will be able to effectively and efficiently communicate with global marketplaces. Partnerships can exist outside of the immediate region and will flourish as their world begins to shrink.
Consumers and regulatory agencies look for prices to be lowered so that more citizens can have access to communications. Together they are demanding prices that are more in line with global trends. When prices fall, higher teledensity follows, and markets as a whole grow, yielding more profits.

This was just the case in China, which has been liberalizing its telecommunication market over the past few years. From 1990 to 1999, China's policies have yielded a 2270% increase in telecom service revenue, a 1471% increase in telephone calls, and a 557% increase in the number of international outbound calls. Teledensity in China has also increased 1479%, giving more citizens access to tools that allow them to have a national and global voice.

With a change in policy, countries will find a massive influx of capital from corporations looking to gain a foothold on new markets. If competitive providers are allowed lower prices, new customers are enticed and people never able to afford service now rush to gain access to it. In fact, in most newly deregulated countries, wait lists just to get new access exist. Service cannot be installed quickly enough.

Developing nations often look to outside sources for capital to improve or build network infrastructure. Most of these nations have limited budgets for network improvements. Maintaining existing communication networks is often a challenge in itself. Circuit-switch telephony equipment is very expensive and growth in these nations is virtually impossible under current conditions. Many telecommunication companies themselves are capital depleted and carry heavy debt burdens. They are focused on improving short-term liquidity, not on developing new networks. They look for opportunities where capital requirements are low and returns can be very high and very quick. Simply put, they will not invest millions of dollars in markets that are unproven and that cannot be scaled in such a way that profits are assured.

3. Case Study: Bolivia

Bolivia is a market in the process of deregulating. On November 28, 2001, the Bolivian telecommunications marketplace will be open for competition. A series of laws beginning in 1992 began the process and cleared a path for competition. The law allowed for privatization of the state owned companies and the eventual deregulation of the telecommunications market. Companies are now positioning themselves to be the new competitive carriers within the country.

Since telecommunications came to Bolivia, the market had been run and controlled by a privatized system. In countries where deregulation is not eminent, the telecommunications service is generally run by a government owned and operated company or has been privatized by the government and sold or run by a private company.

Major foreign carriers often run and own controlling interests in state providers. Foreign investment and management bring needed capital to emerging governments but prices remain relatively high. Foreign carriers usually receive percentage payments or share in the revenue; each promoting the stability of high prices set by organizations and not by the market itself.

In the case of Bolivia, COTAS is poised to profit and flourish in this developing marketplace. COTAS is a cooperative operating in the Santa Cruz region. Prior to deregulation local exchange carriers, like COTAS, were responsible for handling calls and the infrastructure in their own local loop, usually defined by the borders of the departments (states). The local exchange carriers routed calls from person-to-person within their department but if a call was headed out of their department, the call would be given to the privatized incumbent carrier for termination outside of their region.

In this model, calls made within the department were relatively inexpensive, but calls made to other departments and other countries were very expensive, and were cost prohibitive for most consumers. The incumbent carrier was very successful, keeping margins stable with high volume for local calls, and keeping margins very high but with low volumes for calls outside the country. Access to foreign markets and international trade only grew slightly over the years because the high price of communication made it hard to justify the cost.

Pressure from Bolivian citizens, corporations, world regulatory bodies, and the intelligent foresight of the Bolivian government itself were all factors that contributed to the changing of the telecommunication regulatory policies. Companies on the day of deregulation will legally be allowed to operate and to offer customers local and long distance phone service, including international long distance. These companies will only have access to the international infrastructure through co-location space offered to them through the former incumbent privatized carrier. If a company does decide to enter into competition it must do so countrywide. Deregulation policy in Bolivia mandates that access to service be given to all its residents, not just residents in certain key regions of the country. This makes the network needed to compete that much more complex and larger in scale, with coverage to even the most remote areas.

4. New Markets, New Carriers, New Challenges

New carriers will be faced with the same challenge already discussed; the need to build a cost efficient, national network that can scale as call volumes and subscribers increase.

New carriers have several options to consider:

- Option 1: Co locate with the incumbent carrier
- Option 2: Construct their own network and make agreements with carriers around the world to complete calls
- Option 3: Work with another international carrier.

4.1 Option 1

Co-location with the incumbent carrier is often an enticing option for emerging telecommunication providers. In most cases, access to these locations is policy as part of deregulation. The incumbent carrier is allowed to charge a "reasonable" rate to emerging carriers in trade for access to its infrastructure and to international markets. However, access is often limited, incumbent carriers limit access by controlling the speed at which technology is deployed. Often simple installations take weeks if not months or longer. Further change or expansion can be even slower.

4.2 Option 2

Constructing new networks gives carriers the most freedom and the greatest responsibility. New networks are generally fully owned by the new entrant or subsidized by foreign corporations. Access to the services is only prohibited by the time needed to deploy and begin operation and the capital required to complete the build out. Carriers are responsible for the quality of the calls and the stringent standards held by consumers. Operations must run smoothly otherwise consumers will lose service and quickly switch providers.

Capital sources for new networks must run deep. The capital markets of the world have been deeply depleted in recent years. The expansion of the Internet and related services have driven markets to shift from older systems to new technology that offer more efficient and higher returns. Companies looking to expand or emerge are finding it harder and harder to gain entry solely due to lack of major investment.

Constructing new networks also takes a prohibitive amount of time. Hundreds or thousands of miles of cable must be laid or mobile towers put up. Buildings must be leased or constructed. Massive amounts of equipment must be installed and connected. For companies looking to be immediately competitive in developing markets, this is not an option. Even if capital was readily available and the physical network could be built in time for deregulation, new carriers working with their own network will often need to make hundreds of agreements to various state, privatized international carriers to gain access into those countries for their customers. Long-term agreements have proven to be devastating to new carriers. Companies are faced with lowering rates but stable costs. Margins begin to shrink as prices are driven down. The agreement on paper would allow for profit, then a short time later could financially hinder that same company from operating efficiently. Volumes would need to increase just to maintain a positive cash flow.

4.3 Option 3

Emerging carriers can work with various types of alternative suppliers that bring the national and international marketplace to them. Traditional carriers face the same issues as carriers looking to build their own networks. They too must have new equipment, lease office, and building space and generally lay miles and miles of new cable or build mobile infrastructures. Investment in new markets is often a risky one. Long-term payoffs are inevitable but often the shareholders of the larger companies demand profits within shorter time frames.

COTAS, the Bolivian cooperative mentioned earlier, chose to work with ITXC, an international wholesale carrier that operates a global voice over the Internet (VoIP) network. Voice over the Internet takes calls off

the traditional circuit-
switch networks that already exist around the world and routes the call over the Internet. Calls travel over the Internet to their final destination. COTAS found that by working with an International supplier they could not only be competitive but they could be competitive soon after deregulation. A new network will be installed for them without the need for a vast amount of capital or expertise.

VoIP providers often have programs that enable new carriers in developing countries to compete by installing the equipment they need to transport calls. This equipment is flexible and can be connected to existing infrastructure in a short amount of time.

These emerging carriers bring the richness of the Internet to new markets. Wholesale VoIP providers like ITXC make agreements with emerging carries to provide them not only access to international markets but also help them develop, finance, and architect entire country-wide networks that will be used to lower costs and effectively make the new carrier very competitive, often with lower rates and higher margins than the incumbent carrier.

In the case of COTAS and ITXC, the companies will share in the evolution of the marketplace, both investing time, equipment, and expertise. ITXC will own and operate Internet telephony "gateways" that convert calls between the IP format and circuit-switch format. Internet telephony deployment and installation takes a fraction of the time necessary in comparison to circuit-switch networks.

Wholesale VoIP providers bring many advantages to developing markets, including:

- Lower cost structures
- Lower recurring costs
- Faster installation times
- Faster and more scalable networks
- Instant access to international markets

The telecommunications infrastructure is limited in Bolivia but a low-cost, high-quality voice over the Internet network will allow COTAS to have instant access to a global network for terminating international traffic and have a new means for interconnecting existing termination locations within the countries. Equipment and bandwidth can be provisioned and deployed in a fraction of the time of a traditional carrier and a circuit-switch network. Calls between companies within Bolivia can also be transported over IP for a less than the cost of a traditional call over a circuit-switch network.

The network COTAS will utilize will be ready and tested for traffic upon deregulation. COTAS customers will travel off the proprietary circuit-switch networks of the privatized incumbent carrier and onto an IP network with global termination and a lower cost structure.

VoIP is one of the most powerful economic development policy tools available to developing nations as high-quality, low-cost communications have a proven track record of fostering both economic growth and democratic development.

5. What About The Incumbents

Incumbent carriers on the day of deregulation are faced with similar and related issues. They will likely lose valuable traffic they once relied on for revenue. Customers may migrate to new carriers who offer a wide range of services and packages. Incumbents will also be faced with lowering prices and the need to quickly react to a changing environment. To combat the inevitable erosion, carriers need to look for ways to maintain or increase revenue and increase traffic. One way to do this is by lowering costs. VoIP can be employed to not only lower costs but also increase margins. By working with VoIP providers, incumbent carriers can ease many of the problems that exist with legacy circuit- switch networks and long term bi-lateral agreements with foreign carriers.

First and foremost, carriers can get paid for additional bandwidth they might have in-country. Carriers can open up their network and allow VoIP providers to complete calls to their customers. Carriers get a percentage of each call routed over their own network from international destinations. Today's successful VoIP providers have more customers than international capacity and are looking for networks that offer immediate and high bandwidth options.

Secondly, carriers can have instant access to a global international footprint for their own customers to use. Connecting with a global VoIP provider gives them access to the world, through one connection. Carriers no longer have to make multiple agreements with numerous carriers. One carrier can provide all their global and national calling needs.

Incumbent carriers, like competitive carriers, can also work on building their own IP networks to route and manage traffic. The cost structure of IP networks allows companies to focus on the customer and market share not the cost and complexity of their networks.

6. What to Look for When Choosing a VoIP Provider

- Proven technology that routes around Internet congestion
- Fully integrated routing, network management and trouble handling system
- 24/7 Network Operations Center to watch and manage the network
- Redundant Tier 1 Internet backbone access
- Redundant network components
- Multi-vendor and interoperable network components

7. VoIP is the Future of Telecommunications

Internet telephony or VoIP can bring developing nations and deregulating markets competitive and low cost telecommunications. In fact, the International Telecommunications Union recently stated in a report form the Secretary General, "A fundamental paradigm shift has been underway in the telecommunications industry - a shift that has arguably brought about as dramatic a change in personal communications as the telephone did compared to the telegram. That change is a shift from traditional PSTN circuit-switch voice networks to packet-switched data networks, using Internet Protocol (IP) technology."

VoIP will be the driving force worldwide as higher and higher teledensity prevails. Nations will be able to better communicate with each other and more easily promote trade and prosperity. Individuals will have access to tools that will allow them to better their own communities. The world will grow ever smaller in this new age of communication. Nations will look to VoIP to better serve their citizens, increase teledensity, and better their own economic future

back to index

Abstract

Everybody has heard the Internet referred to as "the great equalizer" between people, companies, and countries, but what does this really mean and how does it apply to the telecommunication needs of developing nations?

In some areas of the world, telecommunications infrastructure is often limited, significantly impeding economic development. In these areas, basic telephone service is often unavailable and/or very expensive, long distance rates are high, and teledensity tends to be low. Low-cost, high-quality Internet telephony (VoIP) allows traditional and emerging carriers alike to increase revenues and decrease international call completion costs by partnering with wholesale carriers who operate global Internet-based voice networks. Internet infrastructure is capital efficient. Migrating to Internet telephony allows new carriers to offer not only high quality voice services at lower capital and recurrent costs through 'Internet economics', but to integrate voice and data services over one network. Further, flexible, IP-based telecommunication platforms provide the best foundation on which to build enhanced services.

back to index

Steve Ott

Steve Ott is the Executive Vice President of Global Sales. In his four years with ITXC, Steve has built a global sales force that sells wholesale call completion services to carriers round the world. In addition to North and South America, Steve has established direct sales operations in Singapore, China, London, Moscow, and United Arab Emirates. ITXC's Sales Team has built the largest network of its kind and as of 5/01 and is selling destinations to carriers around the world.

Prior to joining the ITXC team, Mr. Ott served as the VP of worldwide Sales and Support at Voxware, Inc. a speech and audio compression technology provider. At Voxware, Steve built a world class team and grew sales from startup to over $13M per year. He also assisted with the company's IPO in 1996. Before coming to Voxware, Steve was VP of Corporate Development at the Legent Corporation in Virginia where he managed all merger/acquisitions and assimilation activities for the $500M company reporting to the CEO. Earlier he was a Director reporting to the Executive VP of Sales at Legent and prior to that held numerous sales positions at the company. Prior to joining Legent, Steve was a very successful member of the sales team at several software firms.

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back to index

Business & Applications

Wednesday, 16 January 2002
1600–1730
South Pacific III - IV

W.2.2 The Issues: Network Architecture & Knowledge Management

Chair:
HIYOSHI YOKOGAWA, President, InfoCom Consultancy International, Ltd, *Japan*

W.2.2.1 Evolving Network Architectures for Medicine, Education and Government Usage (View Abstract)

SYED AHAMED, Professor, Computer Science, City University of New York and VICTOR LAWRENCE, Vice President, Advanced Communications Technology, Bell Labs Innovations, Lucent Technologies, *USA*

W.2.2.2 "Information is Knowledge in Motion": Innovative Knowledge Management Using an Open Source Initiative (Academic peer reviewed) (View Abstract)

JAY GILLETTE, Professor, Center for Information & Communication Sciences, and GREGORY JONES, Ball State University, *USA*

back to sessions

Evolving Network Architectures for Medicine, Education and Government Usage

Prof. Syed V. Ahamed
City University of New York
United States of America

Dr. Victor B. Lawrence
Bell Labs Innovations
Lucent Technologies
United States of America

View Abstract

1. Introduction

Over the last three decades, networks have become increasingly intelligent. They have acquired an aura of being generic, adaptive and programmable. These features make the evolving networks useful in almost any application, ranging from being intensely secure private networks to the public global networks able to reach anybody at anytime. In addition, they can be tailored to provide almost any type of service, ranging from low-rate monitoring to multimedia broadband duplex communication services. In this paper, we provide an insight into the technology and the architectures that make these networks perform as elegantly and as eloquently as the Pentium chip in modern PC's.

The role of technology, the extent of processing and the bus architecture within the chip are largely comparable to the intricacies that are inherent in modern networks. The microscopic nature of the nanometer chip stands out as the glaring contradiction to transoceanic global networks. Yet, the functionality tracks in both environments in carrying out the right process at the right time, and at the right place. We further expand on these concepts for the networks that are being deployed to serve our society throughout the world.

2. Features of the New Networks

Modern network technology is experiencing an explosive growth, similar to that of the VLSI technology during the seventies. The applications are immense, and the reach is global for these modern networks. In a sense, it is essential that these networks be self-monitoring, adaptive, and left unattended to perform under the vast variety of applications and usage. Network intelligence thus becomes an essential feature in regulating the operability and performance of the network, depending on the nature and the demands of the traffic.

If the major functions of the network for each application is already standardized by the Open System Interconnect (OSI) model, then there are seven layers of intelligence that become essential. Such intelligence is indeed programmed into networks to respond to the particular needs of the application. The traditional network, which was essentially at the physical layer, cannot handle the needs of modern networks and the switching systems have to become increasingly programmable to handle all types of traffic needs. The concept of "soft-switch" now dominates the traditional grounds of the Electronic Switching Systems (ESS). These soft-switches now handle all the growing needs of all types of circuit, packet, message, etc., switching. More than just satisfying the needs of the particular application at hand, they deploy the network resources in an optimal and adaptive fashion to bring down the costs and enhance the services offered by these networks.

2.1 Network Expectations and its Moderation

The expectations from the new breed of network can far exceed its capacity. Almost all the social and public service institutions that deploy modern networks expect to be beneficiaries from the increased capacity, speed and efficiency of the intelligent and adaptive networks that serve these evolving societies and the public sector at large.

A certain amount of realism is necessary on the part of the network owners and operators as to what these networks can do, and what they cannot do. For example, basic building blocks of these networks such as the routers, the gateways and the servers can accommodate certain types of switching and bandwidth depending on the quality of service (QoS) constraints. The QoS concept is new, and is available in certain type of switches that have the programmability to allocate network resources (such as bandwidth, class of service, buffer sizes, etc.) There is a certain amount of delays and dropped packets/cells that can accrue in the network. Although these types of service parameters may be within the realm of tolerance for the service provided, they are still impairments. The mean and variance of these impairments (though tolerable) need to be addressed. They vary depending on the traffic conditions and network/server/link availability. Further, the extent of programmability can vary considerably between the various types and manufacturers of routers. The allocation of resources (buffers, server space, priority, etc.) and bandwidth also influence the actual QoS based on the actual network conditions. In essence, it is advisable to be aware of the limitations, rather than expecting the best at all times. In the current era of rapidly changing networks, the precaution to the network owners and operators is that the initial homework on the design of the network is as important as the investment in the network.

2.2 Three Specific Applications

In emerging nations around the world, network acceptability and its deployment is in vogue for two reasons: (a) an enormous amount of intelligence and adaptability (that is scarce in the less developed nations) can be programmed into the networks, and (b) the routine benefits organizing the information (based on modern IT concepts) in the routers and servers can be tailored to the application. The IT structure within the servers can indeed be successfully intertwined with the organized methodology of doing business, especially tele-medicine, distance learning and running the government. An IT platform for storage, access, usage and deployment of information is almost inherent for building the network infrastructure. With a certain amount of synergy of IT and network skills at the seminal stages, the developing nations can stand to gain significantly in two of the most dramatic forces of the twenty-first century; IT and network technology.

In the rest of this paper, we address three types of such networks for Tele-medicine, Education/Distance Learning and Electronic Government, and present their possible architectures. Even though we do not emphasize the IT aspects in the architectures, it is evident that the servers used as knowledge bases have a classification based on the contents of these knowledge bases. Their access is indeed controlled by the classification of the query or request for service. For example, in Tele-medicine, the query may be classified as patient/doctor, ailment/disease, doctor/specialty, drugs/cure, etc., and appropriate knowledge is addressed by the network routers/switches. For example, in the Distance Learning application, the contents of the knowledge bases may be classified by the Dewey Decimal System or the Library of Congress numbering system. Both the organization of information and the access of information can thus be accomplished in architectural design, incorporating both the concepts of IT (for education in the virtual university) and networking (for distance learning). In the Electronic Government application, the functions at the office of the head of state are coordinated with the offices of the individual ministers/secretaries of divisions in the government. Data and information is organized in the knowledge bases according to the type of office (based on IT concepts and interrelation between the contents knowledge bases) and the access is organized based on the network addressing of the knowledge bases.

3. Applications and Architecture for Tele-medicine

In the area of Tele-medicine, the architecture can be quite small, ranging from a group of PC's on an Ethernet for a private physician's office to national medical network to monitor and administer medical services for an entire country. In this part of the paper, we present an architectural structure for a mid-sized hospital environment. This intermediate structure shown in Figure 1 may be tailored down to a doctor's office or enhanced to a full-fledged regional or national medical network environment. The design steps for networks of this nature start from the estimation of traffic and the acceptable waiting time for service.

In most cases, the user preference is a factor that is reflected as over-design or redundancy in the network capacity. From the network design considerations, the most inexpensive redundancy is usually the link capacity of dedicated fiber lines. When these links are leased or shared between other network applications, a good estimation of the average response time is obtained by the network simulation studies. Numerous studies (References 1, 2, 3) of this nature have been performed on commercially available network simulation packages such as COMNET1 and OPNET2. It would not be desirable to design these networks without proper attention to the traffic estimation, future needs, scalability, and the quality-of-service requirements.

4. Applications and Architecture for Distance Learning

Distance learning deals with dispensing knowledge and two-way high-speed communication for an interactive environment (Reference 4). Typically, broadband multimedia features are also necessary to maintain a classroom environment. In the architecture shown in Figure 2, the intra-campus traffic is carried by public domain networks and the location of the knowledge bases are also accessed by the digital lines such as the ATM or the broadband ISDN facilities. For multi-campus universities, the distance learning network can be accommodated atop numerous campus networks (CN-1 through CN-x). This two layer design facilitates the more heavily used local networks to respond to the needs of the local campuses quickly, and the more expensive intra-campus lines (via PBX's and DP's or dialog processors) to cater only to the lighter traffic reaching out to other campuses or knowledge bases (KB-1).

The knowledge bases hold digital libraries and electronic books. Students and teachers access these facilities via their PC's, and the subject classification offers access based on any standard library encoding schemes such as the Dewey Decimal or the Library of Congress systems. This type of architecture permits numerous universities to share the facilities of one large high-capacity electronic library. The digital traffic jam during the teaching hours is well handled by intelligent path-finding routers located in the knowledge transfer point/signal transfer point (KTP/STP) switch and the service transfer point (SCP) that actually provides the right address for campus queries. These concepts are already implemented in Intelligent Network architectures (Reference 5) around the world. In the more recent purely digital networks, these functions are carried out by intelligent routers. These adaptive routers are appearing in the market more and more frequently and their proper usage will facilitate the flow of individualized classroom digital data.

Knowledge bases need to be serviced and updated. Typically, this is accomplished by a group of subject matter specialists in the knowledge management systems (KMS). In Figure 2, the intelligent network concepts are carried into the domain of LAN's and WAN's. It appears that it is only a decade or so before the router technology will follow the path of ESS technology, and become increasingly program driven. In fact, this combination of router technology, blended with the CPU technology, will give rise to new and more powerful high-speed networks (typically OC-n rates) and their switches (typically ATM based), leading to more intelligence than the traditional intelligence in the IN's of the 1990's.

5. Applications and Architecture for Electronic Government (EG)

The cabinet or the democratic process formulates national policy and provides the general direction for the nation. The office of the head of state executes the policy. It also carries a full time managerial and executive responsibility. For this reason, the electronic government-IT (EG-IT) architecture for any developing nation should have the capacity to retain extensive information of all the managerial functions such as planning, organizing, staffing, implementation and control of the most crucial and significant projects as well as the command, control and coordination of the ongoing projects of national importance.

Typically, a centralized electronic govemment (EG) is unique to the extent that the funding, and coordination of the other divisions of the government (such as defense, education, commerce, communication, social welfare, etc.) and of projects arising within the government (such as tele-medicine, distance learning, electronic commerce, etc.) The organization and the structure of the IT within the EG has to reflect this rather unique focus and concentration of management and administration (of itself), as well as the other branches of government. To accommodate the flow of information based on the nature of functions particular to the office of the head of state and the functions of the other ministries, an EG architecture is proposed in Figure 3. Whereas the local ministries and the project office may have a unified blueprint for their IT's, the IT of the centralized office of the head of state needs special consideration. It is strongly suggested that the network and IT engineers designing the EG of any country, incorporate the different nature of the functions of the head of state's office in the initial design of the IT, and the networks that support these (the C3I) functions. The network should be tailored to interface well with the offices of the other ministries.

If the trend is to use the generic programmable network components, then the netware that controls the operations of these components (to facilitate the EG functions for the office of the head of state) should be endowed with enough intelligence to perform the IT-EG functions in conjunction with the functions of the other ministries. To some extent, this is not trivial unless the network designers have facilitated these functions as being programmable or already assigned paths and addresses unique to the offices and databases within the offices of the ministries.

This architecture is not optimized nor customized to any particular country. Only a blueprint of one of many configurations is documented in this paper. Several rounds of optimization of the architecture, components, links and server (databases) characteristics are absolutely essential before embarking on the direct application of this architecture. The customization of the network to the country is as essential as the funding of the project itself! We strongly propose that all the necessary aspects of very detailed planning be undertaken in the most serious vein.

6. Special Purpose LANs and Generic Backbones

Network components are becoming increasingly more programmable. In fact, new and more versatile components are being introduced ever so frequently. To rush into architectures that are not mature to withstand the next decade or so would be futile especially for developing countries. In a sense, it would be like subscribing to the FDDI or SMDS technology of the 1980's when ATM was being evolved and perfected for global deployment. It is our contention that the hardware, such as multiplexors (including the add-drop multiplexors or ADM's), routers, and gateways for all these networks will respond to more complex programs, which are indeed the basis for the flexibility offered by the "soft switches" of the current decade.

With the projected impact of the more sophisticated network operating systems and the intelligence that is embedded in such blending of networks (hardware and software), the handwriting is already on the wall. Some of the typical networks such as the telephone, the hybrid fiber-coax, and the fiber-based backbones already serving our communities will become more amenable to serve medical, educational and governmental/social functions. The key to the adaptability of these networks lies in the netware that senses, monitors and operates the networks. Such netware programs call for the highest skill in application and network programming tailored to the particular application such as medicine, education or government. Although it is feasible to build networks unique to each of these applications, it is more sensible to have programmable network components that will respond to adaptive netware and perform in a programmable and optimal way.

7. Architectural Commonality of the Emerging Networks

As networks converge towards the ATM standard, the basic building blocks (ADM's, routers, gateways and servers) of most high-speed networks have become fairly standard, even though the technology and the data rates have gained substantial ground over the last decade. The recent trend, calling all vendors towards interoperability and international standardization, makes the fabrication of modern networks much like the fabrication of special purpose computers. In the earlier days of mainframes, the trend was to develop the IBM-360's, the CDC-6600's and the super-Cray's for different applications. In the modern days of the Pentiums and multi-GHz systems, the programmability of the chip with its expanded instruction set has driven the last nail in the coffin of the mainframes. Currently, we see a similar encroachment by multifunction routers, their programmability, and the WWW IP-addressing operating on the high-speed fiber backbone, thus bringing an acceleration to the eventual extinction and demise of electronic switching systems, massive wire centers and traditional telephone systems.

The final synergy between the computing and the telecommunication environments will result in the full-scale importation of the micro-programmability of the conventional CPU, to the evolving communication processors. These communication processors will control the functioning of the intelligent routers of the twenty-first century. From the modern perspective, this type of harmonious interplay between two very fundamental partners (computing and communications) is already evident. And yet another surge of progress of our society is eminent. The platform for the new generation of networks will be founded on the programming of intelligent networks for multimedia application. It will function in both the traditional and the ATM environments over the fiber optic backbone.

7.1 The All-Internet Solution for Developing Nations

Popular as the Internet may be, it is only the tip of the iceberg. On the positive side, we have the IP addressing capability, to access a vast number of databases, and to gain access into the very broadband flexible networks for the transport of data. On the negative side, even the elementary intelligence embedded in the AI concepts (such as adaptive learning, derivation of cause-effect relationships, hypothesis testing, statistical inferencing, evolved pattern recognition, concept error-correction etc.) are not incorporated in the operations of the Internet. To some extent, such networks may unnerve the marginal user and cause alienation between the users and the network. We have discussed the social impact of intelligent networks (Reference 6). Apart from the social effect, the current Internet solutions do provide a basis for cost-effective implementation for E-commerce, tele-medicine, and educational networks. Together with very secure coding methods, some government and financial networks may also be initiated. However, for the sake of total privacy and security, special purpose, sabotage-proof, electronic governments, financial and banking networks may prevail.

7.2 The All-Private Network for Developing Nations

This type of customized network has existed in society for a long time. The networks for banks and financial institutions, defense networks, the IRS, the INS networks, etc. are examples in the US. However, developing countries face a dilemma in this regard. Dedicated networks are far more expensive and need a team of special staff to operate and maintain the networks. On the other hand, security and availability can be accurately monitored. In the most rapidly growing network environments (ATM), some of the responsibilities may be shifted to the network owners, and the users may be shielded to some extent. Whereas some networks of a developing country need to be totally private (e.g. electronic government, defense, INS, etc.), some other networks can be public (e.g. Internet-based education/library networks, news/information networks, etc.) This type of judicious choice needs to be made by the country that is proposing to move into the information age and become a reasonable beneficiary of the network revolution. At this stage, the science of network yields to the partly social and partly political foresight of the leadership of the country.

8. Conclusions

Some of the typical networks such as the telephone, the hybrid fiber-coax, and the fiber-based backbones already serving our communities will become more geared towards serving the medical, the educational or even the government functions. The key to the adaptability of these networks lies in the netware that senses, monitors and operates the networks. Such netware programs call for the highest skill in application and network programming tailored to the particular application such as medicine, education or government.

At present, the Internet uses very elementary netware at its service centers and performs rudimentary and specific tasks within the Internet environment. As the Internet assumes the tasks of delivering intelligent Internet functions, the role of the Internet netware will become more sophisticated during the next few years, bringing a new wave of medical, educational and government functions to society and the nations of the world. We propose that these new Intranet and Internet services, and their provisioning, will dominate the growth and service sectors for the next decade.

Endnotes

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Centralized Router Facility
to permit multimedia
communication between
patients, doctors, labs, and
other units in the facility.

FIGURE 1. ARCHITECTURE OF A MID-SIZED TELE-MEDICINE NETWORK FACILITY.

The buses assume the role of servers in the network. The flow of information in the large medical complex is monitored by the fire walls at the servers. The contact between the network participants may be in real time or via the remote messaging system on the servers. The various databases may also be structured as stand alone facilities or they can be integrated into the servers.

FIGURE 2. IMPLEMENTATION OF THE NBES USING EXISTING PUBLIC DOMAIN NETWORKS AND ISDN LINES.

ADR DB = address data base of knowledge bases; CN = campus networks; DB = data base; DP = dialog processors; KB = knowledge bases; KLI = knowledge logic interpreters; KMS = knowledge management system; KTP/STP = knowledge transfer point/service transfer point; PBX = private branch exchanges; SCP/EE = service control point/educational environment; SMS = service management systems; SSPs = conventional service switching points. Note that ISDN lines or the intelligent ATM networks become essential for communication between the NBES elements since the channel control information is necessary for information to be relayed back from the knowledge bases at KB's. Although ISDN lines are indicated here, any type of computer network, ATM or HFC backbone, or even Internet facility will serve as well. It is necessary for the network to communicate the control and the content information for the NBES to function effectively.

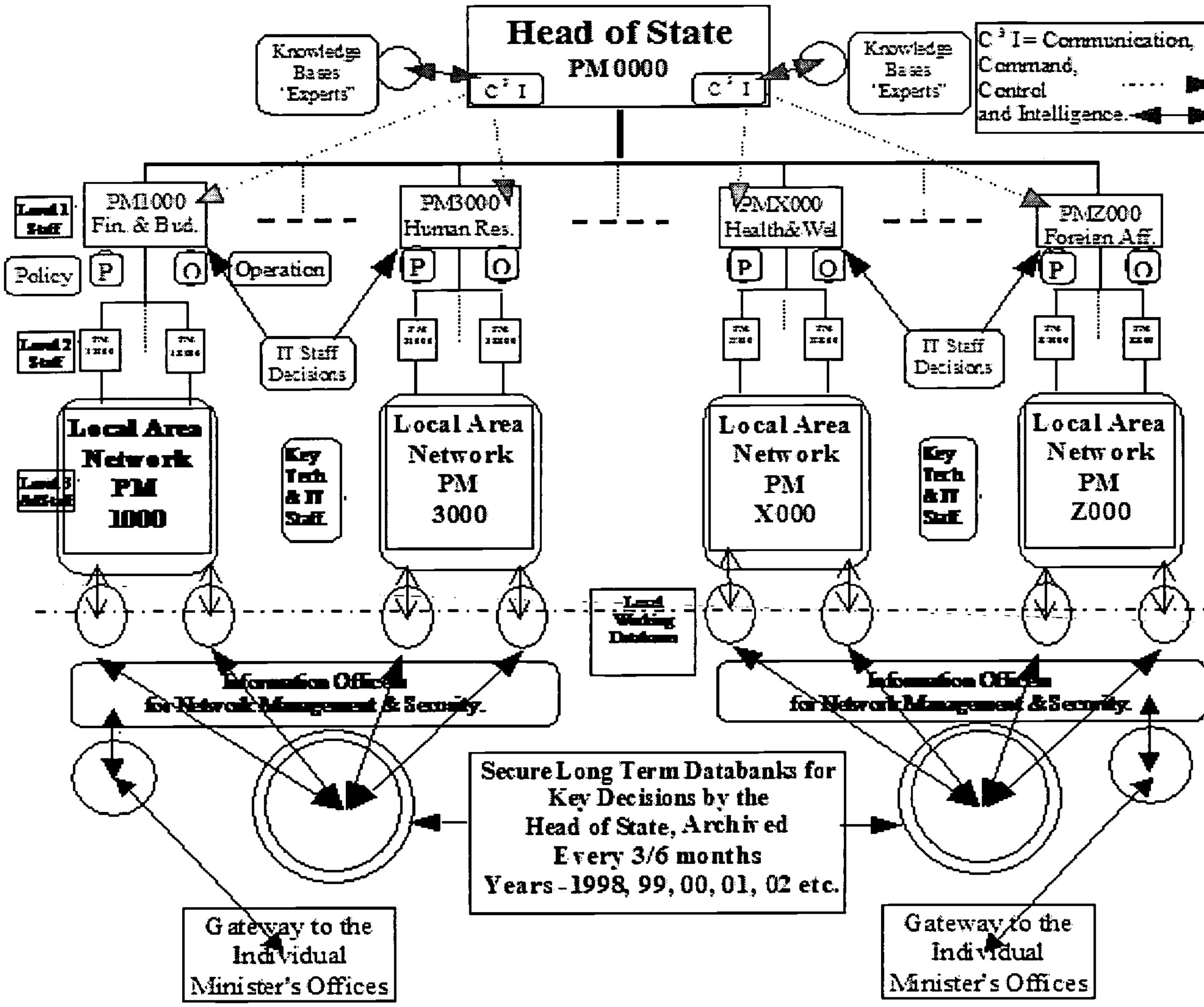

FIGURE 3. AN ELECTRONIC GOVERNMENT-IT PLATFORM FOR A DEVELOPING NATION
The office of the head of state supports the management (i.e., communication, command, control and intelligence, C^3I) and the execution of policies for long-term economic and national growth. The C^3I facility starts from the head of state's office and the feedback comes from the offices of the ministers.

back to index

Abstract

In this paper, we present the architectural commonality between the evolving networks that serve our society. The use of these networks may be for medicine, education or government. We present typical network architectures for medical environments, such as hospitals and medical centers, for educational environments, such as universities and distance learning centers, and finally for local and national governments. We present how these networks can be designed, tailored and customized to such applications from very standardized building blocks to be able to provide knowledge and information highways between the users at large.

back to index

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Syed V. Ahamed received his Ph.D. and D.Sc. in Electrical Engineering from the University of Manchester and his MBA in Economics from New York University. He taught at the University of Colorado for two years before joining AT&T Bell Laboratories in 1966. In 1981, he taught Electrical Engineering at the University of Hawaii at Monoa and in 1982, he became a Professor of Computer Science at the City University of New York and a member of the Doctoral Faculty in 1985. Concurrently, he taught at New York Polytechnic - Brooklyn as a visiting Professor of Computer Science from 1982 to 1986.

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Dr. Lawrence has taught at the University of Pennsylvania, Rutgers University, Princeton University, Columbia University, and Fairleigh Dickinson University, and delivered the Chancellor's Distinguished Lecture Series at the University of California at Berkeley in 1986. He served as the Chairman, IEEE Awards Board in 1994-1995, was Editor-In-Chief, IEEE Transactions on Communications from 1987 to 1991 and a member of the Board of Governors of the IEEE Communications Society from 1990 to 1992. He was also Special Rapporteur on Coding (1982-1984) and on Transmission Impairments (1984) for CCITT (now ITU).

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back to index

"Information is Knowledge in Motion": Innovative Knowledge Management using an Open Source Initiative

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View Abstract

1. Introduction: Knowledge Work is Complex to Manage and Execute

One of the most important aspects of the information economy is the shift from industrial process work to knowledge work based on information networking. Knowledge work effectiveness and knowledge worker productivity are keys for business profitability and indeed are foundations for economic development worldwide.

Among the challenges are that knowledge work is difficult to define, hard to ccomprehend and problematic to manage, and complex to execute. In the Knowledge Management (KM) movement, there is a continuing, innovative effort to address these challenges, building on decades of work in database management, collaborative learning environments, and information movement and use.

Before Microsoft's leadership was consumed by its antitrust trials, Bill Gates wrote a widely-publicizedwidely publicized yet minimally understood book on the topic called Business @ the Speed of Thought: Using a Digital Nervous System (1999). The breakthrough concept he elaborated there is in the awkwardly-named metaphor–"a digital nervous system." The key concept is of an information network that "makes sense" of the business environment's signals and inputs and applies human understanding and wisdom to respond to them with appropriate actions and outputs.

Gates says:

Knowledge Management . . . is not a software product or a software category. Knowledge management doesn't even start with technology. It starts with business objectives and processes and a recognition of the need to share information. Knowledge management is nothing more than managing information flow, getting the right information to the people who need it so that they can act on it quickly.[1]

We are involved in research in both business processes and information technology enablers. We will define knowledge management in practical conceptual models, focusing on information networking–the movement and use of information. We will then examine open source software platforms as practical models for collaborative exchange and knowledge management in organizations. Finally we discuss, as a case study, innovative knowledge management concepts and methods deployed against the business needs of a large Architecture and Engineering firm based in a major U.S. city.

Our interest follows from a growing concern we have about the topic. It takes into account published knowledge management work yet provides original conceptual models, and takes the unique open source platform approach we call the "Open Source Knowledge Initiative" while recognizing proprietary software advantages (and disadvantages).

2. Toward Understanding: Knowledge Management Defined

The issue of knowledge management is new and compelling, yet the challenge is ancient and time-honored. The issue is knowledge about knowledge–how we know what we know. In historical terms, this is epistemology, the theory of knowledge. Epistemology sometimes is defined as the science of knowledge.

"Epistemology" is an impressive word, entering the English language in the nineteenth century, the time of the rise of broad-based science. Yet the origin of the word "epistemology" is more ancient and actually easier to use. The original meaning has practical meaning for people working in organizations today.

The theory of knowledge–epistemology–is based on the Greek word for knowledge, episteme. That Greek word in turn derives from two simpler words, translated as "to stand upon," or as we say in English, "understanding," what we stand upon. In other words, knowledge is ultimately what we understand, what we use as a base. In organizational life as in life in general, knowledge is the foundation for our view of things. Knowledge is the basis of our actions. People refer accurately to their "knowledge base."[2]

Clearly then, knowledge management comes down to what we understand. So the practical issue becomes how we manage knowledge. How do we know what we know? How do we understand what we understand? This has been a business issue for centuries, but we note that in this era it has migrated from the head office to the back office to the front line.

Information is how knowledge moves between things and people, and between people and people. That's why Gates emphasizes information flow. We will call this by the term information networking–the movement and use of information. To make the key relationship easy to understand and remember, we say "information is knowledge in motion."

3. Information In A Scale Of Knowledge: Information Is Knowledge In Motion

Information is a component of knowledge. It occupies a central position in a scale of knowledge from phenomena to wisdom. Information is the gateway of interpretation. Information is how we understand what to do. It's the basis of our understanding. But we don't know what information to look for and put together unless we understand it.

Information is one part of knowledge. There are many parts and kinds of knowledge. Here are some examples: knowledge from experiences, knowledge as skills, spiritual knowledge, gender and cultural knowledge. And there are many names to call parts and kinds of knowledge. Yet for clarity, the six parts or categories of knowledge that we model below are a place to start, a point of departure.[3]

In our approach (for details see Table 1 "Information in a Scale of Knowledge"), these are the six component parts, listed so as to take them into view in one glance:

- **Wisdom**
- **Understanding**
- **Information**
- **Data**
- **Facts**
- **Phenomena**

Information is a component of knowledge. It occupies a central position in a scale of knowledge from phenomena to wisdom. It is the signifier-signified interface; the gateway of interpretation.

Wisdom

The ability to discern, to make judgments. Discerning wisdom is based ultimately on difference or differences. Wisdom is the ability to discern difference. Wisdom guides understanding. Understanding informs wisdom.

Understanding

The ability to recognize, to comprehend, to surround, and to select information on the basis of wisdom. It means to know the implications of information. Understanding tells how to apply information, and what information to look for. Understanding means to know the significance of information signs. Understanding is the basis of research.

Information

Singular, an idea. A concept formed in the consciousness of the perceiver. Plural, a set of ideas or concepts. Specifically, and in its main function, information is data selected, filtered and used to make a decision or to reinforce the users' position. Information is applied data. That is, the data are applied for useful purposes to the information user. Information is useful data. Information value is intrinsically relative to the user.

Data

Organized facts. "Data" in Latin means "the givens." "Datum" is the singular, "a given." Data are processed, that is, structured, facts.

Facts

Representations of phenomena. A fact represents a phenomenon. Facts are signifiers of phenomena. Facts "re-present" phenomena.

Phenomena

A plural term, for "those which appear to be." Singular, "phenomenon," for "that which appears to be." Phenomena appear as knowledge in perception, as they are perceived. Properly, perceptions of phenomena are knowledge.

TABLE 1 Information in a Scale of Knowledge

We conclude that in the scale of knowledge, the most critical kind of knowledge is information. That is not to say it's the most important kind of knowledge. Yet information has a critical function. It's a key point on the critical path of knowledge.

Information is the door that swings both ways. It's the doorway or gateway between–on one side–our perceptions of phenomena, which we represent as facts and organize as data–and on the other side–what we understand, guided by wisdom.

Information is where wisdom interacts with phenomena. Information is where phenomena reach wisdom.

Information is how knowledge moves from "out there" to "in here" and back, both for individuals and organizations. Information is knowledge on the move. Think of this: information is knowledge, moving.

Information is a complex topic in itself. In the full Oxford English Dictionary, the definitions centered on "inform" and "information" and associated terms go on for five pages. A real challenge in organizational life is to define the organization's information.

How do we define information? To start, in the singular, information is an idea. Information is a concept formed in the consciousness of the perceiver through understanding. Plural, information consists of a seta set of ideas or concepts. The word "idea" comes from the Greek word for "form." The Latin-based word "inform," the root word for "information," means "a form in." Where in? Answer: In the consciousness of the perceiver. Then the idea is information.

We will define information specifically, and in its main function, this way: information is composed of data understood, selected, filtered and used to make a decision or to reinforce the users' position.

Information is a set of applied data. That is, the data are applied for useful purposes to the information user. Information is useful data. We define it informally: "information is news you use." Information value is intrinsically relative to the user.

4. Moving And Using Information: The Practice Of Information Networking In A Knowledge Management Context

"Practice" in plain English simply means, "doing." The practice of information networking means how we move and use information. In a sense, the practice of information networking is what allows us to manage knowledge. Information networking is the backbone of knowledge management. Open Source platforms may allow us a unique way to manage knowledge appropriate for the complexities of this era.

Since knowledge is information on the move, how we "do" information–our practice of information networking–is how we are able to know what we know. Again with the goal of bringing clarity, the practice of information networking can be analyzed in five main parts. (See Table 2: "The Practice of Information Networking.") The main categories are information access, filtering, storage, retrieval, using.

Main Category of Information Networking	Second-Level Analysis of Information Networking Categories			
Access	Input	Processing	Movement	Output
Filtering	Display	Selection	Classification	Prioritization
Storage	Organization	Placement	Securing	Indexing
Retrieval	Searching	Finding	Bringing Forth	Queuing
Using	Applying	Deploying	Distributing	Presenting

TABLE 2 The Practice of Information Networking

In general, information is moved and used through these five steps, most often in this order. From one person getting a document off her desk, to a multinational corporation sending an email message, the process is similar. Even while we read these words, we are essentially going through these five steps, in the movement of the words from the page through our short-term memory to our long-term memory and back to our active awareness we use to understand the sentences.

Once again, to take in the entire analysis in one glance, the information is given in familiar written form. Here are the five main categories, followed by the second level of analysis of the main categories:

- **Access** (Input, Processing, Movement, Output)
- **Filtering** (Display, Selection, Classification, Prioritization)
- **Storage** (Organization, Placement, Securing, Indexing)
- **Retrieval** (Searching, Finding, Bringing Forth, Queuing)
- **Using** (Applying, Presenting, Distributing, Deploying)

Reading this list, from top to bottom and left to right, shows the overall movement and use of information. We have given a number of traditional computing and information management terms to the categories, to show how traditional approaches fit into this overall analysis. Most of what we call "information management" can be located in these categories, and that is a useful feature of the analysis.

Once again we can see that information networking as a practical matter has a long history–humans have been "doing" information networking as far back as we can imagine. Yet today we face information networking challenges on an unprecedented scale, in all these categories. What are knowledge workers to do in practice to solve them?

5. Our "Open Source Knowledge Initiative"[4]: Potential Open Source Approaches

We believe that there is a potential approach from the Open Source arena that may prove useful. Putting together our theoretical approach with the "weblog" phenomenon in practice, we call our solution set, the "Open Source Knowledge Initiative." This is the vector of our current research. It aims for "praxis"–the unity of theory and practice.

In the last few years, weblogs or, more commonly, "blogs" have gained in popularity and are beginning to be seriously examined for their abilities to filter, disseminate, and enhance knowledge acquisition. We will explore two Open Source web sites that exist "somewhere between ... content management system[s], ... web bulletin board system[s], and ... weblog[s]."[5] We will examine Slashdot (http://slashdot.org) and Kuro5hin (http://www.kuro5hin.org) as praxical case studies of the theories that are presented in this paper.

Though each site is similar, there are fundamental differences in the processes and philosophies that have been coded into the software platforms and tools on which these sites depend on in order to function.

The added significance of both Slashdot and Kuro5hin is that their tools and platforms have been released to the public for royalty free use under the GNU General Public License (GPL), one of the most common Open Source Licenses. Any person or organization is able to create similar sites, using the same tools, without the need purchase a license or spend money on platform development costs. They also have the express right, and ability, to modify the code in any way that suits the needs of the implementers so long as changes to the source code are given back to the original project in order to be rolled into future code releases.[6]

6. Slashdot Overview

Rob "CmdrTaco" Malda began Slashdot as a hobby site under a different name, Chips and Dips, in the summer of 1997 under the student account he was allotted at Hope College. For him, it was a means of organizing the things that he found interesting on the web and presenting commentary about what made the linked material significant to him or not.

As it gained in popularity and in the amount of content, the administrative tasks of maintaining the flat file system that he created became too much of a strain. With a name change and a move to a server that he could directly control, Malda began designing a content management system backend that would make the updating of his web site easier. He also created features that would allow visitors to comment on the stories that were posted to the system. [7]

This change alone would have made Slashdot unique. Malda had effectively created an interactive news gathering organization. Readers could submit stories for review. Then Malda, Jeff "Hemos" Bates (a friend from school) and an elected band of lieutenants made up of early and faithful readers, would attempt to separate the wheat from the chaff. Once a story was posted, readers could then add additional value through Slashdot's comment system.

Malda's other innovations helped Slashdot deal with its increase in popularity. As any site gets more popular, the number of malicious users, or users not interested in the original mission of the site, generally goes up. To combat the rise in the "noise level" that inevitably comes with popularity, Malda and his group created a system that allowed users to rate the value of the individual comments that were posted in response to stories.

Comments that add value (or humor) to a story generally are moderated up in score and comments that just add noise are generally moderated down. Then they created an interface that allowed the user to set the "moderation threshold" at which they viewed the site. Any comment that is not scored equal or above this threshold is not displayed. The user is then able to experience this "customized" site to that particular individual without affecting the viewing habits experience of other users.

Generally, no comment is removed from the system due to content. However due to traffic volumes of 30 million page-views a month (a testament to the scalability of the underlying code that runs Slashdot), the site "archives" old comments after about 2 weeks which renders them inaccessible to filters (a feature that the creators are working to rectify). [8]

Instead of having to deal with potentially worthless comments that are not being deleted, the user gets to determine exactly her signal to noise ratio. If she wants to see every possible post and whatever value is contained therein, she can lower her moderation threshold. If she wants to only see the cream of the crop, she can set her threshold higher and only see those comments that others have deemed worthy of notoriety.

In addition, users who post quality comments receive "karma" points equal to the sum of the moderation that is done to their the comments they have posted in the past. If a user consistently posts quality comments to the site, his karma increases as others value them higher. The benefit of higher karma is the ability to post comments with an automatic score of two instead of the one for logged in users or zero for anonymous posters. The higher initial score brings the comment closer to average minimum moderation thresholds maintained by most users and, therefore, more likely to be read by the general populace.

In all of this and with little funding, Malda, Bates and crew had created one of the most effective and timeliest news gathering organizations on the web. With its tagline of "News for Nerds, Stuff that Matters," Slashdot covers stories released all over the web, with stories being linked from its main page almost as soon as they make their online debut. It effectively is a newsroom staffed by thousands of editors.

If a story on the web involves a topic that your average geek would find interesting (physics, Linux, computing, astronomy, video games, and cryptography are but a few of the topics normally discussed), then one of Slashdot's thousands of visitors will is sure to have submitted it to the site. Some stories are linked from Slashdot within minutes of being posted to their respective sites. The Slashdot model is quick, it's informative, it's searchable and it can be archived.

As an advocate of Open Source software, Malda released the code that powers Slashdot under the GNU General Public License (GPL). The code, named Slash (the Slashdot Like Automatic Storytelling Homepage) is available for free from the web site slashcode.com (http://www.slashcode.com). Slashcode is the seat of the Open Source development effort to expand the features and functionality of the Slashdot code. As a Slash-based site itself, Slashcode maintains all the information one would need to implement a Slash site or help in the improvement of the code.

7. Kuro5hin Overview

Kuro5hin owes its beginnings to one of the initial releases of the Slash code. Later, dissatisfied with the pace of Slash's early development (since corrected), the creators decided to write their own backend system, named Scoop. The site's creators and maintainers, Rusty Foster and Dylan "Inoshiro" Griffins, set out to create a Slashdot like site with a few philosophical differences.

Chief among those differences was the idea of an "open" submission queue. The founders wanted something different from the "closed" submission queue of the Slashdot model, where readers find stories and submit the ideas to the small editorial staff for review and final say as to whether it makes it onto the web site's pages.

The Kuro5hin founders wanted to allow anyone to submit a story (like Slashdot). However, they wanted to change the review process so that any logged in user can evaluate the waiting queue and vote whether a story is good enough for the front page (a rare occurrence), good enough to be posted to specific subsection (more likely) or "dumped" from the site. Users that vote on the submission's fate can also comment on the article's content or form. Stories that are "dumped" trigger an email to the author with a link to the rejected article and all of its comments. Rejected authors have the option of heeding the advice of the comments attached to their submission, making the necessary changes and resubmitting, or they can drop the issue and try again with a completely different topic. [9]

The process showcases the other main difference between the two web sites. Slashdot generally focuses on the dissemination of links, with value added introductions, to content on other web sites. Then the site invites its community of readers to discuss and add value to what it has read while providing them with the tools to customize how much value they receive in return. Kuro5hin, on the other hand, invites users to create the content of the site (though it does have a section for link dissemination that is somewhat derisively named Mindless Link Propagation or MLP).

Users then judge the value of the submissions and then comment on those submissions that make the cut. Unix Columnist Mike O'Brien, put it this way: "The main purpose of Slashdot is news, followed by discussion. The main purpose of Kuro5hin is discussion, based on the news."[10]

As in the case of the Slashdot site, Rusty and Inoshiro have created a popular and viable web site with few human resources. Kuroshin.org, with its focus on "technology and culture, from the trenches"[11] consistently posts informative original content on a daily and weekly basis. It is a successful experiment in a user-based, and largely user-run, community web site where consensus and context, through hyperlinks and archived material, leads to an exceptional educational experience for its readership.

8. Slash and Scoop as Knowledge Management Tools

Both the Slash and Scoop software tools offer a number of features that make them ideal candidates for low-cost and powerful knowledge management suites. Though their creators might balk at analysis provided by the former CEO of Microsoft, Bill Gates' approach to the "digital nervous system" offers insight into the value of these Open Source systems. Gates makes this point:

A digital nervous system is the corporate, digital equivalent of the human nervous system, providing a well-integrated flow of information to the right part of the organization at the right time.... distinguished from a mere network of computers by the accuracy, immediacy, and richness of the information it brings.... and the insight and collaboration made possible by the information. [12]

Neither Slashdot, nor Kuro5hin (nor the code that powers each), would be worth note if it were not for the context, insight, or collaboration that they add to the information they showcase. By harnessing the free submission of ideas and the ability to filter information based on personal preferences, both sites harness a personal flow of information. In our opinion, there is no better part of an organization and no better time to deliver information than to the individual employee who needs an answer at the moment that they need it most.

In these software models, the user is able to see what they "need" to see and nothing more. If further analysis, or better understood context (perhaps through a hyperlink to an archived discussion), requires a change in the personal flow of information, the end-user can readjust her filters to acquire better perceptions of the information that has been delivered to her.

This idea is very much in line with the metaphor of the nervous system. As humans, we are constantly bombarded by perceptual information. The vast majority of which is automatically filtered out of our sensual experience of the world by our nervous system. In general, the majority of this information is meaningless to us and would take too much effort to react to from one particular moment to the next. Instead, we generally perceive only that which seems important at the time while still taking in more information than we consciously realize. However, should we realize that our contextual understanding of the moment needs to be readjusted, we can plumb our memory with readjusted perceptual filters.

The filtering capabilities of these software suites, coupled with the moderation systems that make such filtering usable, are the linchpins to their success. Both Slash and Scoop leave the difficult job of "grading" the usefulness of the information submitted to each site to humans who are innately equipped with the ability to determine the "worth" of information. They don't attempt to automate understanding. Instead, they seek to provide a means for understanding to be achieved through mass consensus and context.

The filtering capabilities of each system leave open the possibility that a shift in the context of the topic's conversation may lead to information that was previously judged worthless to now be useful. The fix, in turn, is to readjust the focus of the filters instead of alternatives that would have disqualified the information before it made the cut. These systems succeed at adapting the changing demands that are place upon them by accepting and thriving on the complexity of knowledge management. [13]

Since the process of knowledge management is innately complex, it is best to accept this fact and work towards managing the complexity instead of attempting to simplify or deny it. One productive way to accept the complexity is to use adaptive technologies that allow the information to be organized to the needs of its audience. [14]

Both Slash and Scoop offer features that allow the user to navigate a personalized "version" of the web site. Based on preferences set in each user's profile, various elements of the pages are "adapted" to the show only the information that the user wishes to see with an emphasis on topics and areas that concern them most. The complexity and/or amount of information isare not abandoned. Instead, the user is provided with tools that allow the complexity to be adapted and/or navigated more easily.

Both Slashdot (with Slash as its engine) and Kuro5hin (with Scoop as its engine) offer examples of different forms of open, community-based, knowledge management in action. Each effectively, and cheaply, passes the consensus and context of its focus areas, "News for Nerds" and "Technology and Culture, From the Trenches," on to its user base. In fact, it is quite possible to identify a long-time Slashdot reader or Kuro5hin poster by their knowledge or interest in a small sampling of submissions that have appeared on each site.

Through moderation, filtering, filtering and customizability, each suite of tools offer cutting edge tools and techniques to harvest and disseminate knowledge.

9. Conclusions and Recommendations

Understanding the importance of knowledge management leads to fundamental practical questions. If this is so important, why doesn't everybody do it, or do it well?

As we have indicated, the real reason is that knowledge management is complex. It is difficult to do it well.

We believe the Open Source approach we have outlined is a promising way to overcome some of the complexities and practical difficulties of knowledge management, especially in distributed groups. The very barriers to entry that make knowledge management difficult also represent competitive advantages to those who can overcome the barriers. Not everyone can manage such a complex and profound undertaking. Yet the payoff beckons. Those who can, will do. These doers will be the winners.

Endnotes

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back to index

Abstract

One of the most important aspects of the information economy is the shift from industrial process work to knowledge work based on information networking. This paper discusses research in knowledge management business processes and information technology enablers. We define knowledge manage in practical conceptual models, focusing on information networking—the movement and use of information. We then apply open sourcesoftware platforms as practical models for collaborative exchange and knowledge management in organizations.

back to index

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back to index

Conference Sessions

Business & Applications

Wednesday, 16 January 2002
1600–1730
South Pacific I - II

W.3.2 Special Interest Group Federation of Regional Associations

Facilitator:
HOYT ZIA, Executive Director, Pacific Telecommunications Council

Presentation:

Asia Pacific Preparatory Process for the WSIS (PowerPoint Presentation)

JONG-SOON LEE, Executive Director, Asia-Pacific Telecommunity

back to sessions

Country / Region

Wednesday, 16 January 2002
0845–1015
Honolulu Suite

W.1.3 Southeast Asia

Chair:
WHAJOON CHO, Vice President B, KT ICOM, *Republic of Korea*

W.1.3.1 Trends in Asia-Pacific Data Services Markets (View Abstract)

JOHN HIBBARD, Vice President for Media and Communications, Pacific Telecommunications Council

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W.1.3.2 Internet Commerce Models in Asia: Case Studies of the Four Dragons (View Abstract)

WONSUK KANG, Assistant Professor and LORA LEE, Research Scholar, Nanyang Technological University, *Singapore*

Presenter:
LORA LEE, Research Scholar, Nanyang Technological University, *Singapore*

W.1.3.3

PAUL WALTERS, Vice President - Asia Boeing Space Systems International Service Company, *Malaysia*

back to sessions

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Projects/Responsibilities

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1998: Rate Rebalancing and Introducing New Subscription System

1997: Defense for Reform of Interconnect Order

1996: Interconnect Charge Determination

1995: A Study on the Competitive Pricing Strategy/ Research on Access Charge Pricing in the Competitive Environment

1994: For the Revision of Access Charge Determination Procedures / Research on Foreign Examples and Drawing Appropriate Conclusions

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back to index

Trends in Asia-Pacific Data Services Markets

John Hibbard
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View Abstract

Growth

There is no question that data services traffic has been growing rapidly. In 1998, BT announced that data traffic surpassed voice in the UK for the first time and reported that it expected data to make up 90% of network traffic by 2003.

On networks worldwide, voice traffic over the PSTN is expected to be relegated to less than 2% of capacity by 2005.

And in the Asia-Pacific region, the demand for PSTN voice is only expected to account for 0.4% by the same date.

Ovum's widely-acknowledged Bandwidth Explosion report predicted that, in China alone, the number of Internet users would rise from 930,000 in 1998 to 16.9 million in 2005, driving total peak hour outgoing traffic from just 442 megabits per second to nearly 160 gigabits. We are clearly already well on the way to witnessing that growth.

After analysing these sources and a range of other inputs, Telstra concluded in 2000 that it expected a total global revenue growth in the international data/IP market from around US$13 billion in 2000 to US$44 billion in 2005. The main drivers for this growth were the changing market and explosive take-up of data/Internet, as well as e-commerce.

There were some forecasts that the Asian Internet market won't "peak" for at least another decade, if not longer, suggesting the region may be only in the early stages of an extended period of sustained growth.

So in general, forecasts for growth made over the last few years have been very healthy. Many in the industry advised of internet bandwidth growths well in excess of 100% p.a. However, although information on growth is not as forthcoming at times of financial pressure, there is sufficient anecdotal evidence to suggest that the growth rates during 2001 have been subdued with the consensus being a growth rate between 30% and 50% for bandwidth. In revenue terms, because of the price declines, growth is usually presented as "flat". Typical figures vary from +5% to -20% for international connectivity.

Bandwidth and Capital

As the focus of this paper is the international market, any growth will need to be underpinned by the availability of bandwidth. In the data world, networks require significantly greater bandwidth to function effectively and to support peak loads than in the circuit switched voice world due in part to the immaturity of network and quality management tools, something the voice world has developed over more than a century. While such tools will emerge and efficiencies will increase, the requirement for bandwidth will continue to grow.

But to provide bandwidth at the required level over the coming years, the telecommunications industry will need a constant supply of capital. While substantial investment has been made in providing connectivity infrastructure such as submarine cables, the need for capital does not necessarily end when the equipment or system is placed in service. This is particularly true in the era of photonics. It takes significant capital expenditure to convert the optical wavelengths to electrical data streams. We hear frequently of submarine cables with capacities in the hundreds of gigabits/second, even terabits/sec but upon examination we find that most are only equipped for 40 or 80 Gbits/sec.

With the cost of lighting a wavelengths at around $US25 million per 40 Gbits/sec, the additional cost of converting a cable from 40 Gbps to 1 Terabit/sec is $US600M. It is quite probable that the additional capital is as much or greater than the original cost of installing the submarine system. I wonder how many of the investors (or those funding any associated debt) realised that they would have to make a further major capital injection to achieve the full capacity of the cable.

It's going to be a challenge to secure the capital to enable the expansion of bandwidth, especially at a time when market sentiment is cautious. The lead time on the procurement and installation of equipment to light fibres can be a year or more and with the current tendency for purchasers to look to acquire capacity on a Just-In-Time basis, pre-sales of future capacity is unlikely. This makes securing the capital for extra capacity so much harder. Only the truly capital efficient companies will be able to meet the growing demand for full connectivity.

The importance of capital is fundamental to understanding future trends. As capital becomes harder to acquire, those with a positive cash flow are best placed to keep up with the pace, and those with efficient use of capital are best placed to succeed. The current issue for many companies in the telecommunications industry is that with demand subdued by the economic climate of 2001 and the events of September 11, they do not have the revenue flow to support the interest payments on the debt borrowed to provide the initial capital infrastructure. This provides the basis for a major trend in the industry and one which will be very relevant to the Asia Pacific region. With much of Asia's data growth being with North America, the capital exposure due to the need to construct much longer cables across the Pacific (than those say across the Atlantic), has been disproportionately greater. Many operators who have pursued the Asian market are now increasingly exposed.

Industry Scenario

The demand for growth, albeit at a slower rate than envisaged two years ago, combined with the tightness in the capital market and the challenge of turning healthy profits in the current economic climate suggest the emergence of the following possible industry scenario.

Over the next decade, we will see intensified competition at the retail level as more in-country operators emerge, each trying to offer an individual solution to the end-user. But few will be able to afford extensive networks or have effective relationships with other parties around the globe. So they will be looking to buy their global connectivity. There will be increased opportunities for international wholesalers. This should potentially be enhanced by the projected future price trend in international capacity.

In recent years, the advances in photonics have seen massive increases in capacity of the optical component of submarine cable systems. Historically the "wet" segment of submarine cables represented more than 75% of the total cost. However the increased optical capacities demand more electrical equipment at the cable terminals and greater terrestrial backhaul capacity. The cost of these "dry" components has not been falling as fast as the submarine component and now dominate the long term costs of submarine systems. As such, in a stable market, the rate of decline of the price of submarine cable capacity on a city-to-city basis will reduce and even flatten out. This will assist wholesalers in maintaining revenues. Of course a stable market does not exist at a time of financial pressure with capacity being traded at below market prices out of desperation. Such activity should however be temporary as consolidation will see stability return. However retailers may not achieve the price declines for wholesale capacity that they are expecting.

The fierce competition at the retail level will produce a further pressure on margins in a business where margins are already thin and supply costs are driven by economies of scale. Some fragmentation will occur as larger businesses break into smaller components in the drive for greater capital efficiency.

But ultimately this will lead to consolidation within different market segments and a drive for more efficient capital management as appropriate for each particular business.

So I believe it's clear that high capacity data connectivity will be increasingly undertaken by operators with the requisite scale, reach, and technical skills, often working in global or regional alliances and consortia to achieve capital efficiency. Within that framework, national markets will embrace broadband at varying rates consistent with their own economies and objectives - and the extent of their embrace will largely determine the market trends and growth patterns in each country.

We already know that if national network operators meet their schedules in the roll-out of broadband connections to the home, we can expect the Asia Pacific region's aggregate requirement for international capacity to approach the terabit level in the reasonably short term.

Much of the existing international capacity is locked into carrier bilaterals, as we know. However, further liberalisation in various countries in this region will spawn a completely new set of players, competing with the incumbents in each market. These new players will require significant bandwidth as they seek to undercut the prices of the incumbent and win market share. While some of these operators will not survive, others will and they may well absorb those who fall by the wayside -- or at least acquire their customers.

So increasing deregulation and liberalisation will further open the doors to extensive infrastructure opportunities.

With an equal right to apply for facilities-based licenses in some key economies, alternative providers have already begun making heavy investments in building out independent cable systems with Asian landings.

As a result, cumulative investment in cable build on the trans-Pacific route alone reached more than US$6 billion by the end of 2001 - not too far behind the US$8.5 billion for the much denser trans-Atlantic route. However when taken in the context of the smaller demand of the Asia-Pacific, it is not hard to appreciate the pressures that operators are under.

Falling margins are forcing network operators to exploit new opportunities by deploying value-added services such as co-location, IP web hosting and billing services. However this also has its risks which will be addressed later.

Future Battleground

One future battleground will be in the area of advanced services - particularly value-added Internet, corporate data and interactive residential.

There is no question that data centres, or carrier hotels, will be large drivers of bandwidth use. In fact some industry analysts are predicting as much as 50% of data traffic will originate from these sources.

To drive bandwidth use on their currently under-utilised networks, some providers are already incorporating carrier hotel services into offerings encompassing collocation, telehousing and hosting facilities.

Ovum predicts that the global market for carrier hotels will grow at a compound annual rate of 30.5% between now and 2005.

So within three or four years, we're looking at an expected 10.5 million square metres of carrier hotel space worldwide, and a market worth just under US$56 billion.

How much of that will overflow into this region is a moot point, but we can surely expect a reasonable share. However whether it is enough to cover the costs of setting up such facilities is not clear.

There are some major exposures for participants. As doubts emerged about the ability of new submarine systems to generate the revenues to support the immediate costs, data centres and collocation sites were seen by some cable providers as the panacea. In an attempt to harvest this opportunity in sufficient dimension to cover other less profitable initiatives, or to put newly found capital to rapid use, heavy investments were made in such facilities. A consequence is a current over-supply of expensive floorspace. Rationalisation involving bankruptcies or mergers is occurring and will likely become more active over the next year or so as the holding costs really impact financial performance.

Those who survive and thrive in this segment will be the ones who can capture the value of hosting applications and providing quality of service delivery, to a wide and varied number of IP devices. These are the new growth drivers, not only in megabit terms but, most importantly for operators, in real revenue terms.

Changing Marketplace

The marketplace is changing. In the immediate past, there has been a great fascination for migrating the experiences of trading gas, electricity and power futures in the energy industry to the telecommunications industry. There is no doubt that there are some lessons to be learnt from the successes that have been achieved in just-in-time purchasing, capital management and risk abatement. However whether the fluidity and unpredictability of telecommunications traffic is sufficiently great to make buying and selling through commodity trading more than niche business is unclear. The recent circumstances surrounding Enron has caused many to pause for reflection before pursuing further initiatives in the potential new marketplace.

Certainly one thing that the flirtation with energy trading did reinforce was that in this changed environment, there is increasing importance being placed by customers on service level guarantees, guaranteed delivery, end to end accountability and quality of service.

Security of Service

September 11 has raised the awareness of the importance of security. This is as true in Asia Pacific as it is in the USA. End-user customers and operators alike are re-examining their security arrangements to ensure continuity of service in the event of a major catastrophe. End-users are demanding tighter contracts and greater obligations on suppliers to maintain service. While provisions are made in contracts for genuine compensation in the event of a failure to supply to the agreed level, the focus of end-users is much more on securing service. Naturally, operators, in provisioning to meet the more stringent requirements, are incurring additional costs, which will need to be passed onto customers in some form if margins are to be maintained.

Operators servicing the retail market are now demanding greater service guarantees from their wholesale suppliers. They are also changing their buying patterns to achieve greater certainty of supply not just during cataclysmic events but also in normal times when failures will occur.

Some of the activities, which are being pursued to ensure ongoing service quality, are the following:

1. Avoiding excessive dependence on one country. The shutdown of transportation in the USA after September 11 signalled the risk that under different circumstances, there may be a large scale shutdown of telecommunications in one country indicating the need for country diversity.
2. Distributing traffic between a greater variety of systems and suppliers in the event that one or other is disrupted for whatever reason, a significant proportion of their connectivity remains available so business can continue albeit slightly degraded.
3. Closer study of risk areas and minimisation of their use wherever practical. This has led to heightened concern about shallow-water cables where breaks, accidental or heaven-forbid intentional, are more likely, and the greater interest in deepwater systems. This is particularly relevant in Asia where many of the systems are in shallow water.
4. Increased building security to deter intruders who could potentially do physical damage and/or network damage
5. Increased software protection to reduce the chance of hackers entering the network and introducing such things as viruses

These are but some of the actions being taken by users and operators to respond to the trend, particularly in the international data services business for increased requirement for security of service.

Data/Internet Service Trends

The desire for greater network security has highlighted the ongoing debate on the relative virtues of private leased lines versus switched network solutions as a means for providing data and internet services. The existence of the internet and at long last the emergence of data VPNs has accelerated the interest in switched solutions and a trend to that form of providing data connectivity has been emerging. While operators build in diversity, and properly designed meshed switched networks have inherent diversity, the provision of security is in the hands of the operators and only assured by service level guarantees.

On the other hand, the private line gives the user the chance to pick the route, the carrier, and other parameters so as to derive the quality level they desire. It is under their control, which gives them (rightly or wrongly) a level of influence. Also it allows encryption to be provided on an end-to-end basis. So the trend to migrating from leased lines to switched networks which has been slower than forecast is now likely to slow further with the pressures on communications managers for security of service.

So the challenge to sell such things as MPLS and network based data VPNs will be all that much harder.

Summary

The growth rate of data services in the world, as well as in Asia Pacific has slowed due to economic conditions, augmented by the effects of September 11. This has put considerable pressure on the finances of companies. Capital is less readily available to provide infrastructure. Many systems will not be expanded to their design capacity. In the short term this will have limited consequence. However it will assist the longer term restoration of balance between supply and demand in the capacity market. The trend of rapidly reducing data prices, once any fire-sale activity is out the way, will diminish as the benefits of technological gain in photonics will be diminished. It is expected that stability will return and those in the wholesale connectivity business who survive the current economic shake-out will survive. During the hiatus, the drive for cost economies and business efficiencies will see consolidation occur amongst the international operators, creating the environment where many national operators will move to become buyers of international services, rather than owners.

The desire for service continuity will generate different buying and management patterns at both the operator and end-user levels. There will be an increased focus on risks and on actions to mitigate these. This may well see an even slower migration from network built around private lines to network-based solutions.

back to index

Abstract

There are a variety of technological and commercial trends in the international data services market. The downturn in the telecommunications industry in 2001 has impacted some of these. The events of September 11 have had an influence. This paper looks at the current and future trends in the Asia Pacific market.

back to index

John Hibbard

John recently left Telstra after 38 years with it and its predecessors and has set up his own consulting company, Hibbard Consulting Pty Limited, specialising in international telecommunications. In this long career in telecommunications, some 25 years have been in the international side, in the functional areas of engineering, technical and business operations, technical and network planning, business planning and development, sales and marketing before his elevation to general management. As such, John has a comprehensive knowledge of the international telecom industry.

After managing the Asia Pacific region for Telstra through the emergence of competition, John became Managing Director, Global Wholesale in 1994, responsible for a team maintaining and growing Telstra's international business with some 250 significant telecommunications operators around the globe. John played a major role in establishing the vision and strategy that resulted in the formation of Reach, the Asia-Pacific based joint venture between Telstra and PCCW providing international connectivity services.

John conceived and drove to completion the Australia-Japan submarine cable and remains the Chairman. He continues to be the Telstra representative to PTC and is a member of the Executive Board and the Board of Trustees.

John holds a Bachelor of Engineering degree from University of Sydney (1966) and a Master of Electronic Engineering from the Netherlands (1971).

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back to index

Internet Commerce1 Models in Asia: Case Studies of the Four Dragons

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View Abstract

Introduction

Internet development in Asia has only begun to take off after the mid-1990s, but the explosive growth of commercial activities in the cyberspace shows that "E-commerce on the Internet" is making a big way in the region.

When it comes to e-commerce on the Internet, growth rates in the region are among the highest in the world, and often twice as high as that of America. Internet commerce has rapidly evolved as a promising economic mechanism that links the region to the global market. Geographical boundaries would no longer represent any hindrances to business transactions when Internet commerce comes to the picture (The Economist, March 1999).

The combined Internet universe of Japan, South Korea, Chinese Taipei, Hong Kong and Singapore make up almost 91 million (NUA Survey, 2001). The number of Internet users in Asia is also expected to expand by 422% within the next five years, according to a recent study by the Yankee Group (2001). The study expects the number of users to increase to about 228 million in 2005 and 370 million in 2006. Internet use is still growing at a steady rate worldwide, and more users means more e-commerce transactions.

With the dot-com stock crash and U.S. economic doldrums so much in the news, it's easy to lose sight of the growth in Internet usage and commerce taking place below the surface.

Despite the relatively subdued responses and more cautious approach after the crash, Asia is still viewed as a land of potential. According to a post-crash study by Forrester Research (Macaluso & Regan, 2000), a surge in Asia-Pacific Internet commerce will culminate with US$1.6 trillion in transactions taking place in 2004, which will make the region a powerhouse in the overall global Internet economy, The study also forecasts that worldwide online spending will reach $6.9 trillion in 2004 -- giving the Asia-Pacific market more than 20 percent of total sales.

Asia-Pacific enjoys a number of advantages that will accelerate its development as a major contributor to worldwide e-commerce with localized development efforts and tight links to supply chains in several major industries as key factors. One advantage enjoyed by the region is an established position in the supply chain that feeds the global economy, especially in the high-tech arena.

Moreover, lured by e-commerce's huge lucrative potential, the governments fully recognize the strategic importance of promoting the development of electronic commerce to their country's long-term economic well-being. There is thus increased enthusiasm among some Asia-Pacific governments to support e-commerce initiatives through infrastructure improvements and have committed substantial resources towards Internet development and commerce in their own country. Given these factors, there is still considerable potential for Internet commerce in Asia, despite the current gloomy conditions.

As the regional hub, Singapore embraces Information Technology and promotes Internet-based e-commerce with great zeal. The Singapore government has its own information infrastructure development plans, namely Singapore ONE, as its next millennium approaches. South Korea has also invested heavily in technology infrastructure in a bid to make the country a regional hub for the Internet. Just like Singapore, the Korean government has articulated the Informatization master plan, Cyber Korea 21, to encourage Internet adoption (MIC, 1999). Chinese Taipei has also been increasingly active in building its technoparks, the most prominent one being the Hsinchu Science-based Industrial Park. Its newly developed Tainan Science-based Industrial Park represents the government's plan to build Chinese Taipei into a science and technology island. Not to be outdone, Hong Kong plans to erect a $1.7 billion Cyberport, where its own start-up merchants can work alongside multinational technology firms (Gupta & Storey, 1999).

However, the development of Internet commerce in Asia differs somewhat from that of the States or Europe, due to the prominent disparities in terms of economic structure, governments' roles, different cultural settings, as well as other social aspects among the Asian countries. Most of them have evolved their own Internet commerce models.

Singapore, Chinese Taipei, Hong Kong and South Korea are selected to be the subjects of this study because these countries, commonly known as Asia's Four Dragons, face the common problem of rising to the challenge of the Internet and the need to remain leaders in the New Economy. Moreover, they share similar levels of economic development and Internet infrastructure, as well as comparable government's roles. According to the latest figures released by the Nua Internet Surveys (2000, November), Singapore has the highest number of Internet users in Asia, with 46 percent of people over the age of 15 going online during the month of August. Korea is looking like the next Internet growth area for Asia, with 42 percent of those surveyed logging on to the Internet in August, followed by Chinese Taipei (36.4 percent), Hong Kong (29.2 percent). These countries are also comparable in terms of Internet development.

Though we don't discuss the whole spectrum of e-commerce models in Asia, it is believed that the case study on the Four Dragons would provide useful references and information for the international e-commerce players, Internet policy makers in the region, and the regional countries that are currently developing their own Internet commerce frameworks.

First, we will compare the economy and Internet infrastructures of the Four Dragons, and then we will use the modified B2B and B2C models proposed by Kang, Lee & Chua (2000) to examine the Internet commerce development of these countries. Based on this modified Internet Commerce Model, we will try to explain why and how these four countries have evolved their own Internet commerce model.

Economic Development of the Four Dragons

The economic development of Singapore has evolved from the labor-intensive industries in the 1960s, to manufacturing in the 1980s. Since the early 1990s, Singapore has identified manufacturing and service sectors as the twin engines of economic growth (Economic Development Board, Singapore, 1999). With Singapore's current role as a manufacturing hub for PCs, disk drives and other computer hardware in decline because of high wages, it is re-positioning itself as a business services hub for the IT industry and nerve center for staging regional and international business operations (Lee, 2001).

The Singapore economy is small by world standards, with a GDP of approximately S$159 billion in 2000, the. However, a 2000 per-capita GNP of S$39,585 makes Singapore one of the richest countries in the world. This is largely due to the open nature of the economy. Singapore trades up to 2 ½ times its GDP, with foreign investment amounting to approximately S$7 billion in 2000 (Singapore Department of Statistics, 2001).

The biggest sector in the economy pie is finance and business services, accounting for 25.3 percent of the share in nominal GDP in 2000, following by manufacturing sector at 24.6 percent. Transport and communications had a 10.6 percent share (Singapore Department of Statistics, 2001).

The performance of the Singapore economy in 2002 is dependent on the performance of the US economy and the development in the region. A prolonged downturn is expected as three of the world's biggest economic engines, the United States, Europe and Japan are stalling. Singapore's industrial production fell more steeply then expected in May 2001, giving a signal that the economy might be headed for a technical recession. (Yahoo International Financial Centre, 2001).

However, it is expected that the negative regional and global trends would pose little serious threat to Singapore. Singapore's economic management and external indicators during a period of external volatility have demonstrated the country's ability to withstand shocks (The Economist Intelligence Unit, 2001). The 1997-98 Asian financial crisis that devastated Asia showed Singapore's strength and resilience. This is because the Singapore economy enjoys sound fundamentals such as high savings rate, strong foreign reserves of about S$139,251.9 m (Singapore Department of Statistics, 2001), a pro-business legal framework, world-class sea air and telecommunications infrastructure and strong support for technology, research and development (R&D).

Prior to financial crisis of 1997, Korea's impressive growth performance was described as the economic miracle. Since the first five-year economic development plan (FYP) in 1962, Korea had been transformed from an agrarian nation into one of the fastest growing industrialized economies in the world in three decades. The results of its economic growth have been impressive2. Over the relevant three decades (from the early 60's to the early 90's), Korean gross national product (GNP) has grown from the equivalent of 3.52 trillion Korean Won (USD 3.2 billion) to 563.4 trillion Korean Won (USD 518.2 billion), with per capita GNP soaring from USD120 to about USD11,664 (Handbook of Korea, 1998).

Despite a contraction in 2000 and 2001, South Korea's economy is forecasted to accelerate in 2002 as government spending and low interest rates spur investment and a rebound in exports, but inflation will remain contained. The Bank of Korea estimated that Asia's third-largest economy will grow 3.9 percent in 2002 from an estimated 2.8 percent in 2001. Korea's export-oriented economy, which has been more resilient than many of its neighbours in the face of a global slowdown, grew 1.8 percent in the third quarter year on year (Nam, 7 December 2001). Analysts said the forecasts were largely in line with market expectations and appeared attainable given government measures such as employing flexible policies like further rate cuts and more fiscal spending. With falling exports in early 2001, the government has injected a seven trillion won (US$5.54 billion) stimulus package to spur domestic demand (Toida et al, 2001).

Chinese Taipei currently ranks as the 14th largest trading entity worldwide. Yet, at the end of World War II, the figures for Chinese Taipei's population and per capita income were low. Constant liberalization and international cooperation allowed the island to industrialize quickly, and led to the continual upgrading of industry as well as a persistent rise in per capita income (Government Information Office, August 2001). This enabled Chinese Taipei to maintain relative stability amidst global economic fluctuations where Chinese Taipei's GDP increased by about 10 percent to US$287.9 billion in 1999 despite the aftermath of the Asian Economic Crisis (Republic of China Yearbook 2001, online).

In 2001, under the effect of a slump in international IT industry and economic stagnation in the advanced countries, both exports and investments of Chinese Taipei are registering negative growth rates (Toida et al, 2001). Hence, the current global slump is prompting a dramatic re-evaluation among the island's companies. With a sputtering US economy and no other engines of growth in sight, Chinese Taipei companies are increasingly seeing China as their salvation. Chinese Taipei companies would like a major migration to the mainland, free of restrictions from Taipei. There are many reasons for this : to be close to multinational customers in China, to sell to the booming mainland market, and to tap the relatively lower priced brainpower of China's top academies. Today, 40% of Chinese Taipei's hardware production - computers, parts, and peripherals - is manufactured on the mainland. These cross-straits business transactions and co-operation may increasingly form the basis for a growing B2B sector in Chinese Taipei (Roberts & Einhorn, 11 June 2001). Despite the gloom, the economy of Chinese Taipei is expected to rebound to a positive growth rate, stimulated by a recovery in exports in 2002 (Toida et al, 2001).

Having a GDP of US$165 billion in 1998, Hong Kong is the world's freest economy with few tariffs or non-tariff barriers. Economic policy is based primarily on minimal interference with market forces. Hong Kong has virtually no state-owned enterprises. Hong Kong suffered in the Asian Financial Crisis. The economy contracted by over 5 percent in 1998, with only modest growth in 1999. However, Hong Kong's economy has since recovered from the severe setback. Together with the process of corporate restructuring and downsizing seen in 2000, the economy has restored competitiveness.

However, its economy is not spared from the impact of the recent slowdown of the US and regional economies. Hong Kong faces an accelerated economic downturn, a rise in unemployment, an increase in the fiscal deficit and a delayed recovery. GDP growth is estimated to shrink to about 1% by the end of 2001; unemployment, at a 17-month high, is 5.3%. The budget deficit could run as high as $12.8 billion, or 7.5% of GDP (Hornik and Mo, 2 November 2001).

In spite of that uncertainty, Hong Kong's ability to reinvent itself remains undisputed. Hong Kong still has many prospects. The government has spent millions on a rebranding designed to push Hong Kong as a "world city." At the same time, its asset is its proximity to southern China. Although south China is developing rapidly, it still lacks the legal, financial and logistical infrastructure that only Hong Kong can provide. Moreover, the city-state has a critical mass of human capital, attracting ambitious, talented people from around the world. It remains Asia's leading container port and will be for years to come. It is still the financial capital of Asia, outstripping Tokyo and Singapore. Although, is legal system has been dented by confrontations with Beijing, its independence remains intact. More importantly, Hong Kong's almost unsentimental willingness to change will remain its key to reverse its fortunes (Apec, 2001).

Infrastructure of the Four Dragons

The telecommunications infrastructure in Singapore is one of the best in the world3. Singapore has a fully digital network, the world's highest urban concentration of optical fiber and the world's first 100 percent ISDN availability. Besides, Singapore offers the world's lowest telecommunications charges and plans for Optical-Fiber-To-The-Home by 2005 (McCelland, 1996).

In addition, Singapore ONE is promoting its 1-Net ATM (Asynchronous Transfer Mode) backbone network, which provides ATM users with a broadband Internet access. This network has reached 98 percent of homes, all schools, 42 libraries and community centers in Singapore (Lombardo, 1999).

As at end September 1999, Singapore Cable television (SCV) had about 181,000 subscribers, a penetration rate of more than 22 percent of the Singapore households. It planned to wire up 99 percent of Singapore homes and launch its commercial cable modem service by the end of 1999 (SCV News, 1999). The cable modem allows the viewers to have access to the high-speed Internet via Singapore ONE.

Like Singapore, Korean government decided to take an initiative in information infrastructure development. The government set up the Informatization Promotion Master Plan (IPMP) in June 1996, and later it was finalized as the Cyber Korea 21 project, which embodied the specific goals for Internet development in Korea March 31, 1999 (MIC, 1999). In line with the Cyber Korea 21 project, the Korean government initiated the Korean Information Infrastructure (KII) to serve as the structural basis for the project in 19954. The KII construction plan consists of three stages (Electronics and Telecommunications Research Institute [ETRI], 1999). In the first stage (1995-1997) of the plan, backbone network at 622Mbps-2.5Gbps, and the pilot ATM switching network was constructed5. In addition, 80 major cities across the nation was linked by fiber optical cables, connecting about 2.5 million subscribers to KII. Currently, in the second stage (1998-2002), backbone network is being upgraded up to several tens of Gbps class, and increase subscribers to 7.5 million. Finally, in the third stage (2003-2010), the nationwide use of advanced telecommunications network will be completed with 33 million subscribers (MIC, 1999).

There are more than 100 providers of Internet access in Hong Kong, with at least 10 of them being substantial and well-financed operations. Internet access is available throughout the SAR, with ISDN access available in most places. Broadband access is less competitive with Asynchronous Digital Subscriber Loop (ADSL) access available only through Hong Kong Telecom IMS. There has been very little development of cable broadband access, due to the licensing regime, which has tended to prevent the holders of cable service licenses from offering fixed line telecommunications services (Hong Kong Government Information Centre, Aug 2001).

The government of Chinese Taipei has sought to drive information technology through the National Information Infrastructure (NII) project, a supra-ministry endeavor that has been able to drive investment and decision making through many different ministries. The NII Steering Committee facilitates NII development through deregulating telecommunications and improving related laws. It also aims to expedite network construction through the development of network exchanges, broadband networks, and interconnection of the telecommunication and CATV networks. It aims to integrate computer and network education into all academic levels (Chang, 2001). The government is committed to extending the application of information technology, developing net-related industries, and enhancing research and development.

Method

Kang, Lee, and Chua (2000) compared the nature of B2B and B2C Internet commerce using the concept explication method. According to Donohew and Palmgreen (1981), concept explication method enables researcher to examine constructs by measuring indicators. In their study, Kang et al (2000) found that B2B and B2C Internet commerce are developed from two distinctively different constructs in the abstract levels. They argued that B2C model creates a new production space for a new industry while B2B model links the exchanges among industries (Figure).

B2C B2B

ê ê

Primary production space for industry

New production space for Internet-based industry

Links among the industries

FIG. B2C vs. B2B INTERNET COMMERCE MODEL

From two different approaches to Internet commerce, constructs in B2C and B2B model develop into very different dimensions and indicators (Table). Kang et al (2000) stated that the approach to Internet commerce determines the dominant Internet commerce model by dictating the function and purpose of Internet commerce6. Furthermore, they argued that the engine of growth differs according to its function and purpose. Earning profits through sales in consumer-oriented sector seems the most logical solution to generate or develop economy for a newly invented business. On the other hand, saving cost by restructuring in financial/logistic sector is the reasonable way to improve the current practice by increasing productivity and efficiency.

TABLE. CHARACTERISTICS OF INTERNET COMMERCE MODEL

Abstract Level	Characteristics associated with Internet Commerce	B2C Internet Commerce Model	B2B Internet Commerce Model
Construct	Approach	Production	Exchange
Dimension	Function	Inventing a new business	Improving the current business
	Purpose	Generating and developing Economy	Increasing productivity/efficiency
Indicators	The Engine of Growth	Earning profit through sales in consumer-oriented sector	Saving cost by restructuring in financial/logistics sectors

Through the concept explication of two constructs, namely "production" and "exchange," they concluded that examining the engine of growth would reveal the direction of Internet commerce of the countries.

However, this model could be limited to Asian countries with "directed capitalism" where a strong executive-centered government uses its heavy hand on economy within the capitalistic framework. Unlike the U.S. where the market decides the direction of Internet commerce by itself, Asian countries would select better approach between the two models, and plan out the follow-up policy accordingly. Their selections are demonstrated in their approaches to Internet commerce.

Internet Commerce in Singapore, Chinese Taipei, Hong Kong and Korea

With the vast penetration of the Internet in Korea, Internet commerce has taken a prominent position as a new economic activity. E-commerce in Korea grew from 55 billion won (USD 50 million) in 1998 to 150 billion won (USD 136.6 million) in 1999. It is expected to skyrocket to 3.78 trillion won (USD 3.43 billion) in 2002. Over 75 percent of businesses are expected to take advantage of e-commerce in 2002 (Jung, G., 1999). Currently, the Korean E-commerce is heavily leaned toward B2C segment of E-commerce.

In banking, 10 major banks in Korea started Internet banking as of August 1999. These banks are gathered in a virtual city called "Bank Town," offering the same services as they do in their offices except for loans (Song, 1999). While individual consumer transactions are in progress, business transactions are not offered, yet. In other financial markets, Korean securities companies started providing the cyber trading along with their conventional trading in 1998. As soon as securities companies began cyber trading services, they recorded a very rapid growth from 4.7 percent of total trading in January 1999 to 16.8 percent in June. On January 2000, two cyber trading companies--Future Asset Co., and Trade Korea Co.--were established. With cheaper transaction cost, cyber trading market is expected to continue to grow. More companies are expected to join the bandwagon (Kim, 2000).

In other area, Internet auctions are on the rise. Currently, there are 11 auction sites in Korea. The Internet Auction, Inc., the biggest Internet auctions company in Korea, has US$5 million transactions in a year with 30,000 members. About 700 bids are made every day for 35,000 merchandise items. Jaeyoon Kim, chief researcher in the Samsung Economy Research Institute said Internet auctions will lead e-commerce (Yu, 1999a).

At present, however, it is Internet shopping that is leading the Korean e-commerce market. It is also the fastest growing market in Korea. In 1998, 25 billion Korean won (USD 22.7 million) in sales were made. But in the first half of 1999, sales were already 27 billion Korean won (USD 24.5 million). The number of Internet shopping malls grew from 400 in 1998 to 800 in June 1999 (Ham, 1999). Online shopping malls became so popular that even a shopping-aid web site appeared. Of the total sales, online department stores account for the largest portion of 13.7 billion Korean Won (USD 12.5 million)7. Specialized shopping malls are also on the rise. More than 40 bookstores went online since the first Internet bookstore, Jongro Bookstore, opened on 1 May 1997. Gyobo Bookstore, the biggest online bookstore in Korea, has about US$670,000 sales monthly that comprise about 10 percent of the total sales of the day. Youngjo Lee, director of Gyobo, estimates that the Internet sale will reach up to 30-50 percent by 2001 (Sin, 1999). The consumer oriented E-commerce is growing so rapidly that some of the on-line business is making conventional business obsolete. For example, cyber travel agencies are expected to take over the market from the conventional ones with a cost-effective management and ability to customize service around the clock in partnership with hotels, airline companies and other tour services (Choe, 1999).

On the other hand, Internet commerce in Singapore takes a somewhat different direction. When it comes to Internet development, business and economics are always the major concerns of both the government and private sectors in Singapore. Helping local enterprises harness the opportunities in Internet commerce has become one of the Singapore government's top priorities for the present being.

Unlike South Korea, B2B segment of Internet commerce far outstrips B2C segment in Singapore. When it comes to promoting Internet commerce, Singapore government serves B2B segment as the backbone. Even the private sector is more active partying in the B2B Internet commerce than in the B2C segment

(Chua, 1998).

Wong & Lam (1999) said that "B2B E-commerce constitutes the predominant form of transaction compared to B2C transactions, with 98% of sales being derived from B2B."

The industry stakeholders also cited B2B commerce as the pillar for Internet commerce growth, for fundamental business reasons that a growing company in a liberalizing competitive market cannot afford not to participation in virtual supply chains and electronic market places (Lee, 2001). According to the Singapore Electronic Commerce Survey 2000 (IDA, 2001), the total value of B2B commerce revenues have more than doubled from S$40 billion in 1999 to reach an estimated S$92 billion in 2000, translated into an increase of 130%. The e-commerce supporting services comprise mainly network services, e-commerce solutions, security services, payment services, search engines, web advertising, etc.

It is believed that Internet commerce in Singapore is going to grow tremendously due to the improved technology, security and the government's push. Most large enterprises have favorable attitudes toward the government's push because e-commerce translates into potentially big savings as they simplify and expedite the transaction process. The development of B2B Internet commerce in Singapore is therefore quite smooth.

In a survey conducted by National University of Singapore's Center For Management Of Innovation & Technopreneurship, about 9 percent of Singapore companies had involved in B2B e-commerce activities. This figure showed that Singapore companies adopted e-commerce faster than the most Internet-advanced countries such as the United States (5 percent), Ireland (5 percent) and France (4 percent) (Leong, 1999). The study also indicated that 73 percent of Singapore companies have Internet accounts and one in three companies has its own website. Despite the Singapore government 's efforts to encourage the small and medium enterprises to harness the power of Internet, the government-linked companies and the multinational companies remain the major parties that dominate the local e-commerce development for the present (Lee, 2001).

Leaders in local e-commerce on the Internet are electronics, chemicals and publishing industries. The top reason companies gave for their entry into Internet commerce was the positive image and reputation associates with being in the forefront of technology (Leong, 1999).

On the contrary, B2C Internet commerce is still in its infancy in Singapore. Most online merchants in Singapore are still concentrating on providing basic information and selling products. Not many actually use the Internet to manage customer relationships. The survey by IDA reveals that total B2C commerce revenues stand at S$1.17 billion in 2000 as compared to B2B's of S$92 billion (IDA, 2001).

Compared with the recent booming E-commerce in other countries, E-marketplace is still at the initial stage in Chinese Taipei. It is only three years since the concept of E-commerce was introduced in Chinese Taipei and the number of companies actually engaged in E-commerce is still small. Therefore, it is too early to judge which ones will do well since the whole business environment is not very clear yet. However, what can be ensured is that these E-commerce companies must not only focus on how to expand their revenue but also how to create their value in order to ensure their longevity.

Despite the government and Internet related firms' aggressive promotion of E-commerce, B2C commerce in Chinese Taipei has plenty of room for improvement. According to the NUA Survey (2001), the number of Chinese Taipei's online shoppers has increased over the past year and is now estimated to be at about 1.4 million. Although 61% of Chinese Taipei's net users claimed to be willing to shop on the Internet, only 14% have done that. Net users aged over 25 forms the bulk of online shoppers and the older the surfer, the bigger the spender he or she is likely to be. A recent survey by the government shows that most people are concerned with online transaction security and privacy issues.

Recently, Chinese Taipei has adopted the Japanese B2C E-commerce distribution system - picking up orders and complete the transaction at local 7-11s or other convenience stores. As the number of Chinese Taipei net users and their online experience increase, so will B2C E-commerce (Chang, 2000).

B2B E-commerce is being more rapidly adopted in Chinese Taipei than B2C; this can be partly explained by the vibrant manufacturing sector. The leadership of the electronic manufacturing industry, in particular, has actively embraced information technology, including recently the use of enterprise resource planning (ERP) software. The multinational corporations (MNCs) have driven some of this acceptance. Intel, for example, takes 80% of its orders in Chinese Taipei from distributors placing orders through a Web-based system. The use of Web-based ordering, however, is not yet pervasive among Chinese Taipei distributors taking orders from end-user manufacturers. A plausible reason is that the dot.com crash has left an indelible mark on many in the country, resulting in a more cautious attitude towards B2C commerce and a slightly higher trust in the B2B segment. This is especially so when the public opinion is that B2B business model is sturdier than that for B2C. Moreover, the increase in cross-straits business transactions will further strengthen the B2B commerce component.

Hong Kong's unique free economy, unlike its counterparts, has brought it an advantage of a wide spectrum of B2B and B2C activities. The value of Hong Kong's products and services transacted over the Internet is expected to top US$2.4 billion by 2003, compared with US$60 million in 1998.

The number of B2B and B2C companies in Hong Kong had its genesis in the Stock Exchange. When the economy recovered in 1999, the Stock Exchange branched out with its GEM (Growth Equity Market) and a rash of start-ups launched IPOs or sourced venture capital funding to take advantage of dot.com mania. However, in mid-2000 most of the 1999 listings were below their offer price, and a queue of aborted IPOs rapidly running out of cash. Still, the rounds of Internet development have left Hong Kong with a wide range of established Internet firms that run the gamut of B2C, B2B, WAP and infrastructure companies.

It is expected that B2B will take the lead in Hong Kong's e-commerce developments, despite the plethora of e-commerce companies. B2B's lead emerges primarily because of Hong Kong's economic foundation as a financial and logistics hub. According to a survey by eMarketer, the overall figures for Hong Kong's e-commerce industry look promising, but online retailers are performing poorly. Hong Kong's estimated 1.2 million Internet users is estimated to spend US$601 million online in 2001. Of which, 90 percent of this total will be spent in the B2B sector and a smaller proportion of 10% on the B2C sector (Dilenge, 2000).

This relatively low B2C transaction is mainly because of its banks' inertia in equipping themselves with Internet payment processing systems as well as its demographic and cultural make-up. In the urban, densely populated environment of Hong Kong, retail shops are within easy reach of most web users, so the consumers are not enticed by the convenience of web shopping. However, the outlook for Hong Kong's B2C sector is not as bleak as envisioned. With speculation and bargain-hunting as part of the national psyche, Hong Kong is a lucrative market for online brokerage firms and auction sites.

Each country's focus on Internet commerce is quite clear. The next section will explain why each country has directed Internet commerce in certain way.

Explanations

Purpose and Function

The first explanation can be made examining whether the purpose and the function of nurturing B2C/B2B segment match the goal of future economic progress. In the summer 1997, the financial crisis that struck the economies of Thailand and Indonesia began to spread through Asia. On October 1997, Korean Stock Plunge followed by a sharp fall of the Korean Won against dollar. By November 21, Korea's foreign reserves were nearly depleted, and to prevent total collapse of the economy, the government seek for an emergency loan from the International Monetary Fund (IMF). Through a series of decisive government policy, the economy has stabilized within a year. However, economy has slowed down with two problems for Korean government. The first problem is rising unemployment rate. As a part of the structural reforms in the economy, labor market that used to be rigid and secure became flexible and contract-based. Just in nine months, unemployment rate jumped from 2.6 percent to 7.6 percent, and is expected to increase further (A Handbook of Korea, 1998).

The second problem is overall slowdown of Korean domestic economy. Since the mid-1980s, domestic market steadily started to increase as export market became tougher8. By mid-1990s, most major exporting products including automobile, camera, general machinery, consumer electronics, computers, semiconductor, and telecommunications equipment was relying on domestic market for 30-50 percent of their total sales (A Handbook of Korea, 1998). When economic slowed down decreased domestic demands, major industries in Korea suffered substantial losses9. Even after the economy stabilized, the domestic demand is still sluggish. Therefore, the E-commerce in Korea had to reflect two immediate economic concerns for Korean government. In fact, the Cyber Korea 21 which represents the government's views on E-commerce writes that Korea will use E-commerce to create new business to pull itself out of the current economic crisis and to create jobs to ease the unemployment pressure. To Korean government, the purpose and the function of B2C E-commerce is better suited for recent economic concerns in Korea.

Singapore suffered a significant loss from economic slowdown as well. In 1997, the Committee on Singapore's Competitiveness (CSC) was formed to re-examine Singapore's competitiveness in light of the external changes during the economic downturn (Economic Development Board, Singapore, 1999).

The CSC concluded that, as a knowledge-based economy, Singapore is supposed to have a strong entrepreneurial base. In addition, companies operating in Singapore should be able to leverage on a cost-competitive motivated workforce. Therefore, one of the major suggestions the CSC came out was to "reduce the business costs, to help viable companies tide over the crisis..." (Economic Development Board, Singapore, 1999).

Viewing from the way Singapore government faced the economic crisis and solved the problems, one can realize that the "exchange" is actually the guiding philosophy behind the economic structure. In other words, its major function is to improve the current business and economic situation, with a purpose to increase productivity and efficiency.

From the same report, the CSC recommended a $10 billion package reduction of Singapore's business costs per year. This includes reduction in total wage costs, the levy for foreign workers in the manufacturing and services sectors, factory rentals, charges for services, etc. Improving the current businesses and cutting cost were two major issues then.

Also, formation of the CSC and its recommendations reflect how Singapore emphasizes on business sector, instead of the consumer's side.

The Chinese Taipei government, in recognition of its later entry to the Internet commerce sector, has identified Chinese Taipei's strengths to lie in IT hardware production, semiconductors, supply-chain management. It has hence taken aggressive steps to develop its B2B segment as a natural extension of the country's competitive advantage and foster electronic business methods and implement programs to assist Chinese Taipeiese businesses to deploy such technology. It is hoped that the development of B2B segment would provide a short-cut for the country to be ready for the quantum leap into the new era of Internet economy and make up for lost time.

Hong Kong, having a freer economy, is a more unique case. With the Growth Equity market in 1999 launching a plethora of B2B and B2C companies, the SAR has no lack of choices. While the government has taken active steps to create a conducive environment for Internet commerce to take place, it did not appear to favour either the development of B2B or B2C. One of the most important comparative advantages of Hong Kong is knowledge of the Chinese market. Hong Kong's other ace may be its sophisticated financial sector, which will surely continue to attract international companies planning an entry into the emerging Chinese market. However, as Hong Kong banks have been slow to equip themselves with Internet payment processing systems, B2C commerce is somewhat impeded.

Relation to Conventional structure

Every economy has its own characteristics. Its rate of growth, composition, consistency, and success would be different from other economies. However, most countries share a similarity: serving their existing industries as the top priority in their economic development blueprint.

Many countries have fallen into economic distress simply because development of their existing primary industries has slowed down. Many countries tend to create an effective environment that fosters the growth and prosperity of existing industries because the expansion and retention of conventional industries is proven to be very important components of economic development (Fruth, 1998).

The Internet commerce can never be created in vacuum. Its development is closely linked with the conventional industry as well. It is found that the conventional structure has its own significance when Singapore and South Korea develop their Internet commerce models.

Finance and business services is the major sector that contributes to the Singapore's GDP. In 1998, it accounted for 29.2 percent of the GDP pie, with manufacturing at 21.9 percent, commerce at 18.8 percent (Ministry of Trade & Industry, Singapore, 1999). When the economic crisis hit the country, one of its major solutions was to help the manufacturing and services sectors cut cost.

The Singapore EDB (1999) launched its economic blueprint for the 21st century, namely Industry 21, which aims to develop Singapore into a global hub of knowledge-driven industries. Under I 21, the manufacturing and services sectors will be developed with a strong emphasis on technology, innovation and capabilities. The blueprint encourages the local SMEs to embrace more knowledge-intensive activities, with Promising Enterprises evolving into world-class players. At the same time, it tries to attract more MNCs to anchor more of their key knowledge-intensive activities in Singapore.

The latest economic blueprint is trying to create a conducive business environment and infrastructure necessary for knowledge-driven activities among companies. Once again, it shows that Singapore government emphasizes on the B2B when it comes to the strategies to the overall economic development.

In addition, Singapore is highly open to international trade and investment. In 1998, the ratio of trade to GDP is 250 percent, with foreign investment commitments in the manufacturing sector amounted to US$3.1 billion (MTI, 1999) Singapore's regulatory system has been promoting a stable financial and banking system to attract international enterprises to conduct business in Singapore (Monetary Authority of Singapore, 1999).

However, Singapore is doing relatively less on B2C when it comes to providing friendly e-commerce environment. For example, the Monetary Authority of Singapore (MAS) said it will not lower the minimum qualifying income for individual credit card application. The minimum income requirement was raised from S$24,000 (about $ 14000) to $30,000 (US$17650) per annum in 1991 (Chan, 1999). Consumer online transactions are basically credit card-based.

The recent years, Singapore has gained vision of becoming an early adopter of Information Technology (IT) and innovators of IT applications in order to remain competitive in the international arena. The government has started a major push to develop a strong local science and technology base to support both the manufacturing and business services industries (Economic Development Board, 1999). Once again, Singapore shows that it is more comfortable restructuring the conventional industry and help it take flight (Economic Development Board, 1999). Unlike Singapore, the main structure of Korean economic structure was built for manufacturing goods and exporting them. In the 1960s, the government's focus was on building a labor-intensive industry such as Textile, Clothing and Footwear (TCF)10. In 1970s, Korea concentrated on the heavy and chemical industries (HCI). Korea enjoyed a steep growth at first, but start to accumulate external debt at a very rapid pace under the second oil crisis11. Korea Steel had external debt of approximately US$ 530 million which were equivalent to 1.4% of Korea's GNP in 1980. Korean government had to make a dramatic shift in its economic policies under the pressure of economic break down--mainly due to the trade deficit and a failure in its heavy industry orientation (Park, Hwang, and Yoon, 1997)12.

Seeking more efficient and less energy-consuming industries, the Korean government shifted its industrial policy focus from heavy industry to consumer electronics starting 1980. By 1983, local electronic company Samsung and Goldstar started to produce VCR and color TV. About ten years later, Korea became the largest manufacturer of color television, VCR, and satellite television receivers (Larson, 1995). The policy shift changed the focus of the manufacturing industry from HCI to consumer-oriented industry. Currently, Korea's primary production is consumer goods using high and low technology. TCF, automobile, consumer electronics, computers and peripherals consists more than 60% of total exports (A Handbook of Korea, 1998).

Chinese Taipei has been extremely successful in building up a hardware-based high technology industry. It makes up for US$50 billion of exports. Thus, Chinese Taipei's strength in hardware manufacturing, production and operational management, supply chain management has made B2B a natural focus for the government. Both the B2B and B2C segments are however in its infancy in comparison to Singapore, Korea and Hong Kong.

Despite its relatively later entry, the Chinese Taipei Executive Yuan and Ministry of Economic Affairs have taken aggressive steps to foster electronic business methods and have implemented programs to assist Chinese Taipei businesses in deploying facilitating technologies. One of which the Plans creates incentives for leading international IT firms to cooperate with their Chinese Taipei suppliers to establish supply-chain systems (Reuters, 2000).

In addition, the Chinese Taipei authorities are moving forward in deploying on-line public procurement and payment systems for selected types of projects. Besides enhancing efficiencies in the area of public procurement, this is designed to encourage SMEs to develop their e-business capabilities. Ultimately the authorities have a long range plan to establish at least 200 on-line business networks connecting over 50,000 firms island-wide.

As the volume of web-based activities have increased in Chinese Taipei, the number of firms involved in electronic commerce has increased. In 1998, the number totaled 3,000, with transactions estimated at NT$46 billion (USD1:4 billion) and consisting primarily of on-line cataloguing. This grew to 10,000 firms in 1999 with transactions reaching an estimated NT$79 billion. The sophistication of on-line applications has advanced as supply chain management and enterprise resource planning solutions have taken hold. Industry experts predict that the number of Chinese Taipei firms employing electronic commerce methods will double by 2002. This will be partly bolstered by increasing cross-straits business transactions and cooperation (Chang, 2000).

Chinese Taipei's B2C emerges somewhat as a serendipity to its developments on B2B Internet commerce and its increasingly affluent consumers (per capita GDP exceeds USD13,000). These consumers increasingly use the Internet to conduct on-line securities trading and banking and to purchase books, computer hardware and software, electronics, health care items, movie and theater tickets and airline tickets. Though the government did promote B2C as much as it did for B2B commerce, Chinese Taipei's non-profit Institute for Information Industry (III) predicts that Chinese Taipei shoppers will purchase NT$3.67 billion (USD114.68 million) worth of goods online this year and NT$8.19 billion (USD255.94 million) worth of goods in 2002. Online purchases in 1999 totaled NT$1.63 billion (USD50.94 million) (Chang, 2000).

Hong Kong has world-class financial services to offer in the off-line world and it is looking into this natural advantage as an extension into the online arena. Despite its relatively rudimentary online banking facilities, there are a number of financial portals in Hong Kong offering share-dealing and investment services. This appears to be an area of potential high growth. Whatever Hong Kong does, major global brokerages will offer on-line trading in all important types of global security to Asian investors. The large retail financial services groups view Hong Kong as a high-potential market. The perception of global players at present is that Hong Kong is a market rather than a source of advanced Internet facilities, and it is not clear that the SAR is undertaking initiatives that might change this, bar the Cyberport (Tradeport, 2000).

Over 90 percent of Hong Kong's businesses are small businesses. Almost all are family owned. Hong Kong businesses are masters at building highly flexible supply networks that allow them to produce goods better, faster, and cheaper than anyone else in the world. Though information technology such as the phone, fax, and e-mail are indispensable to these networks, many Hong Kong businesses have been slow to invest in more advanced technologies, such as EDI and ERP. These also form barriers to B2B commerce in the SAR. However, with the aggressive push by the government through the provision of a conducive environment and attracting renowned Multinational Companies to set up base, B2B commerce in the SAR look set to develop.

Conclusions

In this paper, the B2B and B2C models proposed by Kang, Lee & Chua (2000) are used to examine the Internet commerce development of Singapore, Hong Kong, Chinese Taipei and South Korea. It is found that these countries develops different Internet commerce models: The Internet commerce in South Korea are inclined to B2C model, whereas, Singapore, Chinese Taipei and to a smaller extent, Hong Kong tend towards the B2B model. The reasons behind it could be elaborated in terms of function and purpose. Korea economics tends to invent new businesses, as well as generate and develop economy.

Meanwhile, Singapore and Chinese Taipei tries to improve its current industries by increasing productivity and efficiency. In particular, Chinese Taipei, being a relatively late entrant with strengths in hardware manufacturing, production and operational management, supply chain management, sees B2B as a natural online extension. Hong Kong is a laissez-faire economy which government is concerned with building a conducive environment to attract MNCs and local companies as well as to develop the e-economy. Hence it did not particularly favour B2B or B2C. However, its natural strengths as a financial hub somehow means that developments occur in this field. Moreover, Hong Kong, Chinese Taipei and Singapore, reeling after the dor.com crash, have developed more cautious attitudes towards B2C developments.

Within these three countries, the market has become less enthusiastic about start-ups selling goods and services direct to consumers and more enthusiastic about Internet companies offering business-to-business services. The business model for B2B appears sturdier than B2C. This is especially so when B2C commerce is still confronted by security, trust. This is compounded by cross-national transactions where there are barriers of language and currency.

B2B e-commerce, on the other hand, is a natural extension of existing business practices. IT is ubiquitous in the modern office and using the Internet is cheaper and easier than many of the systems it has replaced. Managers who see cost benefits in using the web can insist that their employees use it. This is far easier than persuading consumers to change the mindset habits.

One of the important implications of this paper is that each and every country should develop its own Internet commerce model in light of its current economic development and structure. No Internet commerce model is completely applicable to all countries. What may work well for one country may fail or be inappropriate for another.

It is believed that how Singapore, Chinese Taipei, Hong Kong and South Korea developed their Internet commerce model can serve as a very useful reference for other Asian countries that were currently developing their own Internet commerce frameworks.

Endnotes

1. There are numerous definitions of E-commerce. Although Internet accounts for most e-commerce activities, it is not the only platform for e-commerce activities. To differentiate, the term "Internet commerce" is used in this paper, meaning "e-commerce on the Internet." Basically, the Internet commerce activities can be grouped into 2 main categories: (1) Internet commerce transactions: Business-to-business (B2B) and Business-to-consumer (B2C) transactions. (2) Internet Commerce supporting services: Network services, e-commerce package solution, security services, payment services, web advertising, etc. (Wong & Lam, 1999).
2. The dramatic transformation of the Korean economy is particularly striking against the backdrop of the country's history. Since the era of Japan's colonial rule (1910-1945) and The Korean War (1950-1953), Korea was under extreme poverty and a rapidly expanding, largely unemployed, population until 1961.
3. Currently, Singapore has a 45 Mbps direct Internet connection to the US Internet backbone. This will definitely increase since the major Internet Service Providers in Singapore are going to improve their connection bandwidth via satellite links. The Singapore Telecom Internet eXchange (STIX) is

an Asian Internet center that connects to more than 15 countries in the Asia-Pacific Rim. Armed with 34 Mbps link via sub-marine optical fiber and satellite to the Asia Pacific region, US as well as European Internet backbone, STIX promises to provide faster and better Internet access service for Internet Service Providers and corporate users (E-Commerce Singapore, 1999).

4. The KII has a physical national backbone network, but two conceptually different networks. One is the government network, which wires public institutions including government offices, research institutes, and universities. The other is a public network, which connects homes and offices to the government network.
5. In order to help the general public and industry gain a better understanding of the KII, pilot projects were carried out under a two-stage plan between 1995 and 2002. In the first stage of the pilot project (1995-1997), fiber-optic cables were run to homes and offices to deliver video and information services in Taedok Science Town. In the second stage (1998-2002), distribution of the existing cable networks will be expanded to other cities (ETRI, 1997).
6. Kang and Lee stated that the values in constructs, dimensions, and indicators are not mutually exclusive.
7. The Lotte Department Store, nation's largest retailer and the first the Internet shipping mall, posted 1.85 billion won (USD 1.68 million) in revenue, a whopping 728 percent increase from previous year's 254 million Korean Won (USD 231,000). The Hyundai Department Store estimates 1.5 billion Korean Won (USD 1.36 million) sales, while the Sinsege Department Store expects about double figure from last year's 1 billion Korean Won (USD 900,000).
8. Since the 1960s, government has provided many export-promotion incentives such as tax exemption, tariff exemptions on materials imports used for export production, and creating funds for export industry. Also wealth accumulation through export expansion was admired and encouraged, while wealth accumulation through production activities aimed for only domestic consumption was despised. This notion began to change when exports faced barriers in 1980s.
9. General machinery were down 12.2 %, precision industry such as camera were down 7.6%; and consumer electronics were down 5%.
10. Although TCF (textiles, clothing and footwear) industries in manufacturing value added (MVA) declined, they are still a major activity which comprises about 24% of total exports (Asia Pacific Economics Group [APEG], 1994).
11. Starting 1980 worldwide demand for its exports began to shrink. Trade deficit reached 530 million US dollars, and for the first time, economy had negative 5.2% growth. Internally, warehouse price index (WPI) rose 42.2% and consumer price index (CPI) rose 32.2%. The worst harvest of that year forced Korea to import rice.
12. Iron and steels that once lead the export in the 1970s now takes up less than 3% of the total exports. However, automobile filled in the place of HCI and make up about 17% of current total export.

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back to index

Abstract

The B2B and B2C Internet Commerce Model proposed by Kang, Lee & Chua (2000) is used to examine the Internet commerce development of the four Dragons - Singapore, Hong Kong, Chinese Taipei and South Korea. It is found that two different Internet commerce models emerge in these countries: The Internet commerce in South Korea are inclined to B2C model, whereas, Singapore, Chinese Taipei and to a lesser extent, Hong Kong tend towards the B2B model. This paper is an attempt to explain why and how these countries have evolved their own Internet commerce models from the economic development perspective.

back to index

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back to index

Paul T. Walters

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back to index

Country / Region

Wednesday, 16 January 2002
1600–1730
South Pacific III - IV

W.3.3 Oceania

Chair:
RICHARD BARBER, Adjunct Fellow, East West Center, *USA*

W.3.3.1 Distance Education, Learning and Telehealth Applications Partnerships and Networks in the Pacific Islands Region: Lessons for Regional and Global Networking

NORMAN OKAMURA, Faculty Specialist and CHRISTINA HIGA, Director of PEACESAT, Telecommunications and Information Policy Group, Social Science Research Institute, University of Hawaii, *USA*

W.3.3.2 The Asian Development Bank's Strategy for ICT in the Pacific (View Abstract) (PowerPoint Presentation)

PATRICK Y. JULIEN, Executive Director and Chief Operating Officer, COL international, *Canada*

back to sessions

Abstract

The Asian Development Bank (ADB) is instigating a strategy for its Information, Communications and Telecommunications (ICT) Technology investments in the Pacific Member Developing Countries (PDMCs). In order to accomplish this, it is undertaking a comprehensive analysis of the ITC readiness of member countries, and of the region generally. The methodology includes mapping activities and interests of all regional stakeholders, and engaging in a policy of inclusion to stimulate complementarities, participation and ownership in the development process by NGOs, national governments, the private sector, academia, key agencies, and other donors. In addition to in-country visits, the ADB team will participate in several regional events to assess the progress in each PDMC's evolution towards implementation of appropriate policy and regulatory frameworks, to meet and familiarize senior officials with the benefits of ICT, and to identify priorities over the next few years in such critical fields as education, health, governance, community development, e-commerce, emergency preparedness and general public access to timely and useful information. Among the expected outcomes of this initiative are a report on the state of ICT development in the region, a major workshop or conference to be co-sponsored with regional stakeholders, a regional ICT policy for the Bank, and a set of pilot or demonstration projects in selected countries. In addition, it is expected that a number of bankable projects will be identified and explored for bank financing.

The author describes the process and invites participation in the process by key regional stakeholders.

back to index

Patrick Y. Julien

Mr. Julien is currently Executive Director and Chief Operating Officer of COL International, an affiliate of The Commonwealth of Learning (COL), an international organisation dedicated to the application of appropriate technologies, human resources, skills and learning instruments to promote full access to knowledge in developing countries. Created by the Commonwealth Heads of Government in 1988, COL is one of only two international organisations headquartered in Canada.

In this capacity, Mr. Julien manages the Executing Agency portfolio of COL which develops, competes for, delivers, and supports turnkey projects funded by international financial institutions (the World Bank, Asian Development Bank, CIDA, Banque Africaine de Développement, Caribbean Development Bank, Islamic Fund, etc.) private capital, and government programmes across the world.

Mr Julien previously held the position of Director, International Development, for Communications and Information Technologies, with the Canadian Department of Industry. In this capacity, he was responsible for Canada's sectoral relationships with foreign countries, with ITU and UN development operations, and with International Financial Institutions (IFIs). His group was also accountable for bilateral MOUs negotiated with several foreign governments, and it administered significant telecommunications co-operation budgets funded by international donors organisations and financial agencies.

In previous positions, Mr. Julien was the Director of International Marketing Operations for the Department of Communications (DOC), and Head of Corporate and Financial Policy in the Telecommunications Policy Branch of DOC. He has also held a number of private sector positions, including corporate directorships, and senior management situations in finance and banking in Canada.

Mr. Julien has participated as a keynote speaker at a number of international events, such as the Telecom quadrennial series in Geneva, World Broadcasting in Amsterdam, the CTO Annual Conference in Port of Spain, and Telkom in Pretoria. He has also published a number of articles on economic issues in telecommunications and broadcasting.

He holds an MBA (Corporate Finance and International Marketing) from Université de Sherbrooke, and has completed specialised studies at INSEAD (Fontainebleau), and in various centres of higher learning in France, Canada, the USA, and Switzerland. He also has degrees from the University of Ottawa and the Université de Moncton. Mr. Julien has also held the position of adjunct Professor of International Marketing in the MBA Programme at the University of Ottawa.

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back to index

Technology

Wednesday, 16 January 2002
0845–1015
Coral I

W.1.4 Cable Network Architecture

Chair:
JANET HERNANDEZ, Partner, Coudert Brothers, *USA*

W.1.4.1 Capacity Expansion from the Designed Limitation of Optical Fiber Undersea Cable Systems (View Abstract)

HIDENORI TAGA, Deputy Director; TOSHIO KAWAZAWA, Manager and KOJI GOTO, Director, KDDI Submarine Cable Systems Inc., *Japan*

Presenter:
KOJI GOTO, Director, KDDI Submarine Cable Systems Inc., *Japan*

W.1.4.2 Transmission Technology for Trans-Oceanic Transmission (View Abstract)

NEAL BERGANO; HOWARD KIDORF; EKATERINA GOLOVCHENKO and MORTEN NISSOV, Tyco Telecommunications, *USA*

Presenter:
WILLIAM MARRA, Senior Managing Director, Global Network Planning & Design, Tyco Telecommunications, *USA*

W.1.4.3 New Network Architectures for Global Undersea Networks (View Abstract)

HOWARD KIDORF, Director, Services Engineering Division; WILLIAM MARRA and MATTHEW MA, Tyco Telecommunications, *USA*

Presenter:

WILLIAM MARRA, Senior Managing Director, Global Network Planning & Design, Tyco Telecommunications, *USA*

W.1.4.4 Practical Technologies for High Capacity Subsea Cables (View Abstract)

TONY FRISCH, Director, Product Marketing, Alcatel Submarine Networks, *United Kingdom*

back to sessions

Capacity Expansion from the Designed Limitation of Optical Fiber Undersea Cable Systems

H.Taga, T. Kawazawa, and K. Goto
KDDI-SCS
Japan

View Abstract

1. Introduction

Recently, wavelength division multiplexing (WDM) technology is widely deployed for the undersea optical fiber communication systems. One favorable merit of the WDM undersea cable system is a flexible upgrade. It is quite easy to increase the system capacity by adding a new signal wavelength to the system until the originally designed number of signal wavelengths. As the terrestrial terminal is designed so that it can accommodate additional signal wavelengths, it is possible to add a new signal wavelength after the system has started providing the service.

On the other hand, technological development of the undersea cable system is so rapid that the latest technology becomes out of fashion quite quickly. This implies that the number of signal wavelengths increases due to the technological advancement, but this advancement shall be applicable to increase the capacity of already installed system. In other words, the rapid progress of terminal related technologies shall make it possible to increase the transmission capacity of already installed system beyond the originally designed capacity.

In this paper, technologies to expand the capacity of WDM undersea cable system from its originally designed value are discussed based on the laboratory experiments. Both repeatered system and unrepeatered system are examined.

For the repeatered system, there are two choices to expand the system capacity. One is improvement of the terrestrial terminal, and the other one is modification of the undersea segment. For the unrepeatered system, improvement of the terrestrial terminal makes it possible to expand the system capacity. Then, the technologies to improve the performance of the terrestrial terminal are discussed for both the repeatered system and the unrepeatered system. The technology to modify the undersea segment is also discussed for the repeatered system.

2. Capacity expansion of repeatered system beyond the designed limitation

In this section, capacity expansion of the repeatered system beyond the designed limitation using the technologies to improve the terrestrial terminal and the undersea segment is discussed. At first, the technologies are explained in detail with some experimental results. Then, the possible expansion of the system capacity is discussed with an example.

2.1 Terminal technologies

There are a few technologies to improve the performance of the terrestrial terminal. Two novel technologies are explained here. The first one is novel Forward Error Correction (FEC) technology, and the second one is Vestigial Side Band (VSB) modulation technology.

2.1.1 Novel FEC technology

As there is a fundamental performance limitation due to the signal-to-noise ratio (SNR), it is quite obvious that an increment of channel numbers leads to a degradation of the optical SNR and it leads to the performance degradation. Therefore, a technology to improve the transmission performance is required for capacity expansion, and an improved FEC technology is the best choice to solve this problem, because it can be realized by matured electrical technology.

FEC technology is widely deployed in the wireless communication systems, and it is also popular in the undersea fiber communication systems. At present, a standardized FEC code is commonly used for the undersea cable systems, and this FEC is based on Reed-Solomon (255,239) code [1]. As a matter of fact, this FEC improves input BER of 1x10-4 to output BER of 1x10-13. This improvement corresponds to 5.8dB FEC coding gain excluding SNR penalty due to the bit-rate increase for FEC overhead. (FEC gain excluding SNR penalty is generally called as the net FEC gain.) Present undersea cable systems are designed to include this FEC gain in the transmission performance. Then, target of an improved FEC shall realize a few dB better net FEC gain than conventional FEC. A few dB improved FEC gain can support several tens percent expansion of the system capacity.

In order to realize such kind of improved FEC, concatenated Reed-Solomon code has been investigated [2]. The concatenation of two Reed-Solomon codes makes it possible to improve the ability of error correction, because uncorrected error of one code can be corrected by the other code. The improved FEC is generally called as Super FEC. We have developed a new FEC using Reed-Solomon (255,239) and (239,223) [3]. This novel FEC can improve input BER of 2x10-3 to output BER of 1x10-13. The net gain of this Super FEC is 7.6dB, therefore, 1.8dB improved performance is expected when this Super FEC replaces conventional FEC. Figure 1 shows a comparison of error correction characteristics of the Super FEC and the conventional FEC. As shown in the figure, the Super FEC can correct significantly higher BER than the conventional FEC.

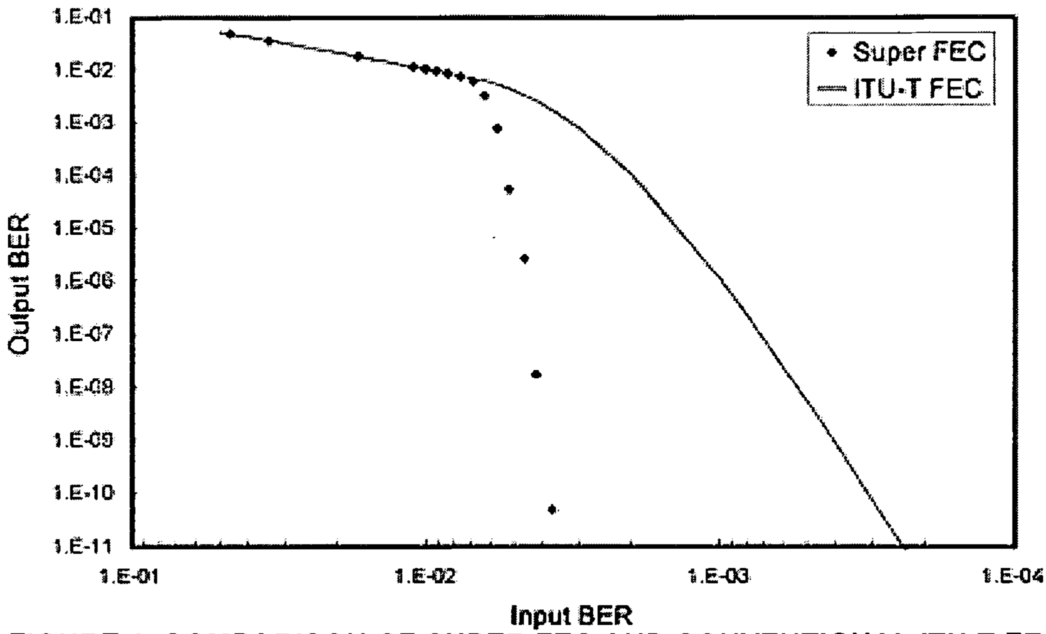

FIGURE 1. COMPARISON OF SUPER FEC AND CONVENTIONAL ITU-T FEC

2.1.2 VSB modulation technology

A technology to effectively utilize the limited bandwidth of the system is essential to expand the system capacity. In general, higher spectral efficiency is realized by adopting narrower channel separation, but it shall cause larger inter-channel interaction and cross talk. Then, a technology to combat with these difficulties is required to improve a spectral efficiency of the system.

Novel modulation scheme is developed to improve the spectral efficiency of the optical communication system [4],[5]. This scheme is called VSB modulation. A general modulation scheme has Double Side Band (DSB), and the interaction of the sideband between adjacent channels limits the spectral efficiency. As the VSB modulation has a suppressed sideband in one end, it can reduce the interaction between channels even when narrower channel separation is adopted. Figure 2 shows a comparison of optical spectrum with VSB and DSB modulation.As shown in the figure, one sideband in the VSB modulation is effectively suppressed.

It is quite easy to realize the VSB modulation. In fact, the VSB modulation can be realized by an optical filtering. One sideband is abolished by narrow bandwidth optical filter. Even though one sideband is extinguished, optical signal does not suffer any deterioration. The effectiveness of the VSB modulation scheme is validated through the laboratory experiment. The spectral efficiency is a measure to evaluate an efficiency of bandwidth utilization, and a record breaking spectral efficiency of more than 50% is realized in this experiment.

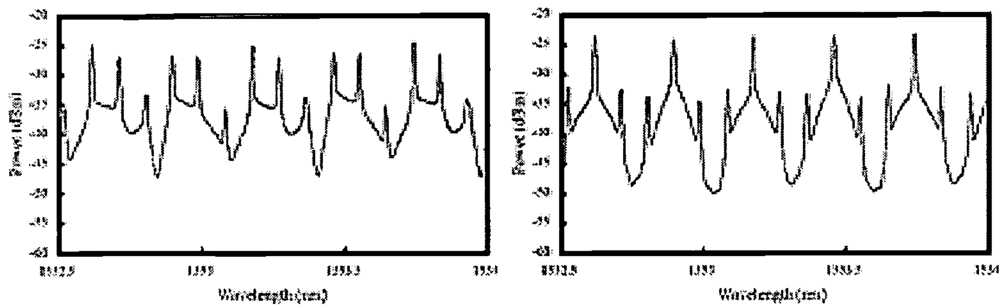

FIGURE 2. COMPARISON OF OPTICAL SPECTRUM

Figure 3 shows a schematic diagram of the experimental setup, and a recirculating loop transmission line was adopted for the experiment. At the transmitter, 200 light sources were equipped, and they were partially DFB-LDs and partially external cavity tunable lasers. Signal wavelengths of the light sources were ranged from 1535.43nm to 1565.34nm with 0.15nm channel separation. Even channels and odd channels were multiplexed independently, and two different intensity modulators modulated these signals independently. The bit-rate and the modulation pattern were 11.4Gbit/s and 223-1, respectively. This bit-rate includes overhead for the Super FEC [3]. Return-to-zero (RZ) modulation format was adopted, and VSB modulation scheme was utilized. After the modulation, even channels and odd channels were polarization multiplexed by a polarization beam combiner (PBC). The combined optical signals were fed into the optical fiber loop transmission line through an optical switch.

The optical fiber loop transmission line comprised 22 fiber spans and 24 Erbium-doped fiber amplifier (EDFA) repeaters. The average span length of the fiber was about 40km, and the total length of the loop transmission line was 840km. Each fiber span comprised enhanced effective area positive dispersion fiber (EE-PDF) and slope compensating dispersion compensation fiber (SCF). The chromatic dispersion of each fiber was +20ps/km/nm and –56ps/km/nm, respectively. The dispersion slope of each fiber was 0.06ps/km/nm2 and –0.16ps/km/nm2, respectively. The C-band EDFA repeater consisted of an EDF, a WDM coupler, two 980nm high power pump LDs, a PBC to combine pump LDs, a 10dB monitor coupler, and a gain equalization filter. The output power of each repeater was set to +16.5dBm. The 12th repeater compensated for the insertion loss of block gain equalization filters, and the 24th repeater compensated for the insertion loss of the optical switch and a 3dB coupler. At the receiver, optical signals were demultiplexed by narrow bandwidth optical band pass filters in cascade.

Figure 4 shows a summarized result of the experiment. The Q-factor is used as a measure of the transmission performance. Measured transmission performance of all 200 channels is shown in this figure. As a result, all 200 channels showed better than 9.0dB Q-factor after 9240km transmission. Average Q-factor for 200 channels was 9.9dB. In addition, less than 10-9 bit error rate (BER) could be achieved for all channels with the novel Super FEC. The dashed line in figure 4 shows a limitation of the Q-factor that implies 10-9 BER after the error correction by the Super FEC. As shown in the figure, there was more than 0.5dB Q-factor margin to achieve 10-9 BER after transmission with the Super FEC.

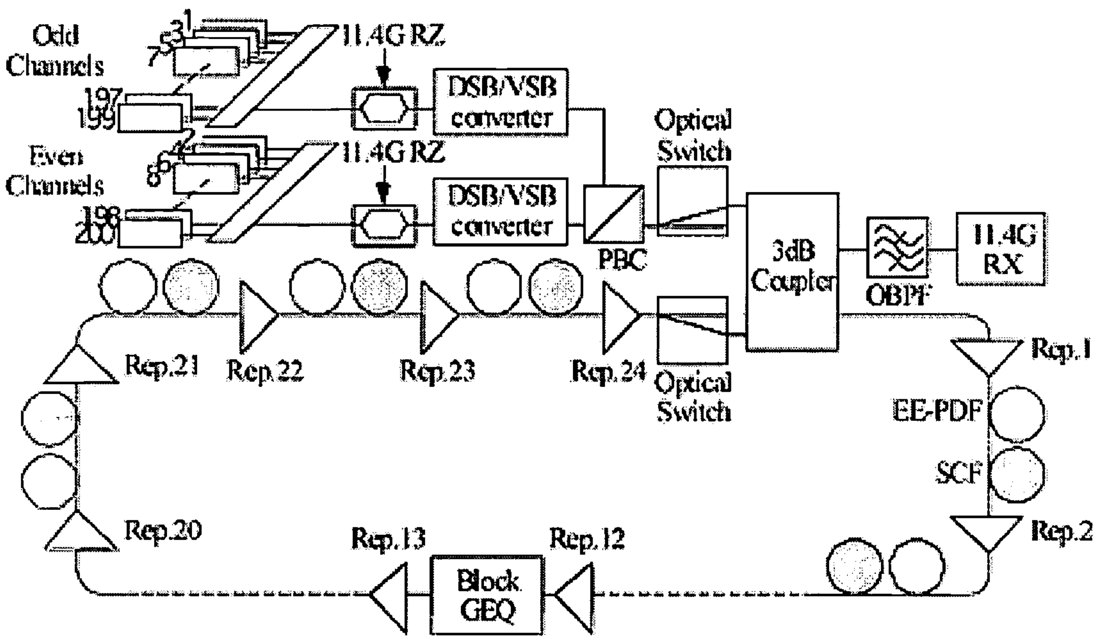

FIGURE 3. A SCHEMATIC DIAGRAM OF THE EXPERIMENTAL SETUP USING VSB MODULATION

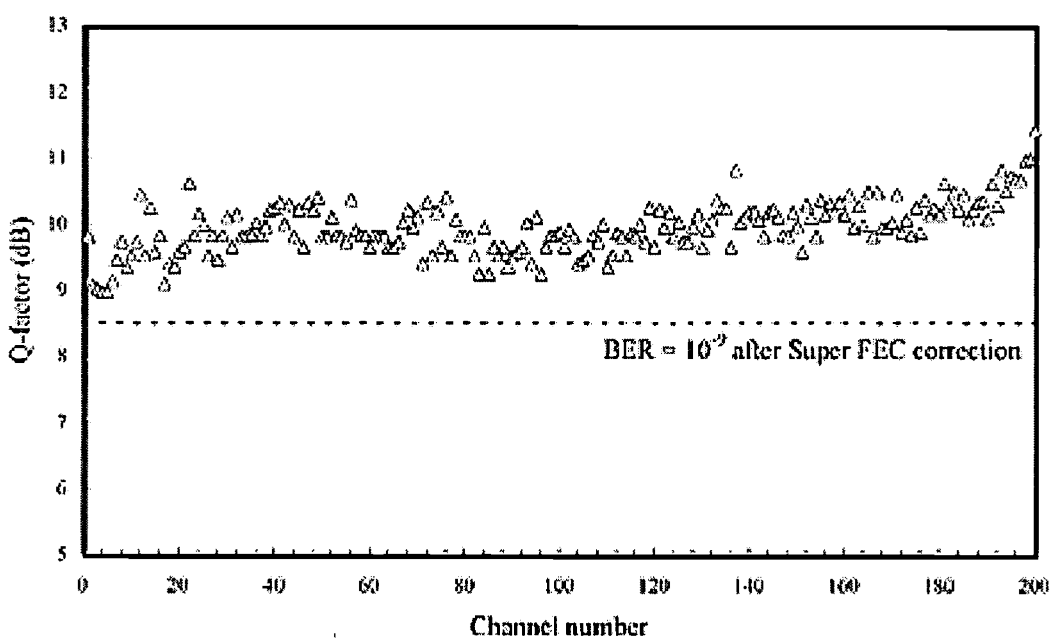

FIGURE 4. MEASURED Q-FACTOR FOR 200WDM, 9240KM TRANSMISSION EXPERIMENT

Figure 5 shows optical spectrum before and after transmission with 0.1nm resolution. As shown in the figure, optical SNR of 200WDM channels were maintained to show similar characteristic after the transmission. As the channel separation was only 0.15nm, the spectral efficiency was approached to 53%. The previous record of the spectral efficiency for the transoceanic distance was 48% using 20Gbit/s per channel [6]. We have improved this record to 53%. Therefore, the effectiveness of the VSB modulation for ultra-long haul and ultra-high spectral efficiency transmission was proved experimentally.

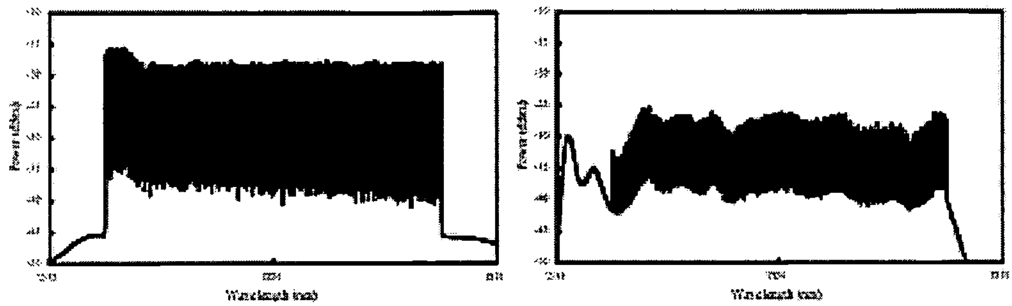

FIGURE 5. MEASURED OPTICAL SPECTRUM OF 200WDM TRANSMISSION EXPERIMENT

2.2 Technology to improve the undersea segment

In general, bandwidth of the EDFA based system is determined by the characteristic of the gain equalization filter in the EDFA repeater. It is impossible to replace the gain equalization filter in the repeater after the system was once installed. Therefore, it is quite difficult to expand the given bandwidth of the system. Even though, it might be possible to insert an additional gain equalization medium between the installed repeaters. The function of this medium is to expand the given bandwidth of the installed system. The trade-off of the insertion of the medium is a reduction of the optical SNR. Then, the possibility to expand the given bandwidth utilizing additional gain equalization unit (GEU) is investigated experimentally. A system that has less than 10nm bandwidth after the transoceanic distance is examined as an example. The major system parameters are summarized in table 1.

TABLE 1. EXPERIMENTAL SYSTEM PARAMETERS TO INVESTIGATE THE BANDWIDTH EXPANSION

Repeater output power	+9.5dBm
Repeater spacing	45km
5dB bandwidth	<10nm for over 6000km

13WDM CW signals ranging from 1541.3nm to 1556.3nm were used for the experimental investigation. Figure 6 shows a transition of the gain profile as a function of the transmission distance. Horizontal axis shows the signal wavelength, and vertical axis shows the relative signal gain from the gain peak wavelength (i.e., 1546.3nm). In figure 6, solid lines show the profile of the original system. As shown in the figure, 5dB down bandwidth of the original system is about 8nm after 8000km transmission. The signals of 1541.3nm and 1556.3nm show more than 10dB gain reduction after 4000km transmission and more than 15dB gain reduction after 8000km transmission. Therefore, these signals cannot be transmitted over 4000km. Then, additional GEU was inserted every 1000km. It has inversely proportional insertion loss to the original gain profile after 1000km transmission. Figure 7 shows the gain profile after 1000km transmission and the insertion loss of the additional GEU. The gain profile of the system was changed by the GEU, and dashed lines in figure 6 show the gain profile after inserting additional GEU. As shown in the figure, 5dB down bandwidth after 8000km transmission was expanded to more than 15nm by the additional GEU. Note that number of additional GEU was only 8 for 8000km transmission.

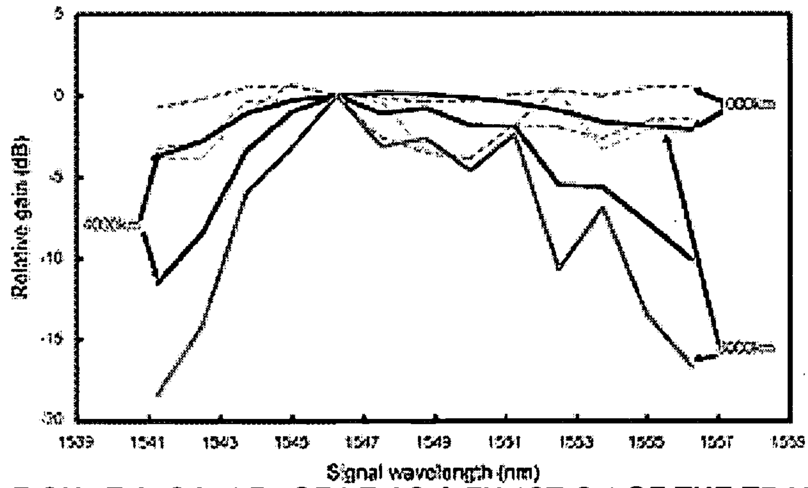

FIGURE 6. GAIN PROFILE AS A FUNCTION OF THE TRANSMISSION DISTANCE

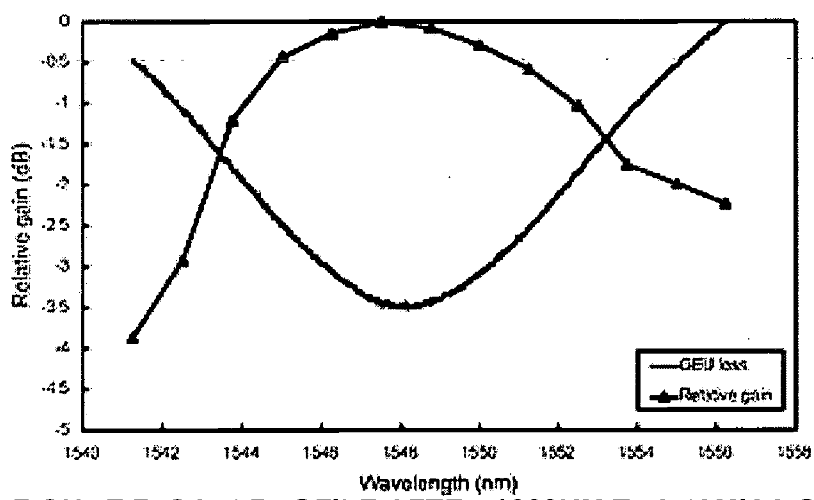

FIGURE 7. GAIN PROFILE AFTER 1000KM TRANSMISSION AND LOSS PROFILE OF ADDITIONAL GEU

Next, 5dB down bandwidth is estimated by parabolic fitting of the measured points. Figure 8 shows a transition of 5dB down bandwidth of the original system and the system with additional GEU as a function of the transmission distance. As shown in the figure, the bandwidth of both systems decreases as the transmission distance increases. Even though, the system with additional GEU shows larger bandwidth than the original system, and it has more than 15nm bandwidth even after 8000km transmission. This result shows that the additional GEU actually expands the given bandwidth of the system.

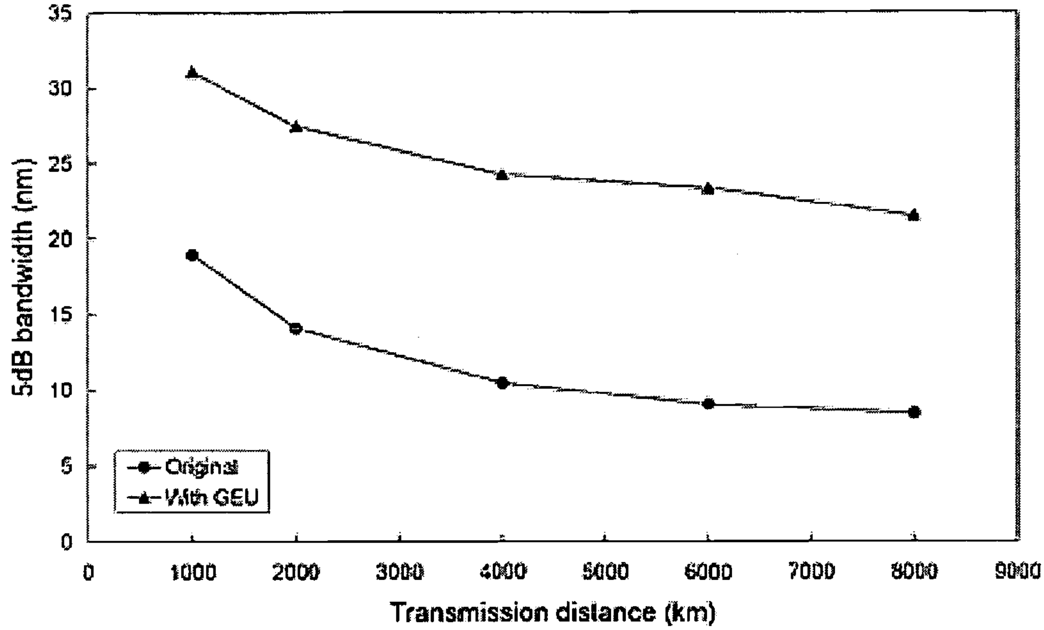

FIGURE 8. ESTIMATED 5DB GAIN BANDWIDTH AS A FUNCTION OF THE TRANSMISSION DISTANCE

Figure 9 shows a comparison of the average optical SNR of the original system and the system with additional GEU. The definition of the average optical SNR is average of individual optical SNR for 13 CW channels. As the GEU has notable insertion loss, it causes the reduction of the average optical SNR. This is the trade-off to obtain larger bandwidth of the system. Even though, as shown in figure 9, the reduction is only about 1dB after 8000km transmission, and this kind of small degradation of the optical SNR does not cause serious impact on the transmission performance. Even if this reduction will cause significant degradation of the BER performance, the improved FEC discussed in the previous section can effectively recover the BER performance. Based on these experimental results, it should be possible to expand the given bandwidth of the transoceanic distance systems by adding several GEUs in the system.

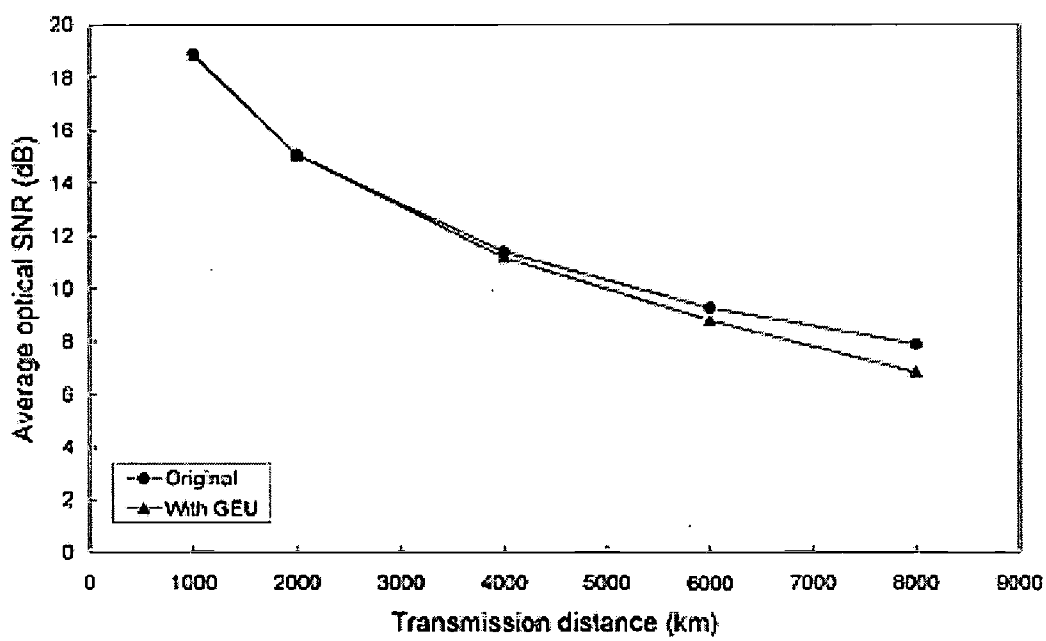

FIGURE 9. OPTICAL SNR AS A FUNCTION OF THE TRANSMISSION DISTANCE

2.3 Possible expansion of the system capacity

Capacity expansion of the repeatered system beyond the designed limitation becomes feasible by utilizing novel technologies discussed above. As the VSB can utilize the limited bandwidth of the system more than several tens percent effectively than the conventional DSB modulation, maximum number of transmissible channels shall become at least a few tens percent more than the designed number of WDM channels. On the other hand, the Super FEC has 1.8dB improved FEC gain compared to the conventional FEC. If this excess gain can be fully applied to increase the transmission capacity, about 50% capacity expansion becomes possible maintaining the same bit error rate performance. Therefore, if a system is originally designed to equip 16 signal wavelengths, the capacity of this system could be expanded to equip 24 signal wavelengths using the VSB modulation and the Super FEC. It is also possible to adopt the modification of the undersea segment instead of VSB modulation. Of course, there should be some penalty due to increased interaction between adjacent channels combined with the optical fiber nonlinearity, maximum applicable number of WDM channels shall be confirmed through a field test using the actual transmission line. Even though, the capacity expansion using these novel technologies is quite attractive, because the system designed yesterday can be renewed as the system designed today.

3. Capacity expansion of unrepeatered system beyond the designed limitation

In this section, capacity expansion of the unrepeatered system beyond the designed limitation using the technology to improve the terrestrial terminal is discussed. The key technology is Raman amplification. Then, the possible expansion of the system capacity is discussed with an example.

3.1 Terminal technology

Capacity of unrepeatered system is limited by the loss of the transmission fiber. Therefore, a technology to compensate for the loss of the fiber is required to expand the capacity of unrepeatered system. The most promising technology to resolve this issue is Raman amplification technology. As the Raman amplifier only requires Raman pump source and the transmission fiber itself acts as an amplification medium, it is quite simple and easy to implement into the actual system. Figure 10 shows capacity expansion of unrepeatered system utilizing Raman amplification, schematically. As the output power of the booster amplifier in the transmitting terminal is constant, the signal power per channel reduces as the number of WDM channel increases. The Raman amplification compensates for the reduction of the channel power effectively.

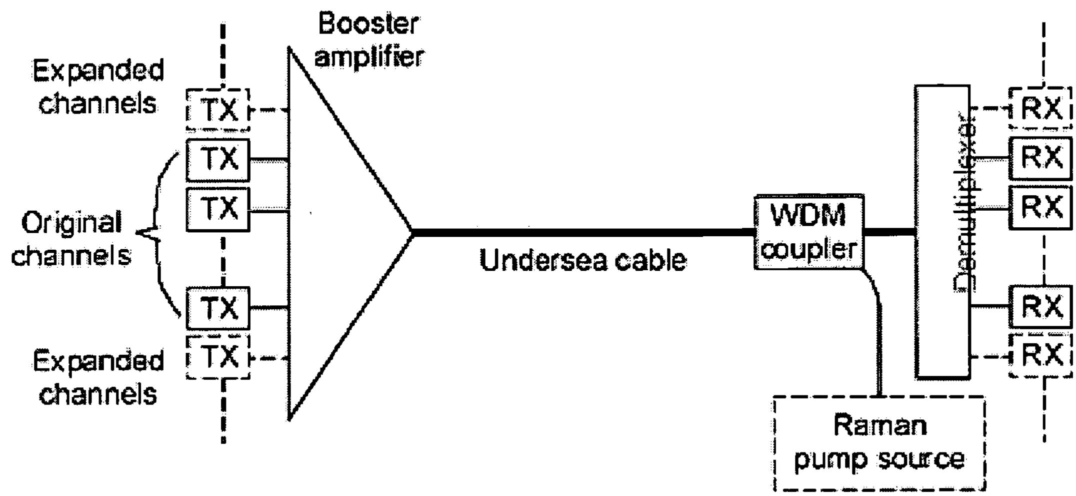

FIGURE 10. CAPACITY EXPANSION OF UNREPEATERED SYSTEM USING RAMAN AMPLIFICATION (DASHED LINES SHOW EQUIPMENT FOR CAPACITY EXPANSION)

It is possible to add the Raman pump source after the system was installed, if there is a built-in input port of the Raman pump light in the terminal. If there is such input port, the adoption of the Raman pump source into the terminal becomes possible under in-service condition, and there should be no interruption to the traffic of already installed channels.

The effectiveness of the Raman amplification was confirmed experimentally [7]. 1Tbit/s transmission was demonstrated with and without Raman amplification. Figure 11 shows measured performance of 1Tbit/s, 200km unrepeatered transmission experiment. The average Q-factors with and without Raman amplification were 16.5dB and 13.5dB, respectively. The effectiveness of the Raman amplification was proved experimentally through this demonstration.

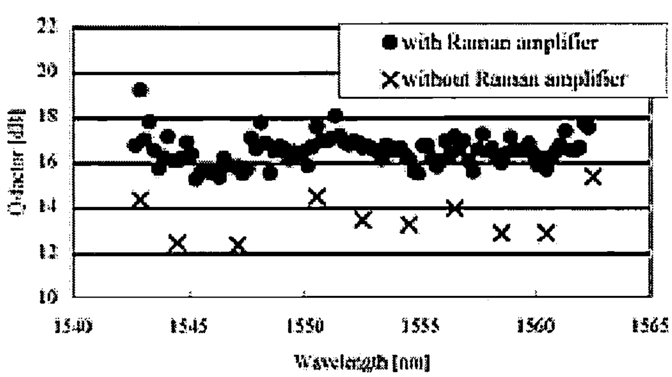

FIGURE 11. MEASURED PERFORMANCE OF 1TBIT/S, 200KM UNREPEATERED TRANSMISSION

3.2 Possible expansion of the system capacity

Capacity expansion of the unrepeatered system beyond the designed limitation becomes feasible by adopting the Raman amplification technology. As the experimental results show, the transmission performance can be improved by 3dB when the Raman amplifier is adopted in the unrepeatered system.

Therefore, if 3dB improvement of the performance is equivalent to 3dB increment of the number of WDM channels, the capacity of the system could be doubled. Of course, maximum applicable number of WDM channels shall be confirmed through a field test using the actual transmission line.

4. Conclusion

The latest technologies to expand the system capacity from its originally designed value are discussed. A superior signal processing of error correction scheme, an efficient utilization of given bandwidth, and a method to expand system bandwidth are the key technologies to realize this kind of system capacity expansion of the repeatered system. Raman amplification is the key technology to realize the capacity expansion of the unrepeatered system. Based on the desktop study, 50% capacity expansion of the repeatered system and 100% capacity expansion of the unrepeatered system may be possible using these technologies. This kind of capacity upgrade beyond the designed capacity should be quite attractive, because the system of old generation can be revolutionized to the system of today's fashion.

5. Acknowledgements

The authors would like to express their thanks to H. Yamauchi and members of KDDI-SCS Shin-Yokohama Laboratory for their kind help for the experiments. The authors also wish to thank members of KDDI R&D Laboratories for their invaluable advise and comments. The authors are grateful to I. Kondo, S.Akiba, and H. Yamamoto for their continued encouragement and support to this research and development.

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back to index

Abstract

Capacity expansion of already installed optical fiber undersea communication system beyond the designed limitation using WDM technology is quite attractive. This paper describes a study of novel capacity expansion technology beyond the designed limitation. A few new technologies to increase the number of WDM channels from the originally designed value is presented, and the possibility of the capacity expansion is examined for both repeatered system and unrepeatered system.

back to index

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Hidenori Taga was born in Kanda, Tokyo, Japan on April 24, 1962. He received the B.E. and Dr. Eng. degrees in electronics engineering from the University of Tokyo, Tokyo, Japan in 1986 and 1998, respectively. In 1988, he joined Kokusai Denshin Denwa (KDD) R&D Laboratories, Tokyo, Japan, where he had engaged in research of undersea optical fiber communication systems employing optical amplifier repeaters. In 1998, he moved to KDD Submarine Cable Systems Inc. (now the company changed its name to KDDI Submarine Cable Systems Inc.), Tokyo, Japan, where he has been engaging development of undersea optical fiber communication systems using wavelength division multiplexing technology. Dr. Taga is a member of Institute of Electronics, Information, and Communication Engineers in Japan.

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back to index

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back to index

Transmission Technology for Trans-Oceanic Transmission

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View Abstract

1. Introduction

For the past decade the transmission capacities of long-haul undersea lightwave systems have been maintaining a growth rate that is faster than Moore's law predicts for integrated circuit technology[1] (Figure 1). This rapid growth rate has been made possible by continuous advances in the fields of the Erbium-doped Fiber Amplifiers (EDFAs), Wavelength Division Multiplexing (WDM), optical fibers, and sophisticated optical and electronic signal processing. These capacity enhancements are born from an increased understanding of the effects that can limit performance of WDM systems. Important strides have been made in areas of dispersion management, gain equalization, and modulation formats. Demonstrations have been made of trans-oceanic transmission capacity of an optical fiber exceeding 1 Tb/s. Demonstrations of this capacity have been performed both at channel rates of 10 Gb/s[2] and 20 Gb/s.[3]

2. One Fiber, More Capacity

At the end of the 1980's the ultimate capacity of long-haul lightwave systems was in question. At the time it was widely known that the intrinsic capacity of optical fiber was very large; however, the capacity of transmission systems based on digital regenerators was not. This of course was due to the capacity bottleneck in the digital regenerator. The important paradigm shift came with the introduction of the EDFA.

Once the EDFA technology became available, other insights and inventions enabled this rapid growth. The first WDM techniques made it possible to use more and more of the available optical bandwidth in the fiber.[4] Then, the technique of dispersion management was introduced along with new fiber types, which allowed more densely packed WDM channels.[5] Error correcting codes were introduced at the electronics end of the optical transmitters and receivers, which allowed for an increase in system margin.

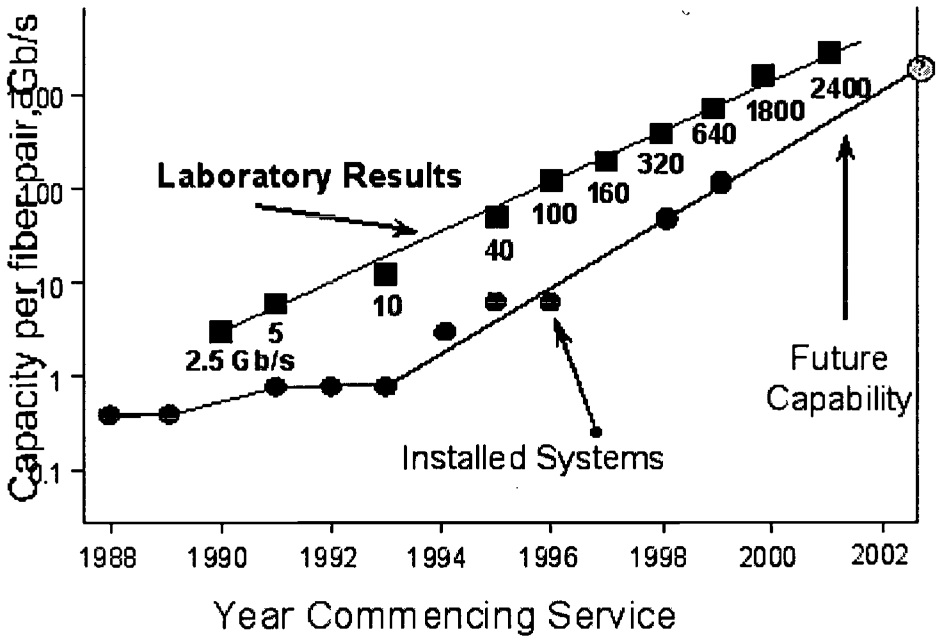


Figure 1 — Transmission capacity of laboratory experiments and installed systems vs. the year in which they were demonstrated/installed.

The upper trace of Figure 1 shows the total capacity of testbed demonstrations performed by TyCom Laboratories over the past decade. The data shows an increase in capacity that has been doubling each year. The transmission capacity of installed undersea cable systems has made a commensurate rise along with the increased transmission capacity of the laboratory experiments. Today, it takes 2 to 3 years from the new technology is demonstrated in the laboratory until that new technology is installed in the field.

3. System Design Process

The shrinking development interval is linked to a revolution in the system design process. Figure 1 illustrates this trend using TyCom Laboratory and installed systems examples. The classical approach to design verification was to build a full-scale model of the transmission line and show that it works. In virtually all cases, this approach is no longer feasible. Time and money are critical elements of an effective process for new system design, and full-length testbeds consume too much of both. The alternative to long testbeds for design verification is a process that uses loop experiments[6] and computer simulations[7] to test concepts and robustness of proposed designs. Progress in the development of loop test and computer modeling techniques has created a way to design systems faster while keeping risks acceptable.

The system design process starts with the selection of the technologies to be used to implement the proposed system at the specified time. Simulation tools are then used to complete a detailed design based on evaluation and optimization of each channel's performance. The design is considered successful if the worst channel's performance is above the target performance for the system, including all required margins. To build confidence in this design circulating loop experiments are performed using hardware representative of the technologies to be used in the proposed system design. The system design simulator is then applied to modeling the experimental data. Having achieved agreement between modeling and experiments we then do parametric studies using the simulator to map the experimental results to the design conditions.

System design simulator

TyCom has developed a system design simulator that allows fast and accurate estimates of WDM system performance even in the presence of nonlinear impairments[7]. The core of the simulator is based on estimates of system performance impairments arising from optical noise accumulation, non-ideal gain equalization, and most importantly, the interplay between the transmission fiber's chromatic dispersion and nonlinear index. The key output from this modeling is an estimate of channel performance in terms of Q-factor.

To verify that our approach accurately describes real system performance, we have performed two levels of experimental verification for this modeling procedure. First, we have designed experiments that can test the accuracy of the individual impairment modules such as FWM between channels, and the nonlinear interactions between signal and noise. Second, we have performed long-haul transmission measurements where 10 Gb/s WDM channels were transmitted over transoceanic distances. Figure 2 illustrates our Q-estimation technique and its comparison to experimental data[7].

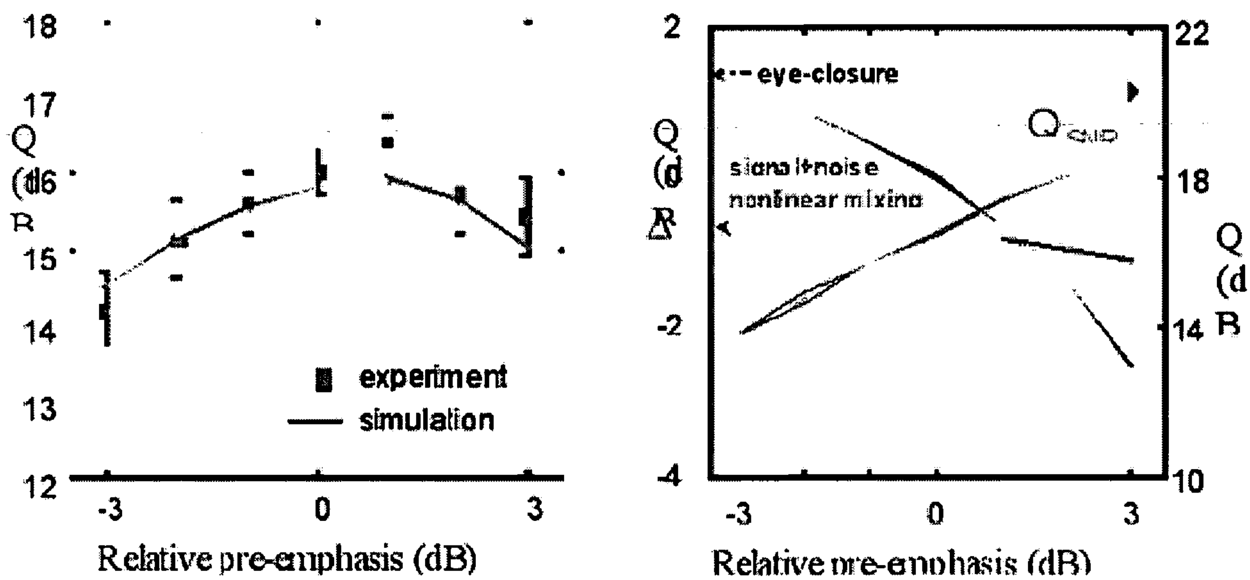


Figure 2. (Left) Performance of a selected WDM channel versus relative pre-emphasis of the its power. Experimental data is shown using square markers. (Right) Illustration of numerical Q estimation technique.

Circulating Loop Experiments

The use of circulating loop experiments has become widespread in the industry because these experiments provide the correct balance between testbed cost, implementation schedule, and the quality of the data. Proper design of a circulating loop experiment can yield transmission performance close to that of a long haul system. Careful attention to loop loss, component polarization, and loop length is required to reduce the effects of loop impairments and provide the proper representation of dispersion, gain equalization, and polarization effects. Done properly, circulating loop experiments make excellent data sources for validation of system designs and design simulation tools.

In many cases system design must be validated using experimental hardware which represents the generic technology to be used in the system but differs in specific features such as details of fiber parameters, exact amplifier spacing, etc.

Figure 3 shows the circulating loop layout. Performance is measured on a per-channel basis using individual pre- and post-dispersion compensation optimization.

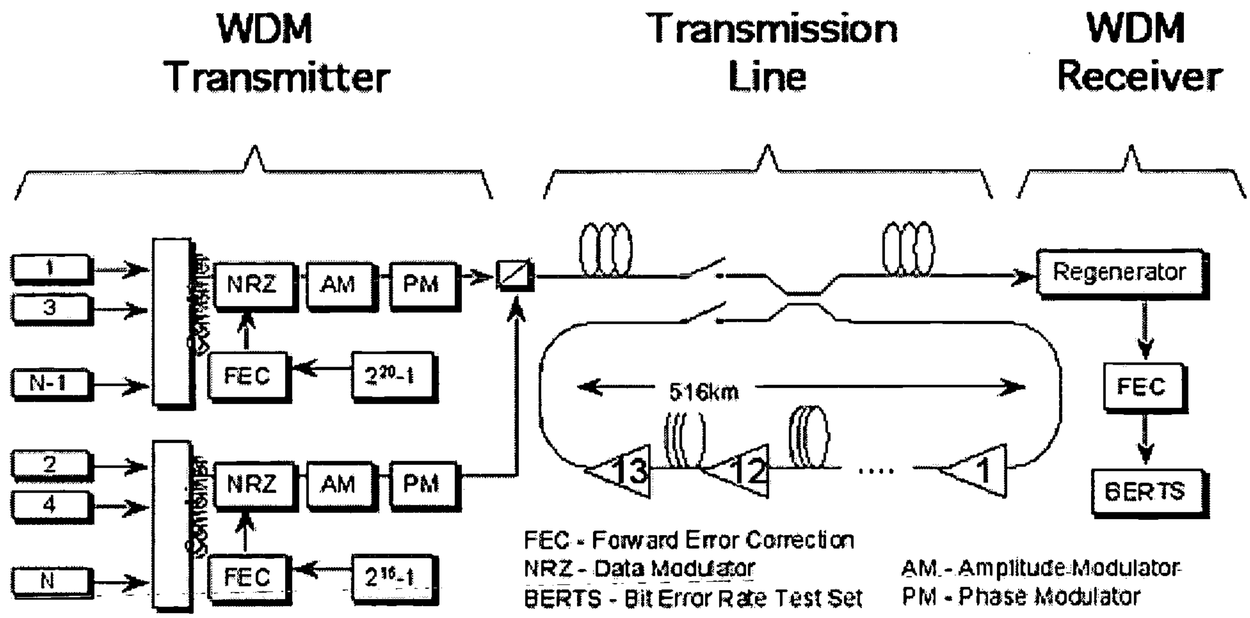


Figure 3. - Block-diagram of a circulating loop.

Channel performance is measured in terms of BER using the laboratory terminal equipment. Q-factor is then calculated according to the relation $BER \approx \left[1/\left(Q\sqrt{2\pi}\right)\exp\left(-Q^2/2\right)\right]$ and expressed in dB ($20 \log_{10}(Q)$). Q=13 dB corresponds to BER=4.0×10^{-6} and Q=14 dB corresponds to BER=2.7×10^{-7}.

Comparison of simulation and Measurement Results

The circulation loop configuration including Gain Flattening Filter (GFF) and amplifier gain shapes, terminal equipment performance, and dispersion compensation scenario were then accurately modeled in the simulator. Figure 4 shows the Q-factors for 32x12.3 Gb/s at 7634 km from simulation and from measurements.

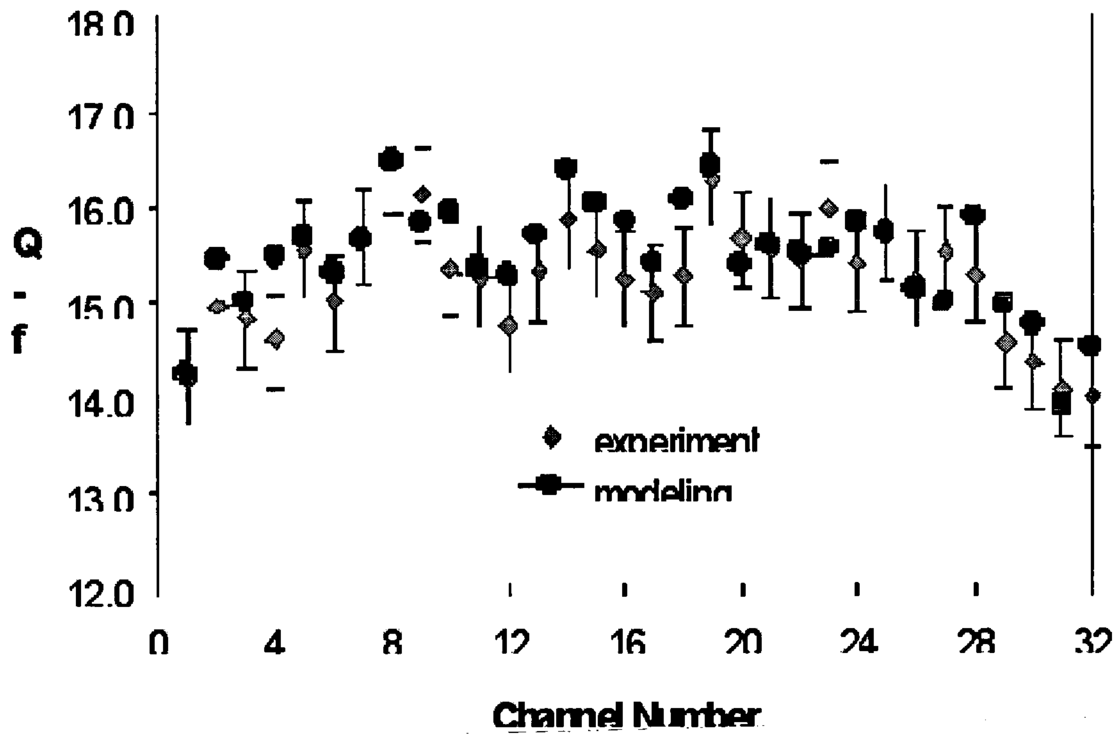


Figure 4 - Measured and simulated Q-factor over 7,634 km

Simulated Q-factors closely track measured performance across the band. To achieve such an excellent agreement between simulation and experiment we start modeling of WDM experiments from matching the testbed gain shape and noise accumulation processes in the computer models. The channel power can experience complicated dynamics along the system length due to the system gain equalization design. Since the nonlinear penalties are power dependent, an accurate representation of the system's gain profile is essential for alignment of simulations and experiments.

Mapping to the Design Center

Having demonstrated that the simulator does provide correct predictions of WDM channel performance, we use this tool to map circulating loop performance to expected performance for a particular system design. To calculate__Q caused by these differences we have performed simulations for the ideally equalized path. Example results are shown in Figure 5.

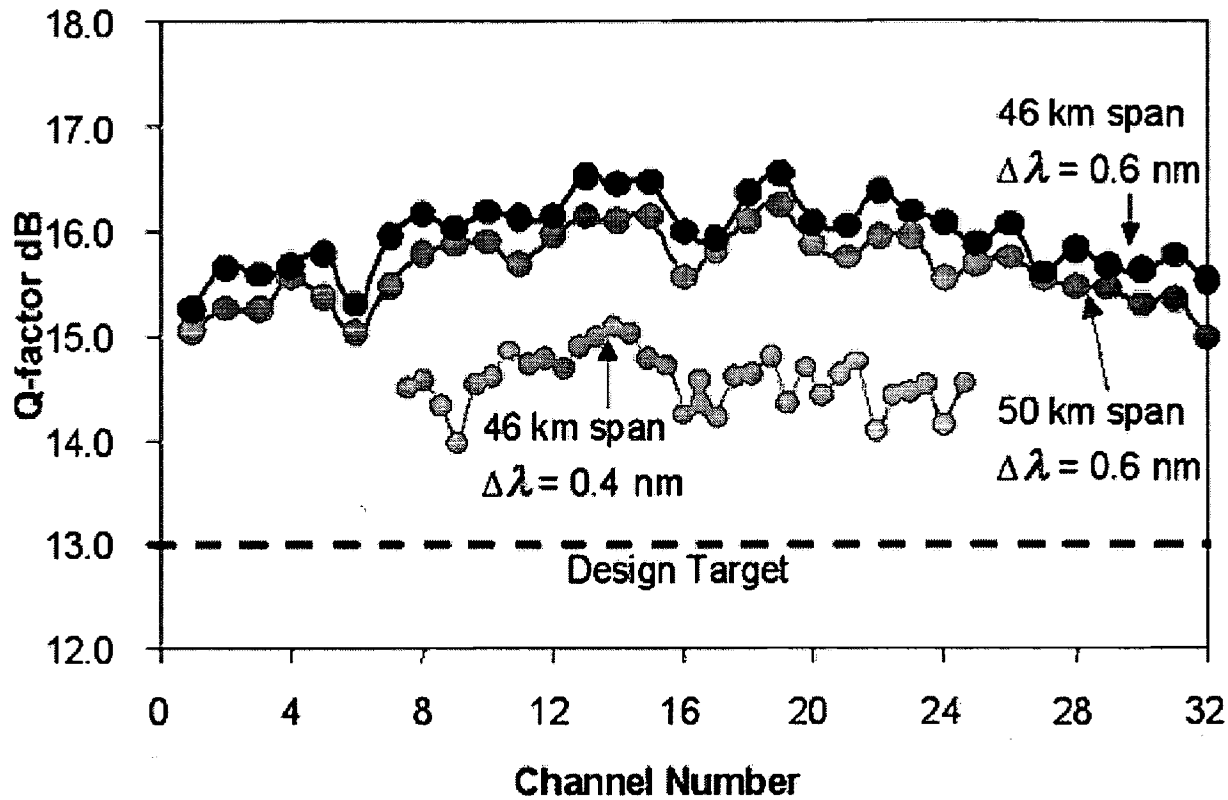


Figure 5 - Simulating performance differences due to span length and channel spacing.

4. The Current Generation of Undersea Networks

The current generation of undersea fiber-optic networks can be classified as the 4th generation undersea, optical transmission technology. (The previous generations were regenerative 1.3 μ m transmission, regenerative 1.5 μm transmission, and optically amplified single channel transmission usually with 1.48 m m pump lasers.) The current generation of networks is characterized by a number of attributes, including:

1. Undersea repeater technology that supports transmission on up to 8 fiber pairs using EDFAs being pumped with redundant 980 nm laser pumps. Gain equalization distributed along the fiber path has resulted in systems with 64 wavelengths each operating at 10 Gb/s across the Atlantic and Pacific (currently available and in 2002, respectively). Over shorter distances, systems will support 96 wavelengths in 2002.

2. Fiber embedded in undersea cable which uses a mix of high dispersion shifted fiber (HDSF) and non dispersion shifted fiber (NDSF) in about a 9:1 ratio. The HDSF's dispersion is about -2 ps/nm/km at 1.55 microns and the NDSF's dispersion is about +17 ps/nm/km at 1.55 microns. The mix of fibers is used to create a dispersion map that minimizes the nonlinear effects of channel mixing and interactions between the fiber and carrier channels.

3. High performance terminal equipment specifically designed for transmitting and receiving DWDM carrier channels for undersea transmission. Included in this terminal equipment are features such as Forward Error Correction (FEC), synchronous polarization scrambling and phase modulation, signal pre-emphasis and dispersion compensation tailored for each channel.

4. When needed, branching units located off the continental shelf 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. Branching units that use wavelength selective filtering can be used to split the capacity between the main trunk cable and the branch cable.

5. Developments in Transmission Terminal Technology

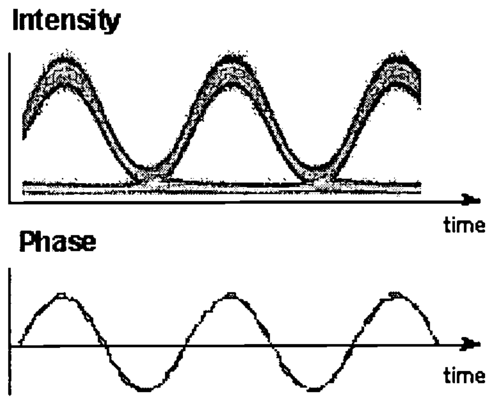
Undersea systems rely on the technology in the undersea plant as well as on equipment in the terminal stations. This includes equipment to condition the digital signal for transmission undersea, power feed equipment to provide DC power to undersea, line monitoring equipment to diagnose the location of undersea cable cuts and other undersea faults, and equipment which supports the maintenance of the above terminal equipment. Evolving technology in terminal equipment has played a critical role in the rapidly increasing capacity of undersea systems in the past and will continue to do so in the future.

Terminal transmission equipment for trans-oceanic, undersea systems differs significantly from terminal transmission equipment for terrestrial applications. Multi-thousand kilometer systems inherently must work at poorer signal to noise ratios (SNR) than shorter systems. The fiber loss of these long systems necessitates many intermediate optical amplifiers to compensate for the loss of the associated fiber (a total of more than 1200 dB for a typical trans-Atlantic system and more than 1800 dB to cross the Pacific). Even with low loss fiber, amplifier noise-figure near the theoretical optimum, and relatively modest repeater spacing (which minimizes total noise), a high level of amplified spontaneous emission (ASE) noise is unavoidably present at the receiver. At the same time, the Kerr effect nonlinearity in the transmission fiber combined with chromatic dispersion creates an upper limit on the optical power that can be launched from each amplifier at a given wavelength; this effect becomes more severe with system length. The combination of limited signal power plus a high noise level leads to inherently low SNR.

The next three sections will address three key technologies at the forefront of developments in transmission terminals: modulation formats, control over launch polarization state, and forward error correction.

Modulation Formats: CRZ

The transmission performance of long-haul systems is limited mainly by noise accumulation from erbium-doped fiber amplifiers and by fiber nonlinearities. In most practical long-haul systems the maximum optical power at which signals can be transmitted is limited by the fiber nonlinearity, thus giving a limit on the maximum signal-to-noise ratio. The interplay between fiber nonlinearity and group velocity dispersion can cause distortion of the optical pulse shape. This signal distortion can be minimized by the proper choice of the transmitted signal format. We have found by simulation and experiments that the chirped return-to-zero (CRZ) signal transmission format (Figure 6) gives superior performance.



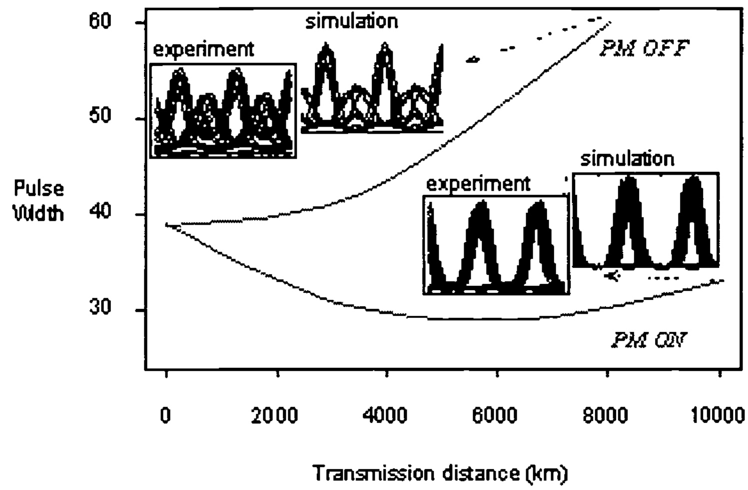


Figure 6 - CRZ transmission format

Figure 7 - Typical 10.7 Gb/s signal evolution in WDM system with standard dispersion map with and without phase modulation[8].

The RZ transmission format is less sensitive to non-linear distortion than NRZ and reduces the bit error rate by improving receiver sensitivity[9]. Chirping of the signal at the transmitter further reduces nonlinear waveform distortion[10]. Figure 7 shows the advantages of phase modulation for quality of the transmitted signal.

Control over launch polarization state

Another method of reducing nonlinear channel interaction and linear channel crosstalk is orthogonal polarization launch of the adjacent channel[11]. When channels are launched pair-wise orthogonal the FWM interactions are reduced to a low level. The randomly varying birefringence of the fiber destroys the phase matching of orthogonal signals; thus, reducing the FWM products to almost zero. The strength of nonlinear cross-phase modulation is also reduced in half by orthogonal polarization launch relative to the case of parallel polarization launch.

Figure 8 shows the results of a WDM transmission experiment where the benefits of orthogonal polarization launch were clearly demonstrated[8]. Orthogonal launch becomes practical and easily implementable with the advent of the new slope-matched fibers[12]. The use of slope matched fibers allows for equalization of the dispersion across wide bandwidths of 40 nm and more, and leads in due turn to significant simplification of the terminal dispersion compensation.

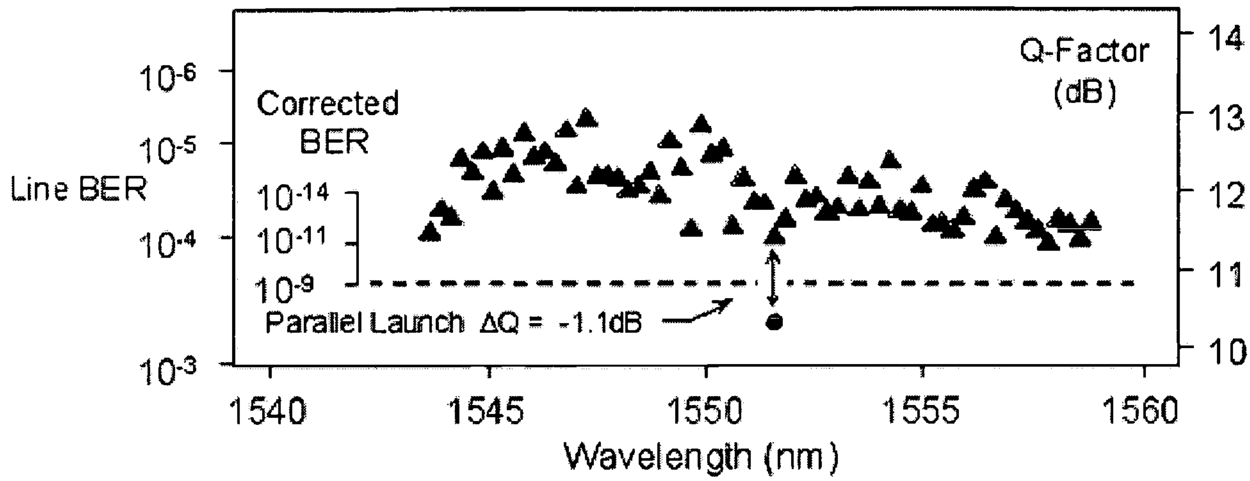


Figure 8 - Transmission performance of many WDM channels with and without orthogonal polarization launch.

Forward error correction (FEC)

FEC codes are used in the terminals of optically amplified systems to correct any residual bit errors after transmission. FEC is standard practice in undersea systems, and is starting to be deployed in terrestrial systems. FEC provides significant margin against line impairments such as accumulated noise, channel cross talk, nonlinear distortions, system aging, and performance variations. With the added margin, one can also increase transmission distances, increase amplifier spacing, reduce optical power and/or increase system capacity. Most importantly, FEC-assisted operation at low signal power results in nearly-linear transmission behavior and consequently reduces the impairment due to fiber nonlinearity. Most of transoceanic systems use the Reed-Solomon (RS) 255/239 FEC, which yields about 5 dB of coding gain with 6.7% redundancy[13]. Reed-Solomon codes have been the most widely used FEC because they offer efficient error correction capability with low overhead, as well as immunity to short bursts of bit errors. It is these properties of RS codes that make them attractive for use in optical transmission systems. The low overhead, typically 7 to 25% for 10 Gb/s data rates, only requires high-speed electronics with bandwidth from 10.7 to 12.5 GHz. There exist codes with rates as low as 1/3 (overhead of 200%) which offer even better performance, but they quickly become impractical as data rates increase because of wider required bandwidth, which leads in due turn to larger transmission penalties and reduction in spectral efficiency.

Generally, there are two types of impairment to optical transmission over long distances of fiber: accumulated noise, and pulse distortion due to many causes including optical fiber non-linearity, channel crosstalk, chromatic dispersion and polarization mode dispersion. Figure 9 and Figure 10 show the results of transmission experiments over 10,000 km using 14% overhead RS 255/223 code[14]. The results show that FEC performs equally well with the same coding gain 6.2 dB in case of noise dominated impairments (Figure 9) and crosstalk (both linear and non-linear) (Figure 10)

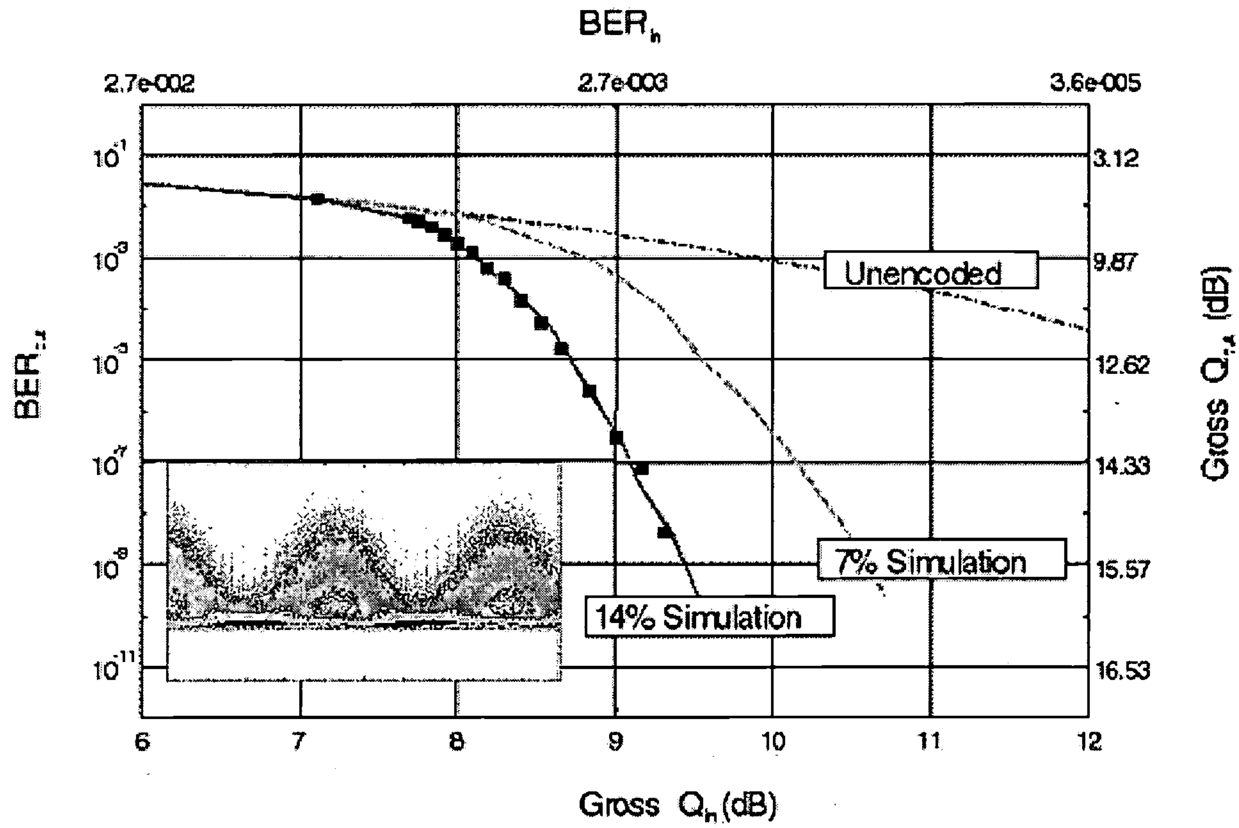


Figure 9 - Experimental results with channel spacing of 0.6 nm after 10,000 km transmission. The inset shows the eye diagram after transmission.

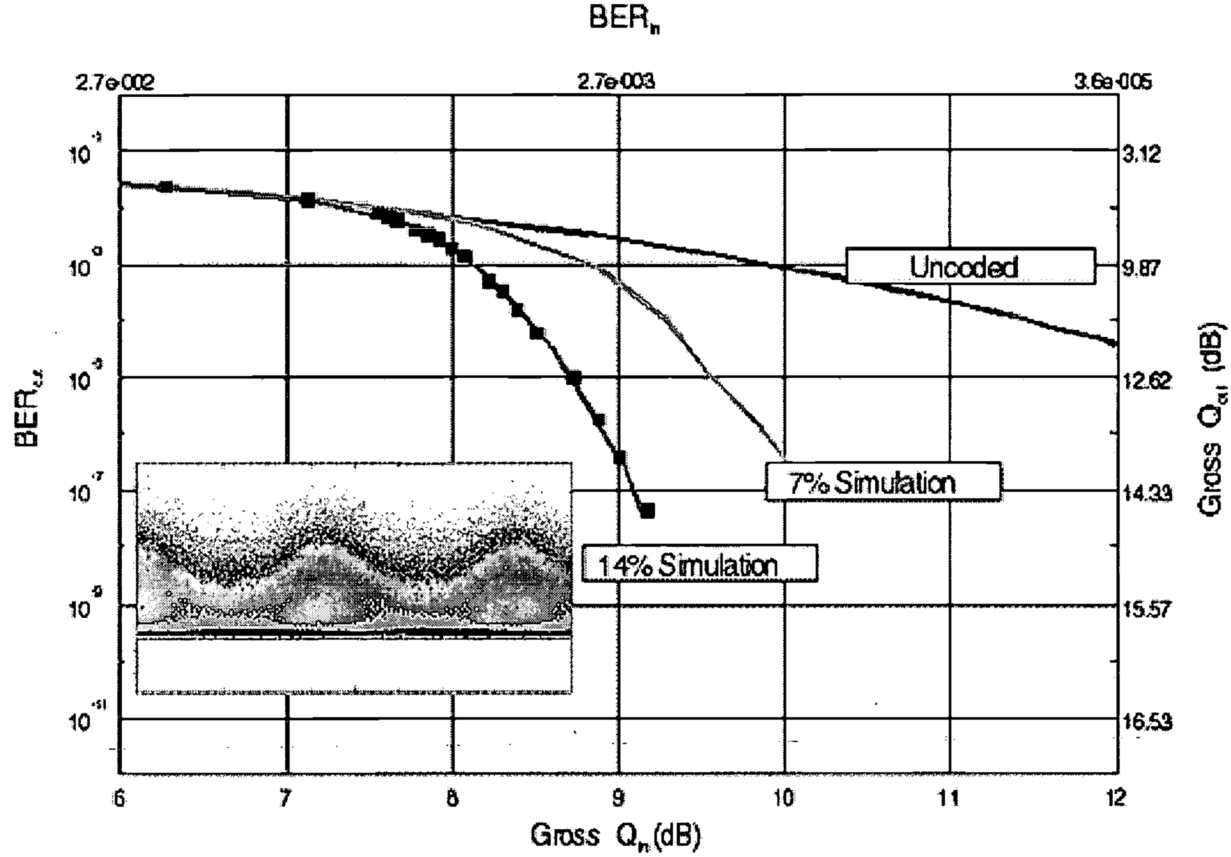


Figure 10 - Experimental results with channel spacing of 0.24 nm after 10,000 km transmission. The inset shows the eye diagram after transmission.

More powerful concatenated codes are also being deployed because they provide enhanced error correction (Figure 11) without a significant increase in the amount of overhead required[15]. A concatenated code is typically superior to a single code with the same net overhead. Performance improvement comes from the fact that any residual errors from the first (inner) stage of decoding will be further corrected at the second (outer) stage. Concatenated codes are important to optical systems because they provide for correction of both random as well as bursty errors.

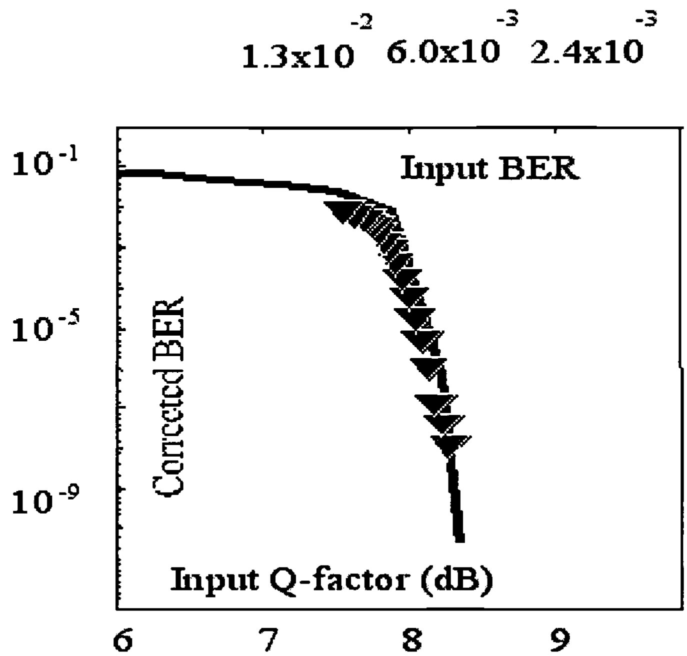


Figure 11 - Performance of concatenated RS code with 23% overhead.

Concatenated codes can be further decoded iteratively, i.e. the two stages of inner and outer decoding can be repeated, with subsequent iterations increasing the coding gain. Such iterative decoding schemes do not increase the code overhead, and do not change the encoder. Additional complexity is added to the decoder due to the feedback that is required. However, greater than 3 iterations does not significantly improve error correction capability[16]. Other even more powerful iterative codes such as Turbo codes[17] relay information back to the decoder at each iteration, thereby providing significant improvement.

6. Power

Undersea systems use DC power conductors in the same cable carrying the optical fibers to supply power to the undersea repeaters. Previous generations of transoceanic systems, including both regenerated and early amplified systems, used a line current of 0.9-1.6 A., and maximum voltages at each end of about 5000 volts. The market demand for increased undersea cable capacity is driving the industry to systems with more fiber pairs and to the more complex amplifier designs required to amplify broader optical bandwidths. Both of these innovations require more electrical power for each repeater, and thus higher voltages and/or currents. Higher currents imply the need for lower resistance DC conduction paths in the cable, while higher voltages require more insulation in both the cable and repeater designs. Either solution requires continuing innovation in the power feed equipment (PFE) in the terminals to meet these increased demands with the level of safety and reliability customers have learned to expect.

7. Looking Forward

The capacity of undersea fiber optic systems has increased, and will continue to increase, by using more optical bandwidth and by using this bandwidth more efficiently. The conventional pass-band of the EDFA (C-Band) is about 40 nm wide, in the wavelength range of roughly 1526 nm to 1566 nm, corresponding to optical frequencies of 196.5 THz, to 191.4 THz. Thus, the conventional Erbium band has about 5 THz available for data transmission. The ultimate digital capacity that can be "fit" into the EDFA's C-Band will depend on how efficiently this bandwidth can be used for data transmission. This spectral efficiency expressed in (bits/second)/Hz is defined as the system's digital capacity divided by the optical bandwidth of the system. The best-reported spectral efficiencies in WDM transmission range from a maximum of 1.0 bits/sec/Hz for very short (<100 km) distance, to roughly 0.4 bits/sec/Hz for transoceanic distance. Figure 12 shows the optical spectrum of 180 10 Gb/s channels after propagation over 7000 km. In this experiment the maximum spectral density was 0.4 bits/sec/Hz.[2]

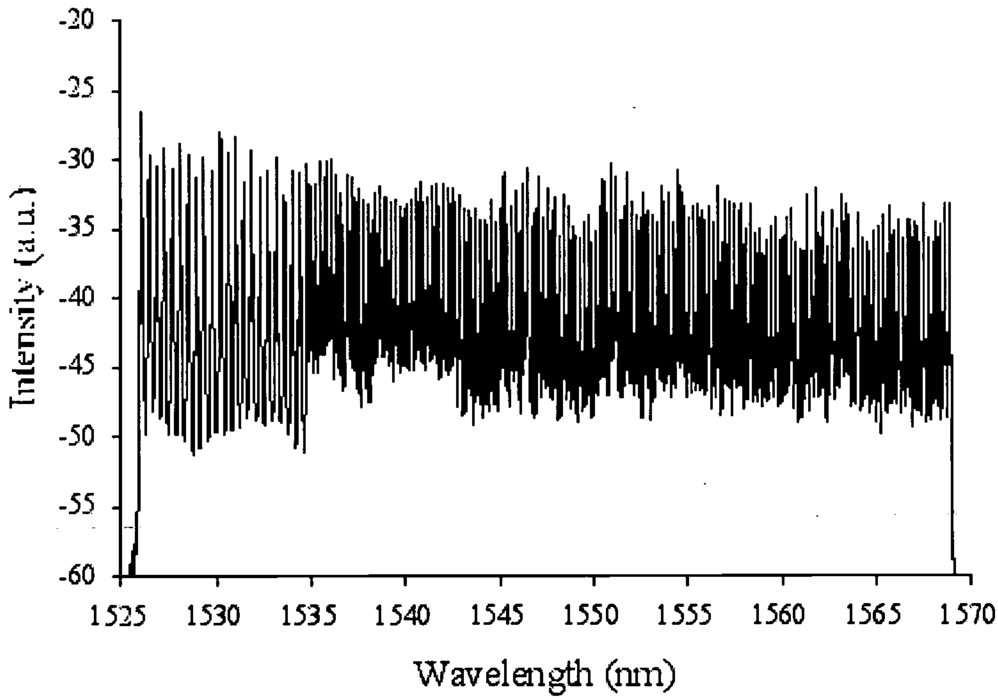


Figure 12 — Optical spectrum of 180 x 10 Gb/s channels after traveling 7000 km.

We can continue to use this bandwidth/spectral efficiency idea to estimate the ultimate capacity of a transoceanic length system (practicality notwithstanding). The low attenuation bandwidth of typical telecommunications grade optical fibers is about 120 nm and extends from approximately 1500 nm to 1620 nm, corresponding to ~15 THz. Assuming the same 0.5 bits/sec/Hz spectral efficiency as above, a fiber's capacity is about 7.5 Tb/s. Erbium amplifiers can cover about 2/3 of this bandwidth by using both the C-band, and the more recently exploited "long" wavelength band (or L-Band)[18]. The leading optical amplifier candidate for the remaining short wavelength band (S-band) is stimulated Raman gain[19], which would be accomplished by pumping the transmission fiber at ~1430 nm. Commensurate with the required wide-band optical amplifier is the need for wide-band transmission fibers that have a "flattened" chromatic dispersion characteristic. Such fibers have been reported recently that extend the concept of dispersion mapping by alternating both the sign and the slope of the dispersion. The resulting fiber spans have relatively constant dispersion value over a broad bandwidth.[2]

Ultimately, one could envision using the entire pass-band of the transmission fiber from 1300 nm to 1700 nm, corresponding to 55 THz. This would pose many challenges to fiber and system designers. For example, a very broad band optical amplifier would be needed (or combinations of amplifiers), and the added attenuation of the fiber at the shorter wavelengths would decrease the signal-to-noise ratios for WDM channels in that region.

Recently, there has been progress for trans-oceanic systems increasing the bit rate for each channel beyond 10 Gb/s. With the development of new transmission fibers and better terminal signal processing, there is finally reason to begin experimentation. Importantly, although the future looks promising for high bit rate channels, more capacity is available in a fiber with a channel rate of 10 Gb/s than with 20 Gb/s or 40 Gb/s.

A recent 20 Gb/s transmission experiment demonstrated 1.12 Tb/s over 6,200 km[3]. Each span was 50 km and the dispersion map used a combination of large area single mode fiber and inverse dispersion fiber in a 2:1 ratio to minimize non-linearities. First generation FEC (RS 255:239) was used reduce the line rate since 20 Gb/s is more sensitive than 10 Gb/s transmission to any further increases in bit rate. The modulation format was CS-CRZ with optimized PM. True PRBS data was used to ensure correct frequency contents of the transmitted data.

Figure 13 shows the received optical spectrum after 6,200 km of transmission[3]. Figure 14 shows the Q-factors before FEC decoding and two representative eye diagrams. The eye diagrams are seen to be open with very little distortion. All channels decoded error free.

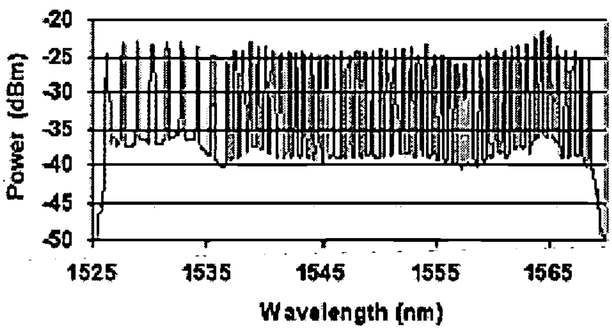


Figure 13 - Received optical spectrum after 6,200 km of transmission.

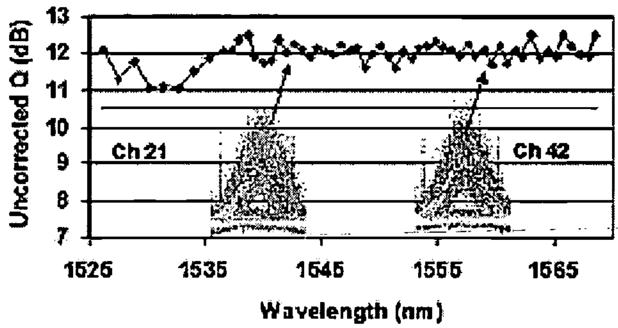


Figure 14 - Uncorrected Q-factor and representative eye diagrams. The bold line shows the FEC threshold.

8. Summary

We have come a long way from the time of the first digital regenerator undersea fiber optic cables of the 1980's which at the time had revolutionized international telecommunications. Optical fiber cable networks now provide the bulk of the long-haul telecommunications for voice and data on both land and across seas. Today, transoceanic cable networks are being built with multi-Terabit capacities. Ultimately, there is another order of magnitude increase in the information carrying capacity of single-mode fiber given wider bandwidth amplifiers and improvements in spectral efficiency. Undersea cable systems will continue to drive these advances.

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back to index

Abstract

The transmission capacity of current generation undersea communication systems far exceeds 1 Tb/s. This massive capacity results from modern transmission techniques developed over the past two decades. These techniques include developments in both the DWDM transmission equipment and the undersea transmission line.

Undersea, repeater technology supports transmission on up to 8 fiber pairs using EDFAs that are pumped with redundant 980 nm laser pumps. Gain equalization is distributed along the fiber path and has resulted in systems supporting up to 64 wavelengths each operating at 10 Gb/s across the Atlantic and Pacific (to be available in 2001 and 2002, respectively). Over shorter distances, systems will support 96 wavelengths in 2002; thus, each fiber pair will have the potential of about 1 Tb/s, giving an eight fiber pair cable a maximum capacity of 8 Tb/s.

The fiber embedded in the undersea cable is engineered to give low end-to-end dispersion and reduce impairments caused by the fiber's nonlinear index of refraction. The "dispersion map" uses a mix of positive and negative dispersion fibers, along with a mix of fiber effective areas.

High performance terminal equipment is specifically designed to transmit and receive DWDM carrier channels for undersea transmission. Included in this terminal equipment are features such as advanced Forward Error Correction (FEC), synchronous optical phase modulation, signal pre-emphasis and dispersion compensation tailored for each channel.

When needed, branching units are located off the continental shelf to 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. Branching units that use wavelength selective filtering can be used to split the capacity between the main trunk cable and the branch cable.

In this article we present the latest development in all of these technologies.

back to index

Dr. William C. Marra

Dr. William C. Marra is the Senior Managing Director of Global Network Planning and Design and Engineering at Tyco Telecommunications. He received his BSEE from the Polytechnic Institute of Brooklyn, a MSEE from Stevens Institute of Technology and a Ph.D. for joint work done at Stanford University and Stevens Institute. He joined the basic research organization of AT&T Bell Laboratories in 1969. Since that time he has worked on the development of numerous fiber optic telecommunications systems for both terrestrial and undersea applications. As a Distinguished Member of the Technical Staff at AT&T Bell Laboratories, he was one of the chief network architects of the first transoceanic ring networks, the TPC-5 and TAT-12/13 Cable Networks. Over the last four years, Dr. Marra has had overall network design and engineering responsibility for all of Tyco Telecommunications undersea projects. Today, his organization continues to design undersea networks for third party system supply and the Tyco Global Network, which in its first phase will reach more than 25 cities on three continents and includes Trans-Atlantic, Trans-Pacific, regional European and regional Asian connectivity.

back to index

New Network Architectures For Global Under Networks

Howard D. Kidorf, William C. Marra, and Matthew X. Ma
TyCom, USA

View Abstract

1. Introduction

The history of undersea fiber optic networks goes back to 1985 when AT&T installed the first deep-water, repeatered, high-capacity, optical transport network between two of the Canary Islands[1]. This milestone event marked the beginning of a new era in technological innovation. The success of this system led to the installation of the TAT-8 network that was the first deployment of fiber optic technology across the Atlantic Ocean. Both of these systems provided point-to-point connectivity between landing locations, although TAT-8 used branching units to split the fiber routing between multiple landing sites. There are a number of additional references[2], in addition to Reference 1, that provide a good historical perspective of other undersea fiber optic networks.

Between 1985 and 1995 virtually every undersea fiber optic network was constructed as either independent point-to-point links or a group of point-to-point links where the termination of the fiber resulted in the termination of all traffic on route to an inland switching center. The concept of terminating only a portion of an undersea fiber's traffic carrying capacity was not adopted until 1995.

2. Ring Networks: 1995-2000

In 1995, the first segments of the TAT-12/13 and TPC-5 networks were installed and put into service. Both networks completed construction in 1996 and were the first operational self-healing undersea ring networks deployed. They deployed of SDH/SONET Add/Drop Multiplexing technology in the cable station and used K-byte protocols embedded in the SDH/SONET overhead byte structure to execute automatic protection switching.

With only a minor number of exceptions, all undersea networks have adopted self-healing ring architectures as the method of choice to protect against undersea equipment failures and external aggression. There are two physical topologies that are used: cable segments deployed to form a geographic ring and trunk/branch cables configured into a collapsed ring. See Figure 1. With these architectures, network providers can achieve highly reliable networks (99.999% availability) in the presence of equipment failures even when cable cross-sections approach 8 Tb/s. (Such a model assumes that the network protection equipment is located at the landing site cable station and external aggression is not considered.) To date, most cable networks have been installed with cross-sectional capacities of only 4 fiber pairs with wet-plant-ready capacities of 16 to 48 10 Gb/s WDM channels per fiber pair. This is equivalent to about 2 Tb/s per cable. Currently, TyCom is deploying systems with wet-plant-ready cross-sectional segment capacities of 8 Tb/s (8 fiber pairs x 96 channels per fiber pair). The initial deployment of these systems will be supported by the topologies and equipment described above, i.e., SDH/SONET rings. However as these systems are upgraded to their maximum capacities, space becomes critical, equipment costs grow and different equipment platforms will be needed to support the different types of services which will be offered. In view of this, network designers are considering alternative topologies and equipment platforms to provide the connectivity required, maintain high levels of network availability and drive down costs by eliminating superfluous equipment.

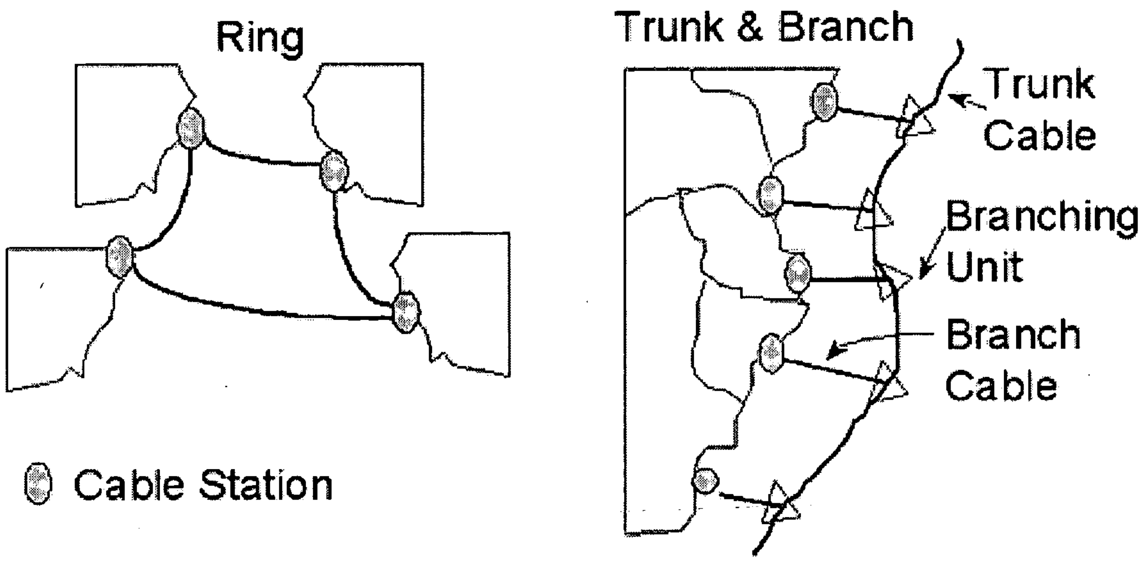

Figure 1 - Ring Topology (left) and Trunk and Branch topology (right)

3. Alternative Designs: Extended Range of Protection

In 1990, the SDH/SONET ring seemed to be the natural solution for the needs of high-capacity backbone networks when ultra-high availability is required. But despite its many advantages, SDH/SONET rings can be expensive (in terms of space and equipment) and requires 50% of a system's capacity be reserved for protection.

Consider the three simple termination configurations shown in Figure 2, Figure 3, and Figure 4. Figure 2 is representative of traditional undersea networks showing the relationship between Customer Equipment, CE, Network Protection equipment, NPE, Dense Wavelength Division Multiplex, DWDM, and Line Termination equipment, LTE.

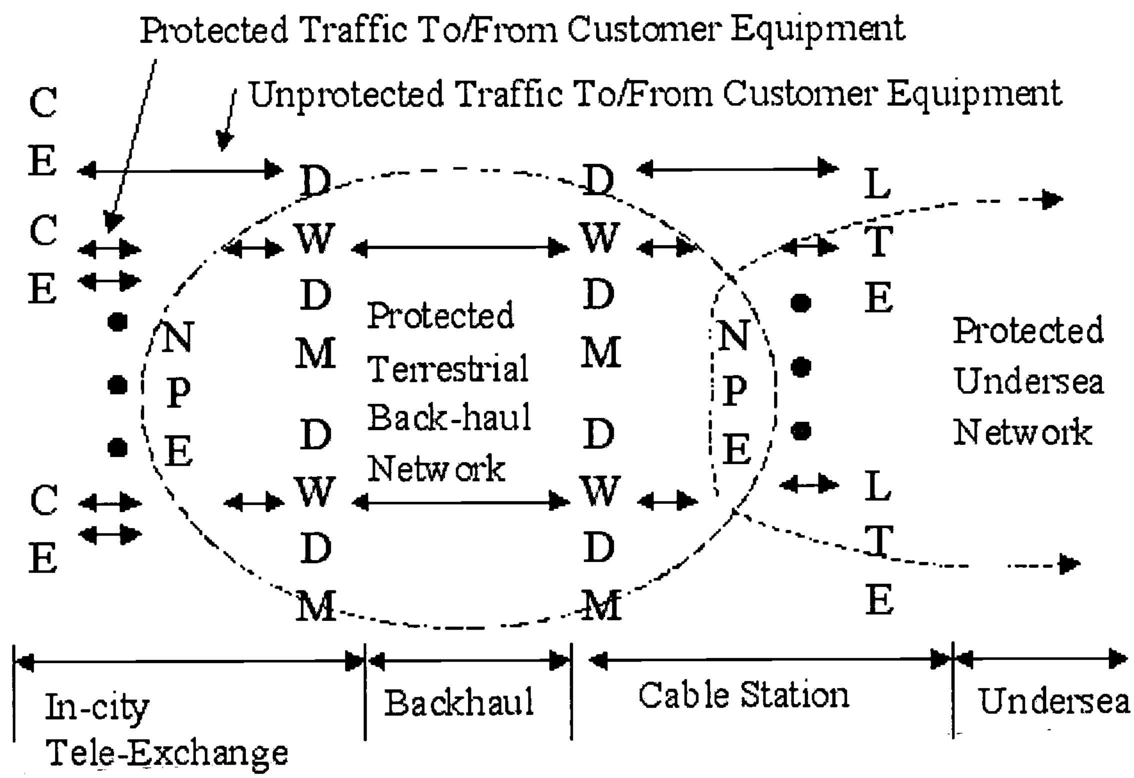

Figure 2 — Traditional Undersea Network Protection

The undersea network and terrestrial network are segregated. There are two independent levels of protection. The network reliability is very high because, in part, failures in the land and wet portions of the network are independently protected. Assuming SDH/SONET shared protection concepts are deployed, each wavelength carrying service can be protected against a single equipment failure simultaneously in each segment of the network for both land and wet portions. Assuming that the topology shown in Figure 2 has 4 landing sites, terminates 768 service wavelengths (96 •'s and 8 fiber pairs of service), some 3072 equipment failures can be protected, via span switching in the wet and dry segments simultaneously. In the event of a cable cut in either in the wet or dry networks, a ring switch is required. Any second event (e.g., equipment failure) on any wavelength within the same network will result in an outage of that wavelength until a repair is made. This point will be discussed in more detail below.

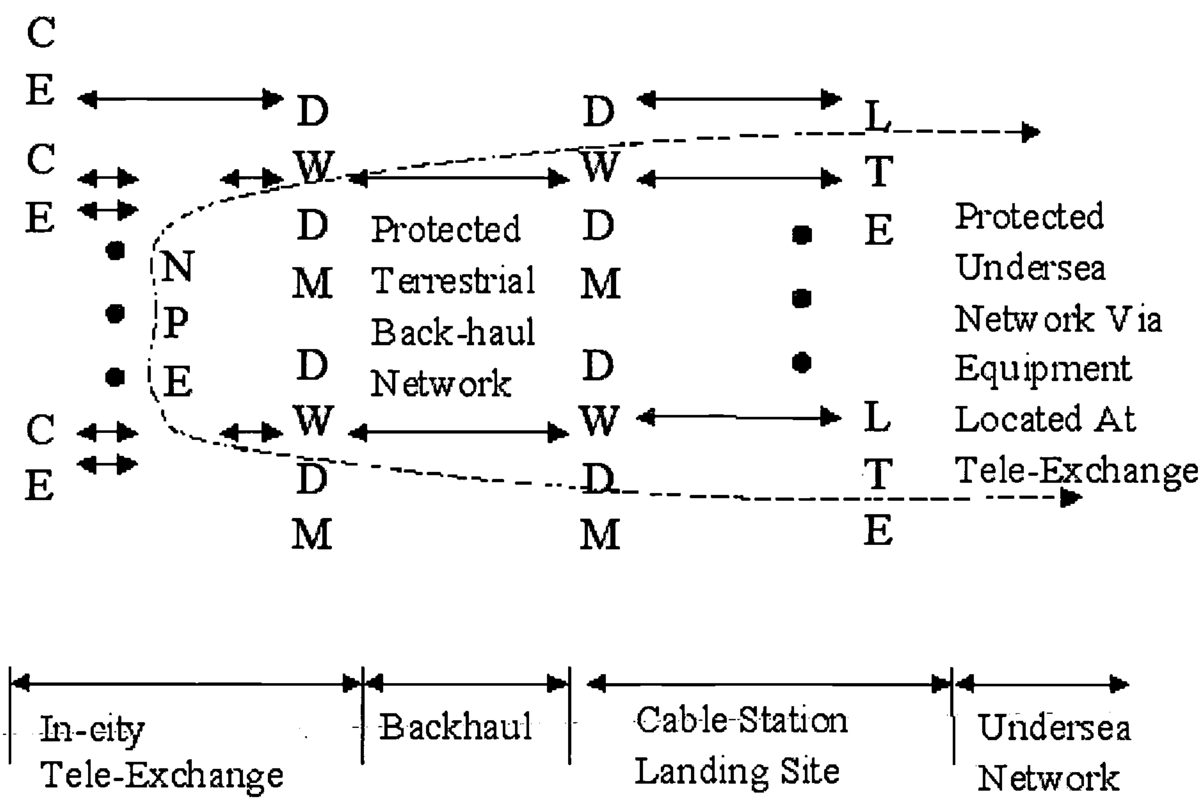

Figure 3 — Extended range of protection resulting in less protection equipment

In the configuration shown in Figure 3, the NPE in the cable station is removed. This eliminates the "segmented protection" scheme created in Figure 2. The NPE in the Tele-Exchange protects all failures. The trade-offs are clear.

- A major reduction in equipment at the cable station locations where space is a premium asset. Using the SDH/SONET NPE available today, even under the most optimistic conditions there are approximately 200 racks of equipment eliminated for the example provided above.
- Network infrastructure costs are significantly reduced.
- Although there is a great deal of equipment removed, the protection equipment in the Tele-Exchange must protect a greater number of potential failures, i.e., the effective failure rate of the protected network has increased.
- The NPE in the Tele-Exchange now needs to safeguard the network against external aggression events in both the dry and wet networks. The occurrence rates and characteristics (i.e., outage times) of these events may be very different.

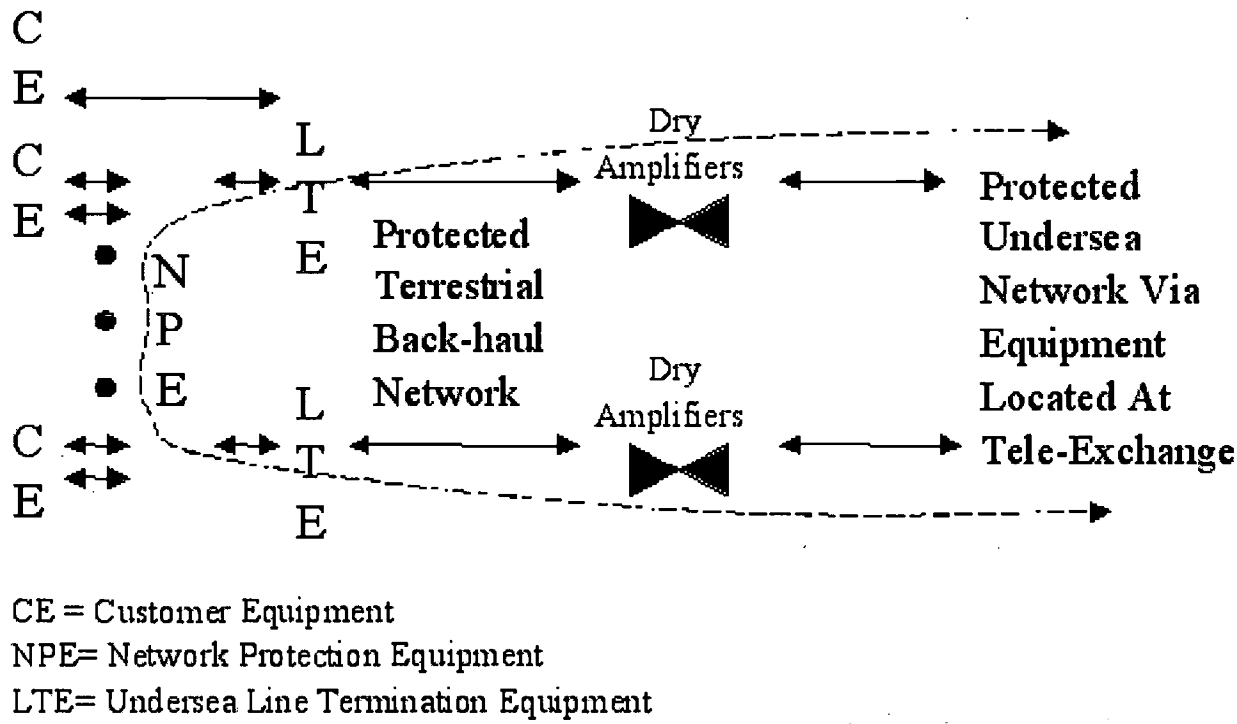

Figure 4 — Extended range of DWDM transmission

The configuration shown in Figure 4 goes even further and integrates the wet and dry plant designs into one. This eliminates another layer of DWDM equipment and delivers substantial savings in both space and cost. Of course this configuration can only be used in limited set of applications and requires a dry plant fiber and amplifier design that seamlessly inter-works with the wet-plant design.

The real challenge in any of the cases described above (obviously there are many variations of these 3 cases that go beyond the scope of this paper) is to protect against the impact of external aggression and still maintain the required reliability that customers demand.

For any of the above cases, single failures will be protected, whether the result from equipment failures or cable cuts. When cable cuts occur, any simultaneous equipment failure on the other cable will result in an outage, as mentioned above. In Figure 3 and Figure 4 above, where there is an attempt to lower the overall costs of the network by reducing the number of layers of protection and equipment count, the major vulnerability to an outage will be from external aggression. In high capacity networks where many wavelengths terminate at a site, an even larger number of circuit cards are required. Even when the actual network availability numbers stay the same, the circuit card numbers are large and therefore the likelihood of an equipment failure, which simultaneously occurs when a cable is cut, increases. For example, although the mean time between failures is not high on a wavelength basis, for many wavelengths a failure is likely. Therefore, it is important to find protection mechanisms that safeguard the system from simultaneous equipment and cable cut scenarios. A simple way to implement this type of scheme and not burden the network with redundant equipment is to insert an Optical Cross Connect (OXC) in place of the NPE.

4. Alternative Designs: The Optical Cross Connect, OXC

There are currently two types of OXCs available, opaque and transparent, having an electronic and photonic switch fabric, respectively. There are trade-offs for both types and we will focus on the opaque type for this discussion. The opaque OXC is more fully developed, has all the positive attributes of the more traditional SDH/SONET NPE in addition to a much smaller size, has better scalability, superior performance monitoring features and can manage traffic in a mesh configuration in addition to basic rings. This later attribute, the ability to manage and protect traffic as a mesh, safeguards the network, allows less traffic to be designated as protection and enables higher availability when multiple failures occur. As an example, take Figure 2 and Figure 4 above and assume that another terminal with an identical architecture is connected to it on the other side of the wet plant. It has been shown that the resulting outage can be lowered by a factor of 100 even in presence of external aggression, when contrasted to an SDH/SONET ring solution.[3]

To understand how a mesh protected network allows less traffic to be designated as protection, Figure 5 shows a hypothetical trans-oceanic configuration. With only two cables deployed, a choice can be made to provide restoration with either ring protection or 1:1 protection. Of course, both 1:1 protection and ring protection will reserve at least 50% of a network's capacity for protection. As more cables are added and by using 1:N protection (a simple form of a mesh enabled by an OXC), a reduction in the amount of protection capacity that needs to be reserved is achieved. For example if the network has three point-to-point links, 1:2 protection can be used. Hence only 33% of the network is reserved and a high level of protection capability is provided that will protect against all single failures (including a full cable cut).

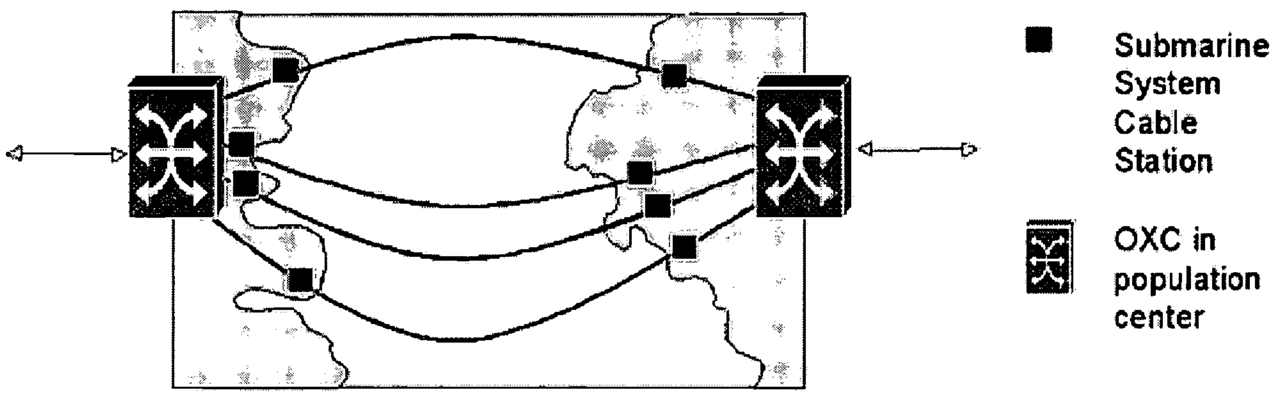

Figure 5 - Trans-Oceanic Links Showing One Protection Link and Up To Three Working Links

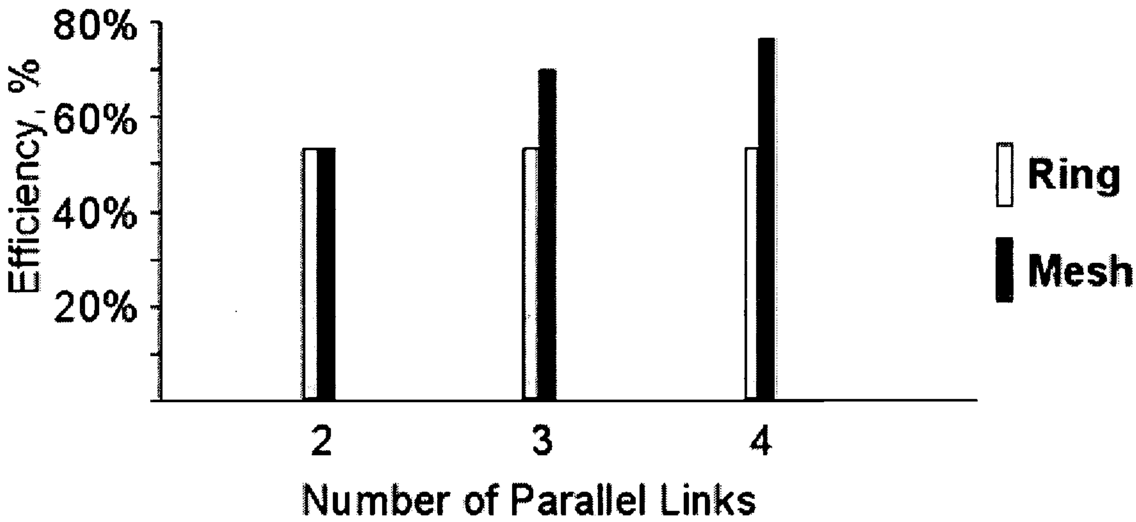

Figure 6 - Efficiency of Ring and Mesh Protection as a function of the Number of Point-to-Point Links

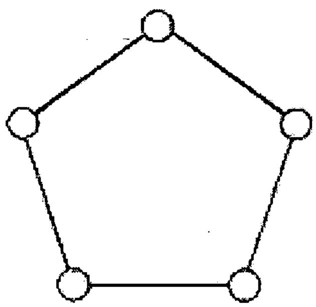

Figure 7 — Regional Network

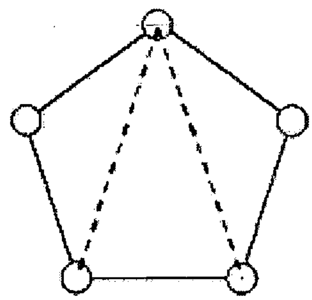

Figure 8 - Regional network after high capacity additions are added.

Mesh restoration also has great appeal in regional undersea networks. Most regional networks begin as a ring topology because this is the lowest cost way to redundantly connect multiple points, i.e., it uses the least cable. See Figure 7. As the network becomes loaded and preferential traffic utilization patterns become evident, additional cable builds may become necessary to provide additional capacity to nodes that are in great demand. In this case, ring protection and mesh protection will co-exist in the same network. See Figure 8. Depending on traffic patterns and service types, additional ring or mesh capacity can be configured. Network planning and optimization tools become essential to achieve optimum capacity utilization.

The opaque OXC also allows straightforward deployment of a greater variety of services than conventional SDH/SONET equipment. Examples include:

- Since a mesh network made of opaque OXCs has complex, network-level intelligence, provisioning times are very quick. Unlike SDH rings that must be individually be provisioned, opaque OXCs communicate routing information (using, for example, the OSPF algorithm developed for the Internet) using a signaling protocol that allows point-and-click provisioning without complex Operation Support System software.

- Opaque OXCs allow services that are more granular and allows more customized service levels than SDH/SONET NPE. In addition to the conventional STM-1, 4, 16, 64 rate services, the opaque OXC allows grooming at the STS-1 (51.84 Mb/s) rate and interfaces that conform to SDH, SONET, and GigaBit Ethernet. Service-levels are offered that allow a tradeoff between protection level, cost, and speed of restoration.

- An Optical Virtual Private Network (OVPN) can be simply deployed on an opaque OXC. The OVPN allows the cable network operator to partition some its network for a customer. The customer can then be given complete control of just its portion of the network. The customer has the capability and to redirect and re-configure traffic to where it is most needed. This is accomplished with complete security so that one customer's activities have no impact on any other customer's services.

The opaque OXC's architectural characteristics discussed above are being used in today's undersea networks, stimulating better-integrated wet and dry segment designs. The rationalization for this deployment is justified simply from an economic perspective (less NPE cost) and that OXCs offer more robust protection mechanisms that can be deployed to achieve comparable or superior reliability.

As global connectivity is extended, undersea networks need to provide universal interfaces to different equipment platforms to enhance service offerings. The customer equipment (CE) in Figure 4 can include a variety of different aggregation devices, e.g., standard Add/Drop multiplexers, ATM aggregators, core IP routers or DWDM line equipment to move capacity to customer POPs. In each case the undersea network is usually designed as the core optical networking platform and the aggregation equipment is located at the network edge.

5. Next Generation Network Designs

The architectural characteristics discussed above will be utilized in next generation systems, stimulating more integrated wet and dry segment designs and greater use of OXCs. The rationalization can be justified simply from an economic perspective and the fact that more robust protection mechanisms can be deployed to achieve comparable reliability.

In addition to the ever-growing communication capacity that can be carried on an optical fiber, the network elements that integrate these undersea pipes will continue to evolve. The next major advance in the development of submarine system architectures will likely be the widespread use of the transparent optical cross connect (also called the photonic OXC). Transparent OXCs provide network protection at the optical level instead of requiring an Optical-Electrical-Optical (O-E-O) conversion, as is required with the current electronic equipment. Transparent OXCs make use of mirrors or other optical switching mechanisms to eliminate the need for costly O-E-O conversion. This could lead to dramatic savings of electrical power, cost, and space in the already crowded submarine cable stations.[4] Though the transparent OXC can be less expensive per port, the transparent OXC currently has some drawbacks. For example, since it is all optical, performance monitoring capabilities are very limited and it is not possible to do any grooming at a sub-wavelength level. Soon, as wavelengths services (i.e., services where there is no demand for division below the 10 Gb/s rate) become more in demand, the transparent OXC will find a role in the core of the optical transport network. Grooming OXCs will then be used at the "edge" of this network to aggregate traffic at lower levels and to re-distribute the traffic onto higher speed trucks for its ultimate delivery.

6. Conclusions

The simple migration from SDH/SONET NPE based equipment toward OXC's opens up a number of opportunities for improving global networks. They include:

- A seamless migration from SDH/SONET based networks. Without disrupting existing SDH/SONET investment/infrastructure, OXC based networks will increasingly be deployed in their place. Customer interface options on OXC platforms are totally compatible with current equipment. New interface options are planned for OXCs including Gigabit-Ethernet.

- An evolution from ring based networks to mesh based networks. This evolution allows for a more cost effective network leveraging existing infrastructure and allows SLAs to be adapted to customer needs, e.g., different protection options coupled to different quality of service.

- Most undersea networks are being deployed on 10 Gb/s wavelength platforms. The OXC allows for taking any individual wavelength to be rapidly provisioned through the network, between global regions, rings, and segments in a transparent manner. Again, this efficient implementation reduces the cost of equipment and OA&M expenses.

There are a number of other important attributes required from next generation, undersea networks. The first is a ubiquitous network footprint, providing regional and global connectivity[5] to the major financial centers, cities, Internet exchange centers and growing telecom communities. This becomes increasingly important as customers extend their need for connectivity on a global scale.

As global connectivity is extended, undersea networks will provide universal interfaces to different equipment platforms to enhance service offerings. The customer equipment (CE) in Figure 1 can be a variety of different aggregation devices, e.g., standard add/drop multiplexers, ATM aggregators, core IP routers or DWDM line equipment. In any case, undersea networks will be architected as the core optical networking platform. Where needed, aggregation equipment is located at the edge of this global network to support customer's needs, with equal access for all customers.

Lastly, next generation networks should have a network management infrastructure and Operation Support System (OSS) which offers more than simple monitoring and control for the network, such as:

- fast service provisioning across the different types of equipment platforms

- customer visibility of SLA compliance

- optical virtual private networking capabilities at the fiber pair, wavelength and managed bandwidth level with independent control of capacity.

Endnotes

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back to index

Abstract

As a result of rapidly developing industry demands and technological evolution, new paradigms are being used in the design of undersea networks. Unlike their predecessors, these networks are part of a global infrastructure that provides connectivity to the major telecommunication centers.

Over the last 5 years, undersea networks have experienced dramatic increases in the wet plant transmission capacity by taking advantage of improved terminal, repeater, and fiber designs and the continued progress in Dense Wavelength Division Multiplexing (DWDM) technologies. However there have been only minor changes in the equipment that provides network protection. In general, yesterday's networks used SDH network protection equipment as the method of choice used as the protection mechanism for the self-healing rings deployed (whether physical rings or collapsed rings). Over this time, cable stations have continued to be the location that segregates the international undersea network and the terrestrial networks, with network protection equipment being installed in these locations where space is at a premium.

The cable station to cable station connectivity model that has historically been the norm has been replaced by a model where the cable station has become integrated in a mesh of city-to-city connectivity. As a result of the size and scope of these networks, the SDH equipment platforms that have provided restoration have migrating to space and economically efficient optical cross-connects. This equipment manages the undersea networks at the wavelength level; aggregation and/or multiplex equipment has been moved to the location where the customer needs to access it. In most cases, this is at the in-city Tele-Exchange location where telecommunications carriers will co-locate their network equipment and access global bandwidth. This important step toward achieving end-to-end optical networking is allowing network operators to benefit from the improved network efficiency that can be derived from the operation of optimized mesh networks.

Global bandwidth is accessible through different types of multiplex and aggregation equipment that depends heavily on the services that will be offered. This new equipment allows a complete suite of services including SDH, SONET, IP, ATM, G-Ethernet, and VPNs. The methods for provisioning these services and their restoration have also changed. Provisioning times have been significantly reduced from months to days; restoration mechanisms have been tied to SLAs and executed using optical cross-connects, or via diverse paths terminating on high capacity core routers. Many of these features have resulted from the network management infrastructure and communication channels that will be part of these new networks.

At TyCom we have been planning the deployment of these technologies for over two years. In this paper we discuss both conceptual architectural solutions for these new global networks and present practical results from the TyCom Global Network.

Practical Technologies for High-Capacity Subsea Cables

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UK

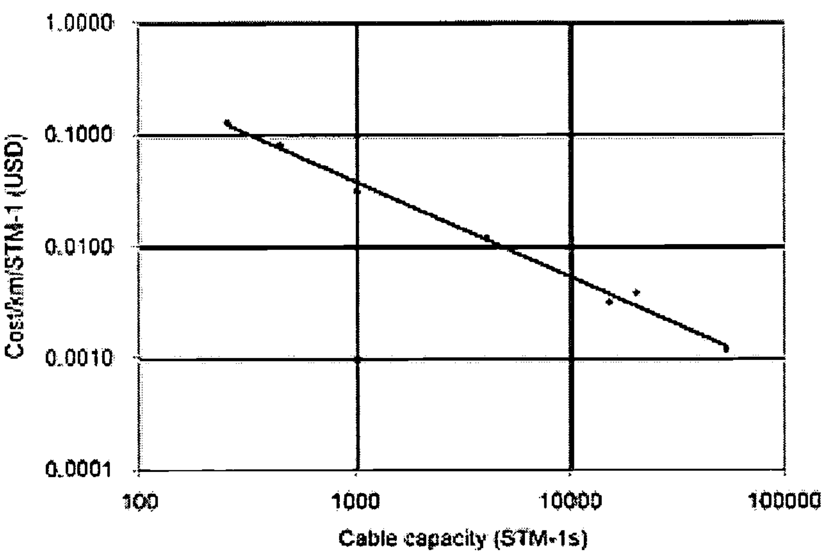
View Abstract

1 Trends in subsea systems

Between 1998 and 2001 the capacity of subsea cables increased by 100-200x. In parallel there has been rapid development of a variety of techniques, which have allowed a single fiber in the laboratory to carry up to 10 Tbit/s [1]; this is roughly 10x more than submarine cables currently under construction.

It's perhaps worth starting by observing that the trend to larger capacities was originally driven by competitive commercial pressures. Early 2.5 Gbit/s WDM cables filled rapidly, suggesting a need for larger capacities, and had a significant fixed cost element; moving to 10 Gbit/s DWDM satisfied the need for greater capacity and diluted the fixed cost part, giving lower unit costs. It also allowed operators more head-room for expansion. The graph below shows the cost / km / STM-1 for capacity in Trans-Atlantic cables as a function of the cable's ultimate capacity.

FIGURE 1. COST AS A FUNCTION OF ULTIMATE CAPACITY



While the unit cost falls as the capacity increases, it's worth noting that higher and higher capacities are not necessarily the best practical choice [2]; the graph shown assumes that the capacity is 100% utilized, but in the telecommunications market of 2001 it seems that there may be an over-supply of capacity in some areas. In the longer term, however, there is likely to be renewed pressure to provide large capacities in an economic way.

2 Capacity

To increase the transmission capacity of a fiber one can increase the number of wavelengths and/or raise the line-rate.

2.1 Increasing the number of wavelengths

The first obvious way to achieve this is to broaden the band of the amplifier, firstly by more sophisticated gain-flattening filters, secondly by extension into the L and S bands. Current submarine C-band amplifiers have around 30 nm bandwidth – compared with a little over 40 nm in the lab – and complicated multi-stage filters are needed to achieve this. As the filters are made more complex to extend the band they absorb more and more of the amplifier power, thus requiring ever more powerful amplifiers.

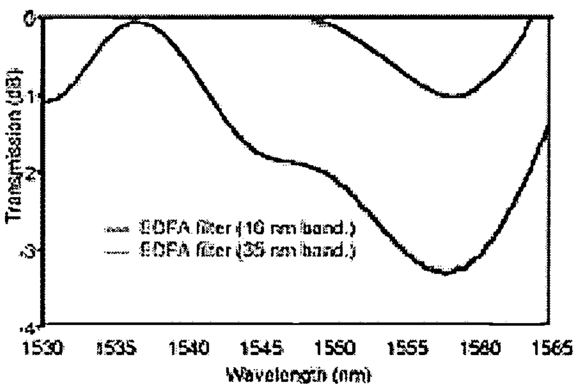


FIGURE 2. GAIN FLATTENING FILTERS FOR 16 AND 35 NM AMPLIFIERS

Gain flatness is very important, as the target lengths (6000-7000 km for the Atlantic and 8000-9000 km for the Pacific) require large numbers of repeaters. After 200 amplifiers, for example, a figure of 0.05 dB/amplifier gain flatness, grows to a deviation of 10 dB.

Extension into the L and S bands offers a potential 2-3x increase in the useable bandwidth, but so far has required the use of an amplifier for each band, as different doping levels and fiber lengths are required in the different bands. This has an obvious impact on the size and complexity of the repeaters, and hence on the overall cost of the system.

An alternative route to higher bandwidths is the use of Raman amplification with a number of different pumps at different wavelengths and power levels, which can give relatively flat broadband gain. A further benefit is that Raman amplification is distributed in the fiber thus giving an effective noise figure reduction.

There are, however, a couple of potential difficulties:

- Several high power pumps are required to get satisfactory gain levels, although the power may be reduced by using small core fibers; a later section describes how this might also be worthwhile to assist dispersion management.
- Getting good gain flatness requires both several pumps and a control scheme; this would probably need to sense the levels at several wavelengths – a degree of complexity, which has not previously been applied to submerged amplifiers.

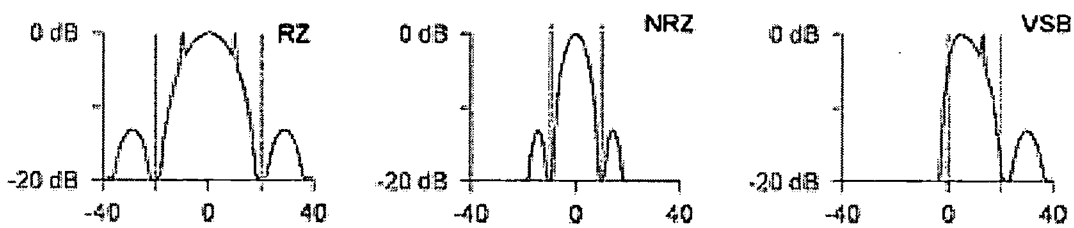
Neither of these represents any form of fundamental problem, but both have practical implications; the first mainly in terms of costs, the second mainly in terms of implementation and reliability.

Another approach to increasing the fiber capacity is to reduce the channel spacing. Current long-span submarine systems use RZ (or more precisely CRZ) format, the spectrum of which is shown below:

These signals are often spaced according to the ITU-T 50 GHz grid, but lab experiments show clearly that spacing at 35 GHz should be practical; examination of the spectrum reveals that with a closer spacing the spectral overlap will give rise to significant cross-talk penalties.

Two alternative approaches have been used with success; Non return to Zero (NRZ) and Vestigial Sideband (VSB), where optical filtering removes most of one side of the spectrum. Their spectra are shown below.

FIGURE 3. SPECTRA OF RZ, NRZ AND VSB



Both formats offer the potential for 25 GHz channel spacing, and have the benefit of requiring no changes to the submerged equipment. There are a variety of other formats, which also offer reduced bandwidth, and there is some debate as to which offers the best transmission performance [3]. This question is complicated by the fact that different researchers have favored different choices for the transmission line technology. Nonetheless, it's worth remarking that NRZ and VSB have the benefits of being relatively simple to implement.

2.2 Dispersion

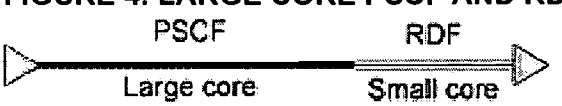
Due to the long distances between regeneration points, dispersion effects are critical and much effort has gone into finding good solutions.

For 10 Gbit/s systems Polarization mode dispersion (PMD) has not been a significant problem, as fibers with PMD < 0.1 ps / ÷km make the limit of transmission ~10 000 km, but it's worth remarking that at 40 Gbit/s the same fiber would theoretically limit the system length to 625 km. In reality, cabled fiber (in the author's experience) is typically not worse than 0.06 ps / ÷km, giving a limit of 1700nm; fibers in the lab may be even better thus allowing experiments at longer lengths [5].

Chromatic dispersion, however, has been a very important parameter for 10 Gbit/s systems. While the pulse spreading caused by chromatic dispersion is a serious issue, very low values of Cd result in serious four wave mixing and unacceptable penalties. The solution so far has been to mix low negative dispersion fiber (NZDSF at –2 ps/km/nm/nm) with high positive Cd fiber (typically ~18 ps/km/nm) to give an average value of zero. The zero value, however, occurs for only a single wavelength, with others experiencing dispersion which increases in proportion to the wavelength deviation from the zero dispersion wavelength. This requires compensation in the terminal, with many km of fiber and local optical amplifiers for long systems; the amount of equipment needed increases with the square of the bandwidth, thus making this a significant cost for wideband systems; it's also something which takes up space in the terminal station.

Here an interesting possibility is offered by the combination of large core PSCF with so called "Reverse Dispersion Fiber" (RDF) [4], where a combination of roughly 2:1 not only gives an average zero dispersion value, but also produces slope values less than 1/10 those of the current fiber combinations. (Note that compensation is now done from one amplifier to the next.)

FIGURE 4. LARGE CORE PSCF AND RDF

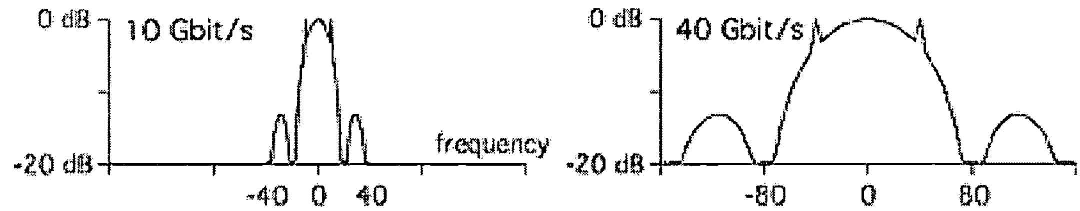


This offers the benefit of vastly reducing the terminal compensation, and for systems based on Raman amplification the very small core size (~20 m2) is ideal, as it lowers the power needed to pump the fiber. At the same time, small core size gives higher non-linear distortion for the propagated light, and both theory and experiment suggests that this fiber map offers little benefit in terms of transmission. At present its cost is high and a second issue is that repairs (where the overall dispersion needs to be tightly controlled) will be potentially more difficult, as the dispersion is much higher than NZ-DSF.

2.3 Higher line-rates

In the past higher line-rates have been economically worthwhile, essentially because the reduced number of units has outweighed the increased difficulty of processing and transmitting at higher speeds. The use of higher line-rates has also increased system capacity in the past, but now it seems this process has reached a limit. Increasing the line-rate also increases the spectral width of the signal and 10 Gbit/s signals are already close to the minimum spacing, so higher line-rates alone will not increase the system capacity.

FIGURE 5. SPECTRA OF 10 GBIT/S AND 40 GBIT/S (RZ FORMAT)



Increasing the line-rate obviously makes dispersion more critical, due to the shorter bit period and it's worth considering the impacts at 40 Gbit/s, where the total dispersion that can be tolerated becomes _ that at 10 Gbit/s. (As an aside, it's important to note also that 40 Gbit/s requires a received signal of ~6 dB more than 10 Gbit/s.)

Chromatic dispersion in fact becomes significant, as the signal spectral bandwidth is increased by 4x (thus giving rise to 4x more pulse spreading) while the time interval is reduced by a factor of 4, thus giving a 16x overall sensitivity increase. While chromatic effects can be controlled by mixing fiber types, with 16x more sensitivity the system must be designed to have a residual dispersion < 4 ps/nm for all wavelengths – and this must be maintained after a repair. It's worth noting that lab experiments tend to require fine tuning of chromatic dispersion in order to get results at 40 Gbit/s.

While PMD only becomes 4x more significant, it represents a limit of around 2500 km at 40 Gbit/s with a fiber at 0.05 ps / ÷km [5]. In the lab lower figures may be found, but in real cables the values are 0.04-0.06 ps / ÷km, making this a potentially serious problem. Maybe better fibers represent a solution, but they must maintain a low value of PMD after the fiber has been put into the cable and installed on the sea-bed. The length limitation quoted above is based on assuming that the total dispersion must not exceed 0.1 Unit Interval (UI) and there are techniques to mitigate the effects of PMD to tolerate significantly larger dispersion values. Here it's important to understand that these mitigation techniques are relatively complex and that they need to be applied independently to each wavelength, thus making them potentially expensive. Finally, periodic regeneration represents the "usual" solution to dispersion. While there are some interesting possibilities with optical regeneration, it remains relatively complicated and doesn't yet seem to be practical for subsea application, where reliability and low power consumption are key requirements.

These potential issues with 40 Gbit/s make it logical to ask whether 20 Gbit/s might be a better choice; chromatic dispersion would be 4x easier than at 40 Gbit/s and PMD should not be a serious problem [3]. Unless 20 Gbit/s becomes accepted as a terrestrial rate, however, the submarine system would require specialized multiplex equipment to accept 10 Gbit/s signals and multiplex them to 20 Gbit/s. Since this would be made for a very limited market, it would probably be expensive.

3 Conclusions

Whilst it's always dangerous to make predictions, some of the technologies discussed appear more practical for long-span submarine systems than others. Note that terrestrial systems, with their shorter spans are subject to different constraints.

Extending the bandwidth of optical amplifiers becomes progressively more difficult, the penalty initially being in terms of gain-flattening filters, which remove significant power. Above ~35 nm it will be necessary to switch either to C+L (or C+L+S) amplifiers or to use Raman amplifiers, all of which require a larger number of high power pumps than a simple EDFA; and pumps are a major contributor to repeater cost. In the case of the Raman amplifier, the pumps need to cover a range of wavelengths and to have a control scheme to give a flat gain.

More attractive is the idea of reducing the channel spacing, as it can be done simply by modifying the format of the transmitted signal. Changes involving terminal equipment only are generally less expensive then those involving submerged equipment. There are already a number of proposed formats and it remains to be seen which appears most effective.

At 10 Gbit/s the dispersion slope of today's fibers represents a significant issue as it requires complex compensation, with large quantities of fiber and optical amplifiers at the terminal. This represents an economic cost, which increases with the square of the optical bandwidth, making it a very serous issue for very high capacity systems; the equipment also uses valuable building space. A combination of large core PSCF and small core RDF may be able to produces much lower slope values, thus reducing these problems; this small core RDF is also well suited to Raman amplification. While there are issues (cost and repair techniques) regarding its use, it seems to offer some interesting possibilities.

40 Gbit/s transmission over more than 2000 km remains a serious challenge, due to a variety of propagation effects. This paper has concentrated on the problems posed by dispersion, but non-linear effects are also of significance and there is (as of August 2001) no obvious solution to long-span transmission. While 20 Gbit/s seems easier, it would require the use of specialized multiplex equipment, which is likely to present an economic penalty.

Due to lack of space (and author expertise) this paper has not considered a number of other possibilities; probably the most obvious omission is the possible evolution of Forward Error Correction (FEC), which is likely to play a significant part in future submarine systems.

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3. "A Comparison among Pure-RZ, CS-RZ and SSB-RZ Format, in 1 Tbit/s (50 x 20 Gbit/s) WDM Transmission", K Shimizu et. al. (Mitsubishi), Suboptic 2001, Kyoto, May 2001.
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Fiberes using All-Raman Amplification", L du Mouza et. al. (Alcatel), Suboptic 2001, Kyoto, May 2001.

back to index

Abstract

This paper reviews a number of R&D techniques and assesses how practical they might be for commercial systems.

back to index

Tony Frisch

Born in the UK, Tony studied Physics before working in the research labs of British Telecom, during which he acquired a Masters degree in Telecommunications. He then spent a few years in Alcatel Australia heading the testing and commissioning of TASMAN 2. After this he worked for Bell Labs in the US (designing terminal equipment) before moving back to Alcatel in France, where he has made a gradual move towards the commercial world, while still keeping his interest in technology. He is currently in charge of Product Marketing for Submarine Networks.

back to index

Technology

Wednesday, 16 January 2002
1400–1530
Coral I

W.2.4 Next Generation Cables

Chair:
SEIICHI TSUGAWA, Senior Manager, Head of International Organizations Section, Global Business Development Section, Global Business Development Division, KDDI Corporation, *Japan*

W.2.4.1 Optimum Architectures & Technologies for Multi-Terabit/second Broadband Trans-Pacific Submarine Cable Networks—the Impact of Emerging Technologies on the Overall Network Cost and Cost Per Bit (View Abstract)

COLIN ANDERSON, Senior Account Executive, Sales & Marketing Dept., Global Business Group, Networks and TATSUO MATSUMOTO, Senior Director, Submarine Telecommunications Engineering Division, Fujitsu Limited, *Japan*

W.2.4.2 From Giga-Hertz to Grapnel: The Interplay Between Terabit Plus Submarine Networks and Their Implementation in the Marine Environment (View Abstract)

HIROSHI SAKUYAMA, NEC Corporation; ROKURO MORIKAWA, OCC, Japan; JAMES RAMSHAW and JAN STRINGER, Senior Manager, Service Development, Global Marine Systems Limited, *United Kingdom*

Presenter:
JAN STRINGER, Senior Manager, Service Development, Global Marine Systems Limited, *United Kingdom*

W.2.4.3 The Role of Submarine Cables in Next Generation Communications (View Abstract)

TIM BRANTON, Director, Business Development and JEREMY FEATHERSTONE, Senior Manager, Service Development, Global Marine Systems Limited, *United Kingdom*

W.2.4.4 Meeting Demands for Submarine Networks (View Abstract)

OSAMU HARADA, Senior Manager and MARCELO COUTO, Submarine Network Division, NEC Corporation, *Japan*

back to sessions

Optimum Architectures & Technologies for Multi-Terabit/second Broadband Trans-Pacific Submarine Cable Networks-The Impact of Emerging Technologies on the Overall Network Cost and on Cost per Bit

Colin Anderson & Tatsuo Matsumoto
Fujitsu Limited
Japan

View Abstract

Key Criteria for Trans-Pacific Networks

In recent years, one of the most predominant driving pressures from the market-place has been for trans-Pacific and trans-Atlantic international submarine networks with highest ultimate capacity and lowest cost per bit, when fully equipped. The focus upon cost per bit when the system is fully equipped came about since it was assumed that in the prevailing market, which was demanding exponentially increasing amounts of capacity, every new system would be expanded to its ultimate maximum capacity in a relatively short time (over a few years), and so the system's high potential capacity and low potential overall cost per bit would both be realised.

However, in 2001 the 'Technology Bubble' burst, and the world economy has slowed, at least in the short term. So it is no longer so certain that new cable system will be expanded to their ultimate capacity in such a short time. Consequently, it is of increased importance that new systems have the lowest possible cost per bit at initial (small) equipped capacities, as well as a low cost per bit at their ultimate (high) capacity. We can expect purchasers of new systems to be much more willing to make a trade-off of initial cost against ultimate cost or ultimate capacity, than in year 2000.

Similarly, if systems are deployed with ultimate capacity far in excess of that which will actually be required in the medium term, then these systems will not be expanded to a significant percentage of their ultimate capacity in a relatively short time, and the overall cost of the equipped capacity will be higher than if a cable network with a lower ultimate capacity had been installed. However, despite the slowing of the world economy, technology developments continue at a fast pace, and it still seems certain that cable system deployed in the future will have lower overall costs that cable systems deployed now.

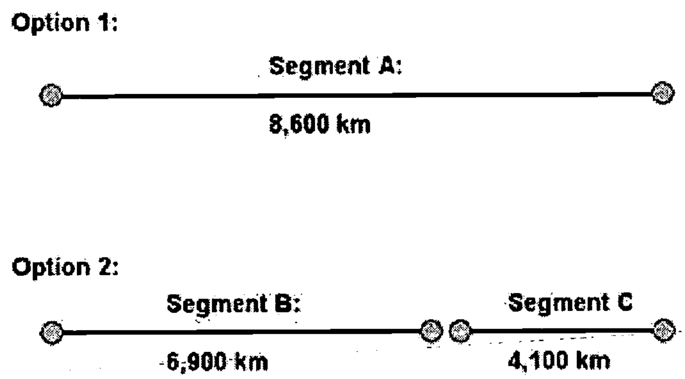
The expected longer time to fill the capacity of new cable systems, has led to renewed evaluation of the optimum strategy for routes such as the trans-Pacific: is it really preferable to deploy one cable with large ultimate capacity, or a cable with a smaller capacity, to be followed by another cable a few years later.

Architecture of Trans-Pacific Submarine Networks

The span of a trans-Atlantic submarine cable network is typically in the range of 6,000 km to 7,000 km. There is no convenient mid-Atlantic landing station except Bermuda, and the total span of around 6,500 km has been achieved in the past with application of appropriate technologies.

- However the typical trans-Pacific spans are longer - around 8,500 km or more. Several current transpacific submarine cable networks utilize a mid-Pacific island such as Hawaii or Guam as a landing station, both to minimise the span between submarine line terminal equipment and to allow traffic add & drop, with interconnection to other international cables, for example Southern Cross, Japan - US, etc. Hence the route options available for trans-pacific cable systems include a direct span, for example from USA - Japan (approx 8,600 km); or two spans via Hawaii (USA - Hawaii: 4,100 km; Hawaii - Japan: 7,000 km).

FIGURE 1: TRANS-PACIFIC CABLE CONFIGURATIONS



Trans-Pacific Cable Configurations

In order to meet the objective of lower span between terminal equipment, all fiber pairs and all wavelengths must be terminated at the intermediate station, even though the actual traffic added or dropped is usually a small percentage of the total capacity. The consequent additional terminal equipment adds significantly to the overall cost per bit of traffic between the end stations - for initial capacity (to some extent), and for the ultimate expanded capacity (to a much larger extent).

Recent Trans-Pacific Systems

In the recent past the following trans-Pacific systems have been deployed, employing different configurations:

China - US Cable: Direct Route, 8 x 2.5 Gb/s (20 Gb/s per fiber pair)

Japan - US Cable: North Route: Direct USA - Japan; South Route: USA - Hawaii - Japan. 16 x 10 Gb/s (160 Gb/s per fiber Pair)

New Enabling Technologies

In our paper presented at PTC2001 we outlined the promising new enabling technologies for long-haul high-capacity submarine cable systems. Some of these key technologies relevant for this analysis are:

- **Dispersion Managed Optical Fibers**

Dispersion Managed Optical Fiber schemes became commercially available in 2001. These comprise a length of positive chromatic dispersion fiber, which also has a positive dispersion slope (variation of dispersion with wavelength); together with a length of negative chromatic dispersion fiber, which also has negative dispersion slope. The combination of these two specialised fibers in each repeater span has several important benefits:

- high effective area (Aeff) at the beginning of the span (longer spans are feasible by using higher output powers per channel - the high Aeff minimises non-linear effects due to high transmit power);
- low attenuation (loss) (longer spans between repeaters);
- low overall dispersion & low dispersion slope (minimised dispersion difference between channels - cost and space savings in dispersion compensation at the terminals);
- high localised dispersion (minimised cross-modulation impairments at high powers).

We can expect further improvements in the specification of future Dispersion Managed Fibers in the near future.

Distributed Raman Amplification

Improved bandwidth and improved Signal to Noise Ration (SNR)

Active Dispersion Compensation Techniques

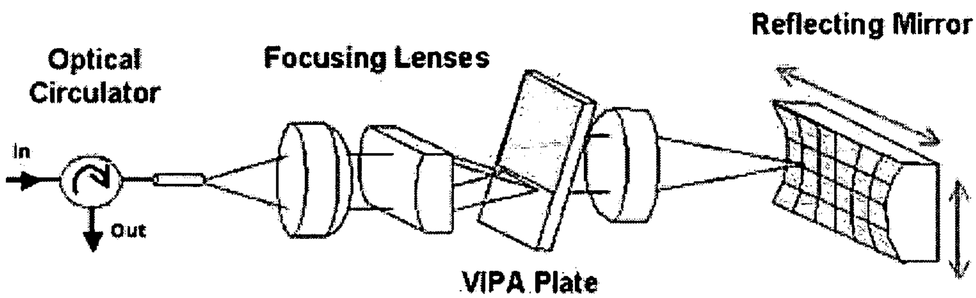
A promising new technology is the Virtual Imaged Phased Array (VIPA). Active Dispersion Compensation offers the possibilities of increased bandwidth, decreased impairment tolerances, space savings and eventually cost & lead-time savings

Advanced Forward-Error-Correction Schemes

In 2001, second-generation FEC schemes with coding gain of almost 8 dB were introduced. We can expect further new technologies to enable coding gains of around 10 dB.

FIGURE 2: VIRTUAL IMAGED PHASED ARRAY TECHNOLOGY

The "Virtual Imaged Phased Array" (VIPA) As an Active Dispersion Compensator



VIPA Dispersion Compensation

Technology Steps

The above "enabling technologies" give us a reasonably clear view of the sequence of likely technology steps:

Step 1 (Current Technologies)
980 nm pumped EDFA

Step 2 (Near Term Technologies)
980 nm pumped EDFA with Distributed Raman Amplification
Active Dispersion Compensation
New FEC scheme ?

Step 3 (Long Term Technologies)
All Raman Amplification
Active Dispersion Compensation
New FEC schemes

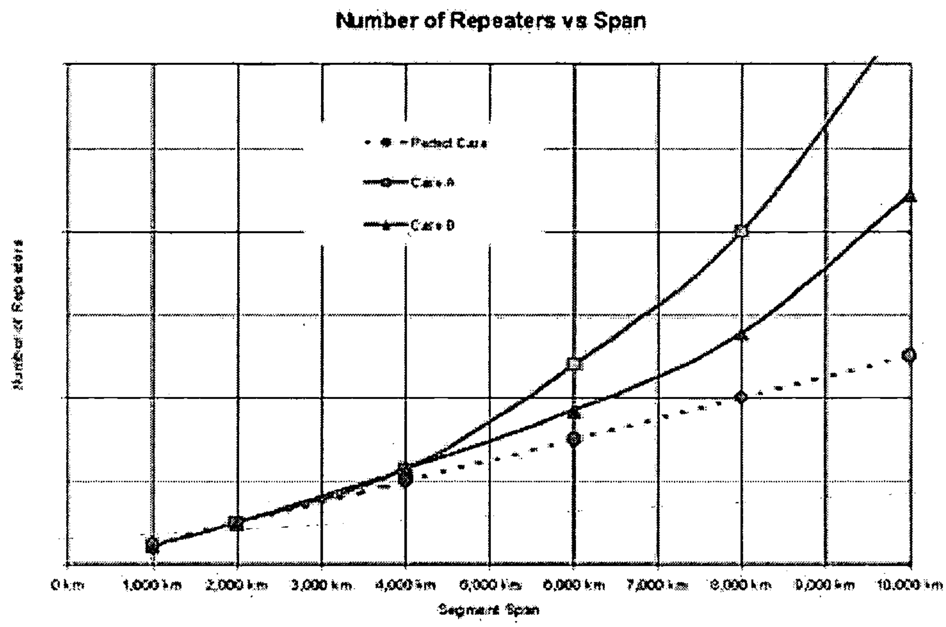
In practice we may even skip Step 2 and migrate directly to Step 3.

Impact of Number of Repeaters

A common factor of all of the current technologies and foreseeable technologies is that in case of very long spans without regeneration, the aggregated amplifier noise requires that the repeater spacing be decreased. In turn this means that more amplifiers are required, which adds to the noise problem. In real systems, each technology has a practical limit to the possible span without regeneration. When the span approaches the limit, then a further increase in the number of repeaters does not improve the performance, it simply adds to the system cost without benefit (for example, Case A).

If we can reduce the amplifier noise, and increase the amplifier spacing in general (for all segment spans), then we can obtain a longer practical economical span without regeneration. (example, Case B).

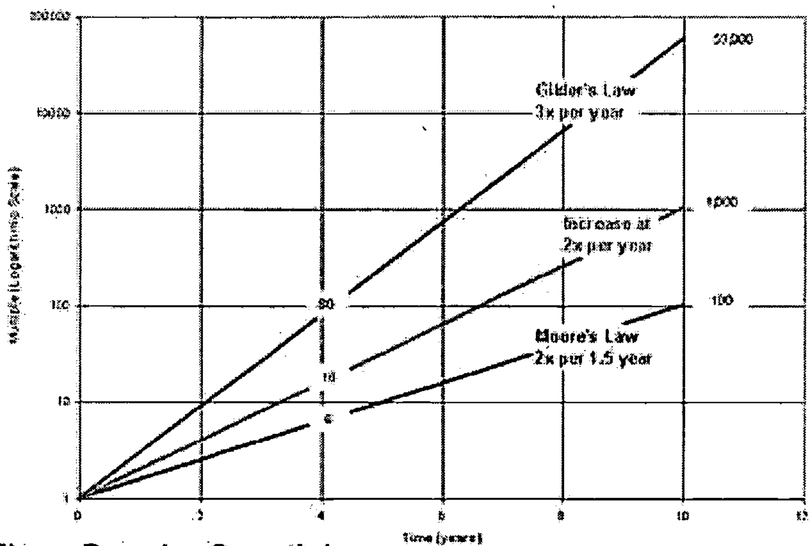
FIGURE 3: NUMBER OF REPEATERS



Impacts New Technologies

Three popular growth "laws" are shown below. "Moore's Law" has been applied to the development of semiconductor technology - performance doubles approximately each 1.5 years. A growth rate of "two time per year' is often attributed to the growth of the internet in the late 1990's. And Gilder's Law (after George Gilder) asserts that some specifications of optical technologies are growing at three times per year.

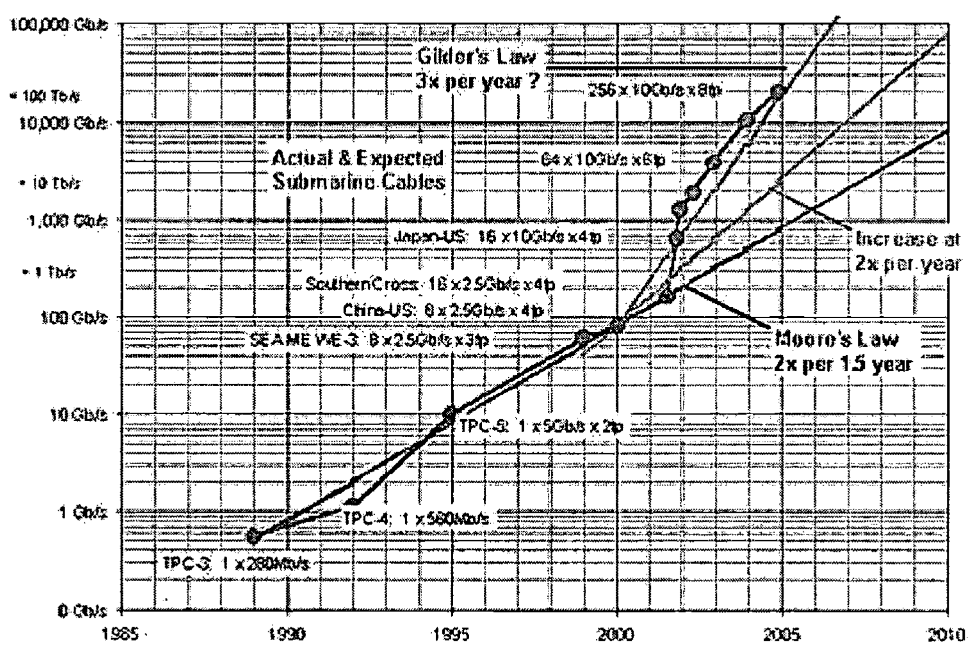
FIGURE 4: THREE POPULAR GROWTH LAWS



Three Popular Growth Laws

In the past 10 years or so, the developments in submarine cable technology have managed to at least provide ultimate capacity growth exceeding Moore's Law, and more recently meeting and exceeding Gilder's Law. A growth rate of two time per annum in ultimate capacity seems possible in the next few years.

FIGURE 5: PACIFIC SUBMARINE CABLE CAPACITY VS TIME



Submarine Cable Capacity vs Time

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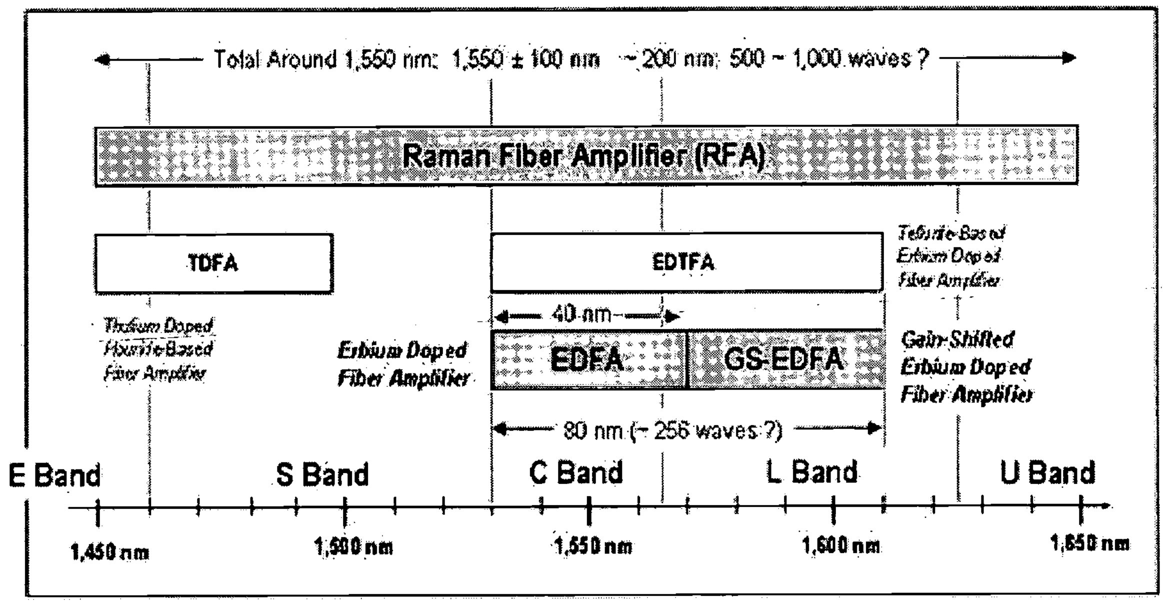
Recent Experiments to Validate Emerging Technologies

The industry's suppliers have all been performing transmission experiments to validate the emerging "enabling" technologies. The have recently included experiments in the C-Band and L-Band optical bands, as well as experiments utilising both bands.

FIGURE 6: AVAILABLE OPTICAL BANDS



Available Optical Spectrum & Types of Optical Amplifier

Our recent experiments are shown in the following table:

FIGURE 7: RECENT FUJITSU EXPERIMENTS (1999 ~ 2001)

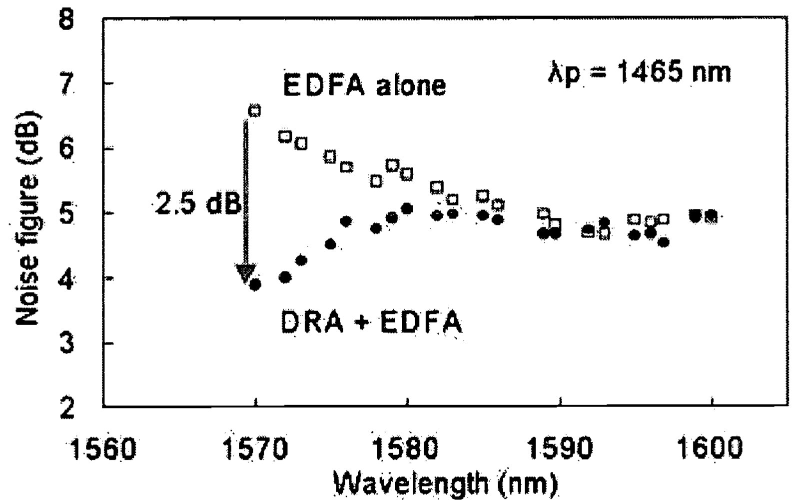
Capacity	Length	Band	Fiber	Technology
68 x 10 Gb/s	4,000 km	C (27 nm)	NZ-DSF	EDFA
84 x 10 Gb/s	4,000 km	C (25 nm)	NZ-DSF	EDFA
105 x 10 Gb/s	4,925 km	C (31 nm)	LCF+LS*	EDFA
105 x 10 Gb/s	6,256 km	C (31 nm)	+D / -D	EDFA & DRA
211 x 10 Gb/s*	7,221 km	C+L (64 nm)	+D / -D	EDFA & DRA
105 x 10 Gb/s*	8,186 km	C (31.2 nm)	+D / -D	DRA (& EDFA)
122 x 10 Gb/s	7,221 km	L (38 nm)	+D / -D	EDFA & DRA
132 x 10 Gb/s*	6,173 km	C~L (40 nm)	+D / -D	DRA & Lumped RA
240 x 10 Gb/s*	**7,404 km**	**C~L (74 nm)**	**+D / -D**	**DRA**

NZ-DSF: Non-Zero Dispersion Shifted Fiber
LCF: Large Core Fiber (Large Effective Area Fiber)
RS: Reduced Dispersion Slope Fiber
+D: Positive Dispersion, Positive Slope Fiber
-D: Negative Dispersion, Negative Slope Fiber

Fujitsu Experiments Published, 68 ~ 240 λ x 10 Gb/s

In particular, the performance capabilities of Dispersion Managed Fibers (DMF or +D / -D Fibers) and Distributed Raman Amplification (DRA) have been well proven recently, as shown by the following excerpts from results of some of the above experiments.

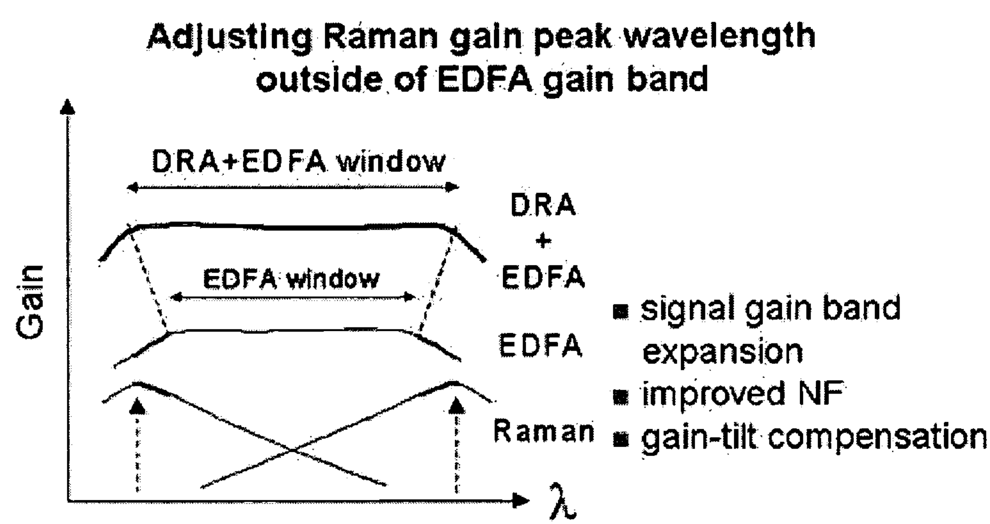
The signal to noise ratio has been improved by application of Raman Amplification:
FIGURE 8: IMPROVEMENTS IN SIGNAL TO NOISE BY RAMAN AMPLIFICATION



Improvement in Noise Figure by Raman Amplification

And the signal band-width has also been increased:

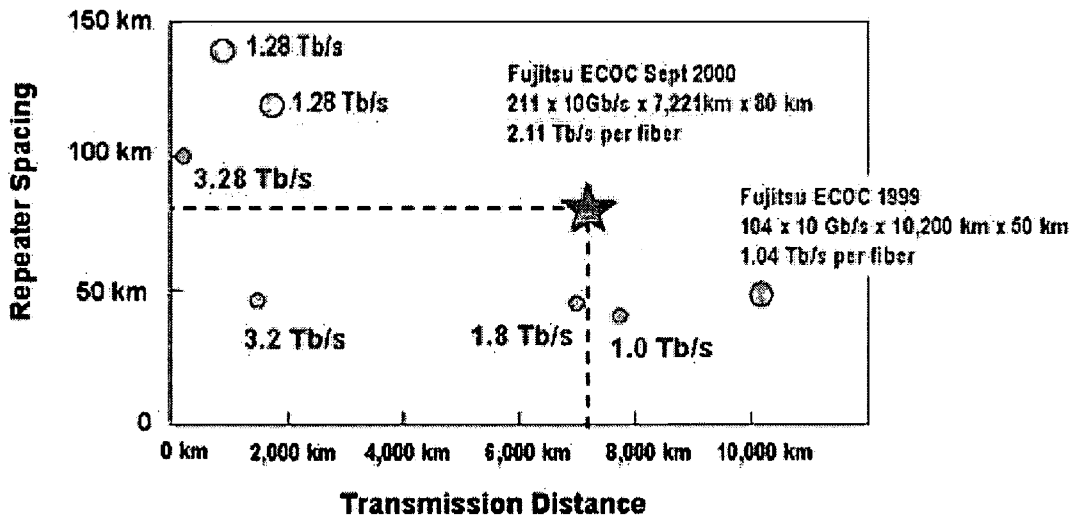
FIGURE 9: BANDWIDTH EXPANSION USING EDFA & DRA



Hybrid Amplification Scheme: EDFA + Raman Gain

Repeater spacing has been increased by applying Raman Amplification and Dispersion Managed Fibers:

FIGURE 10: EXPERIMENTS WITH INCREASED REPEATER SPACING



Recent Experiments: Repeater Spacing vs Distance

An experiment with 105 waves of 10 Gb/s (1.05 Tb/s) over 8,186 km, using both Erbium Doped Amplification (EDFA) and Distributed Raman Amplification (DRA), was presented at the OFC2001 conference in Anaheim USA in March 2001:

FIGURE 11: RAMAN AMPLIFIER CONFIGURATION 105 WAVE X 10 GB/S X 8,186 KM EXPERIMENT

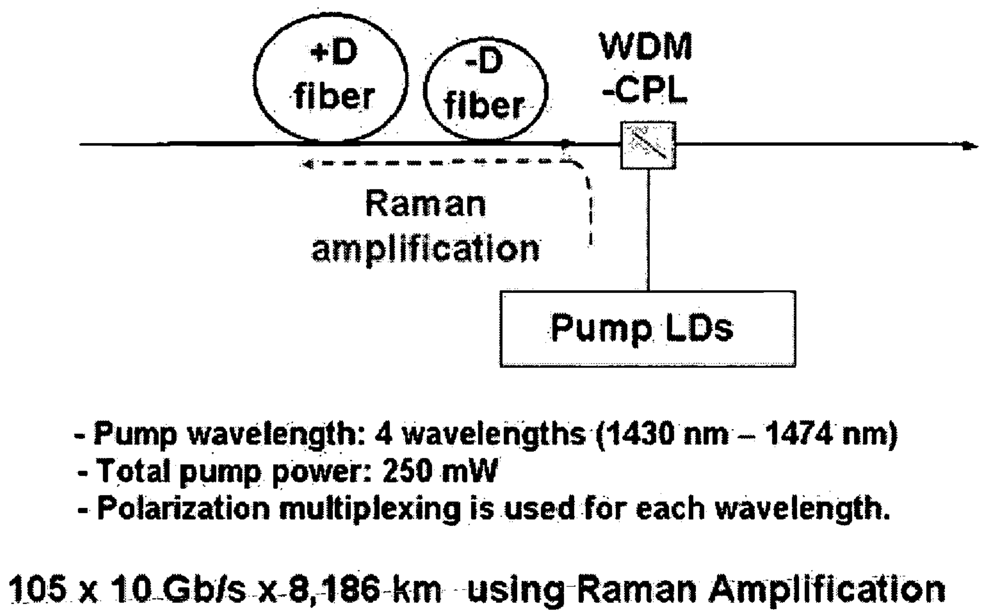


FIGURE 12: SPECTRA FOR 105 X 10 GB/S X 8,186 KM TRANSMISSION EXPERIMENT

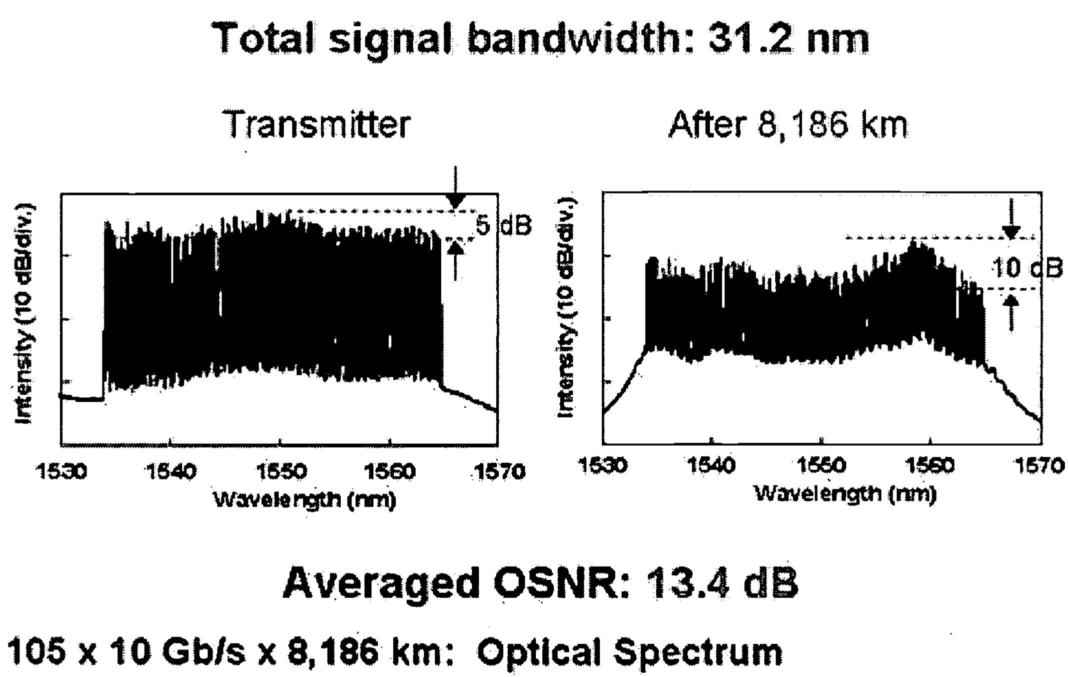
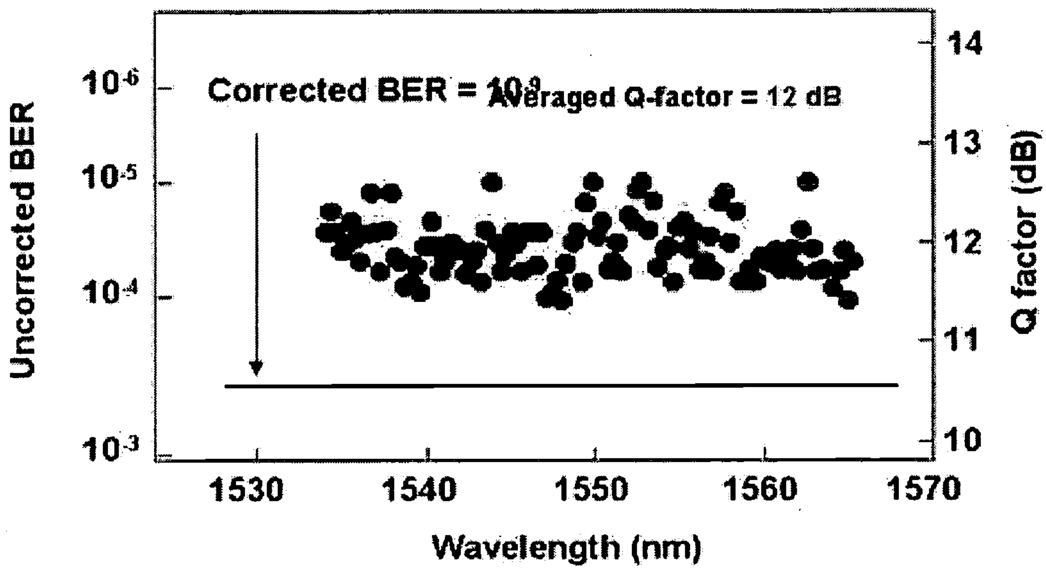


FIGURE 13: BIT ERROR RATE AFTER 8,186 KM



105 x 10 Gb/s x 8,186 km WDM Transmission over 8,186 km

An experiment with 132 waves of 10 Gb/s (1.32 Tb/s) over 6,173 km, using only Raman Amplification, was presented at the SubOptic 2001 conference in Kyoto, Japan in May 2001:

FIGURE 14: SPECTRA FOR 132 X 10 GB/S X 6,173 KM
EXPERIMENT USING ONLY RAMAN AMPLIFICATION

Optical Spectra Before & After Transmission

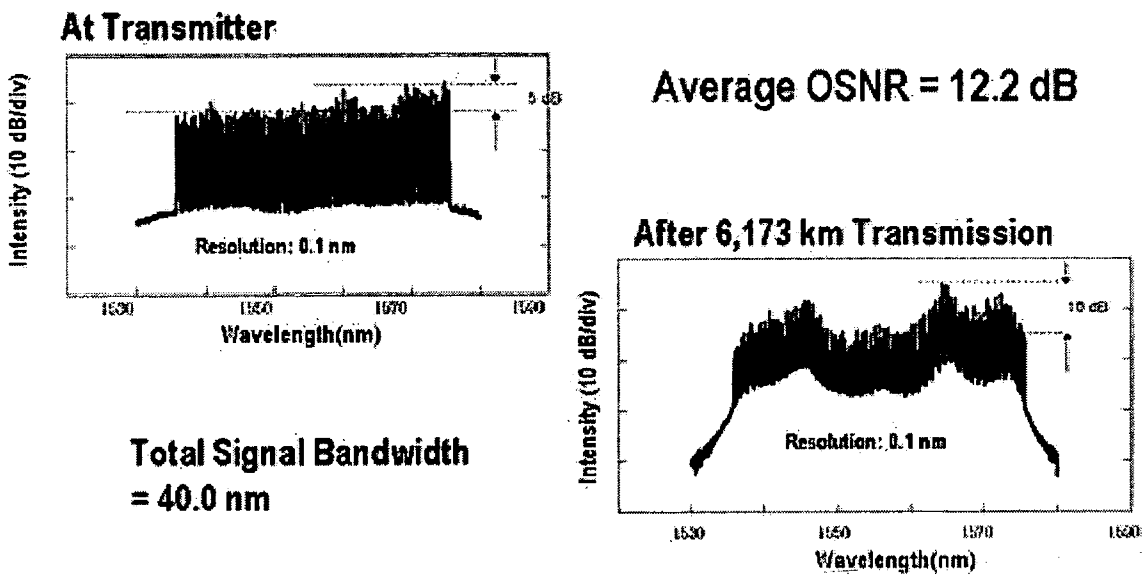
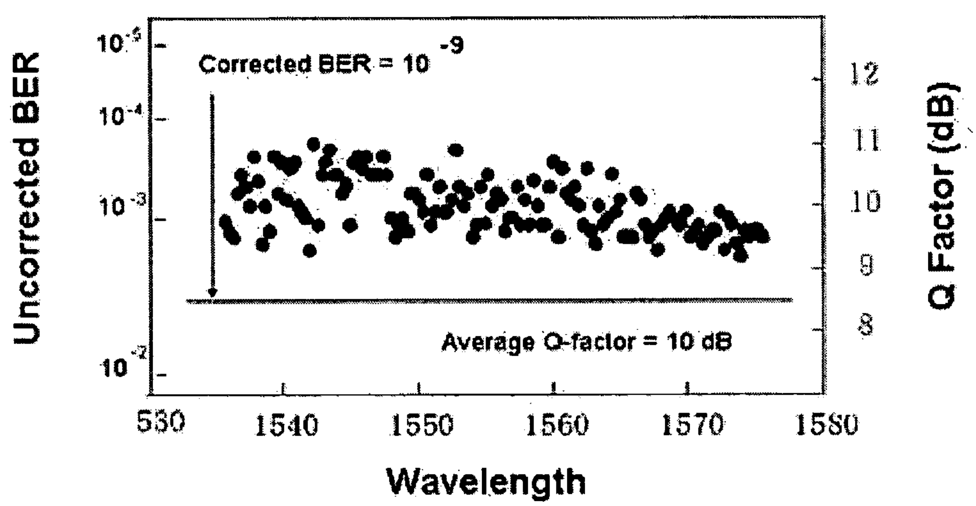


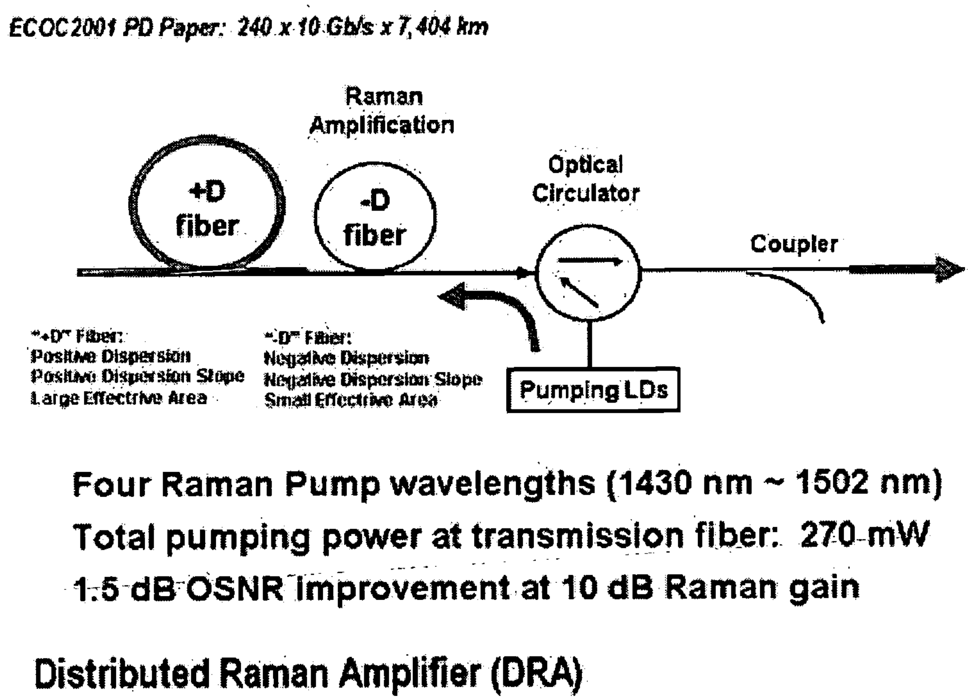
FIGURE 15: BIT ERROR RATE AFTER 6,173 KM
USING RAMAN AMPLIFICATION

BER Measurements: 1.32 Tb/s over 6,173 km



At the European Conference on Optical Communications (ECOC 2001) held in Amsterdam, Netherlands, in October 2001, the results of an experiment utilising only Raman Amplification, and transmitting 240 waves of 10 Gb/s over 7,404 km without regeneration, were presented.

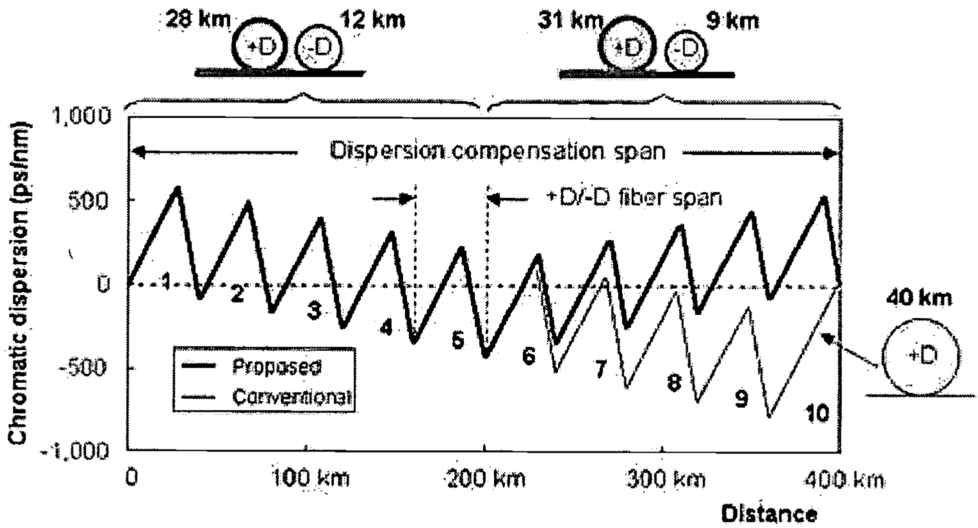
FIGURE 16: DISTRIBUTED RAMAN AMPLIFIER FOR 240 X 10 GB/S X 7,404 KM



A new dispersion map was adopted to enable all-Raman amplification to be used effectively.

FIGURE 17: DMF DISPERSION MAP FOR 240 X 10 GB/S X 7,404 KM EXPERIMENT

ECOC2001 PD Paper: 240 x 10 Gb/s x 7,404 km



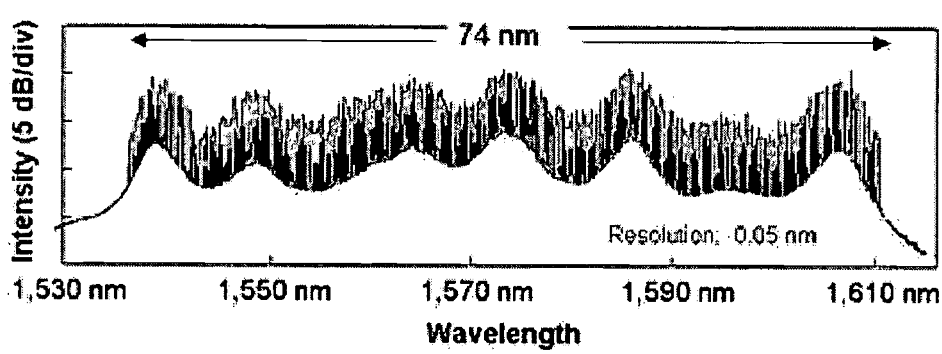
New Dispersion Map for DRA

The spectrum and measured bit-error rate were as follows:

FIGURE 18: OPTICAL SPECTRUM AFTER 7,404 KM TRANSMISSION

ECOC2001 PD Paper: 240 x 10 Gb/s x 7,404 km

Averaged OSNR: 13.1 dB (1.5 dB improvement)



Optical Spectrum After 7,404 km Transmission

FIGURE 19: MEASURED BER AFTER 7,404 KM TRANSMISSION

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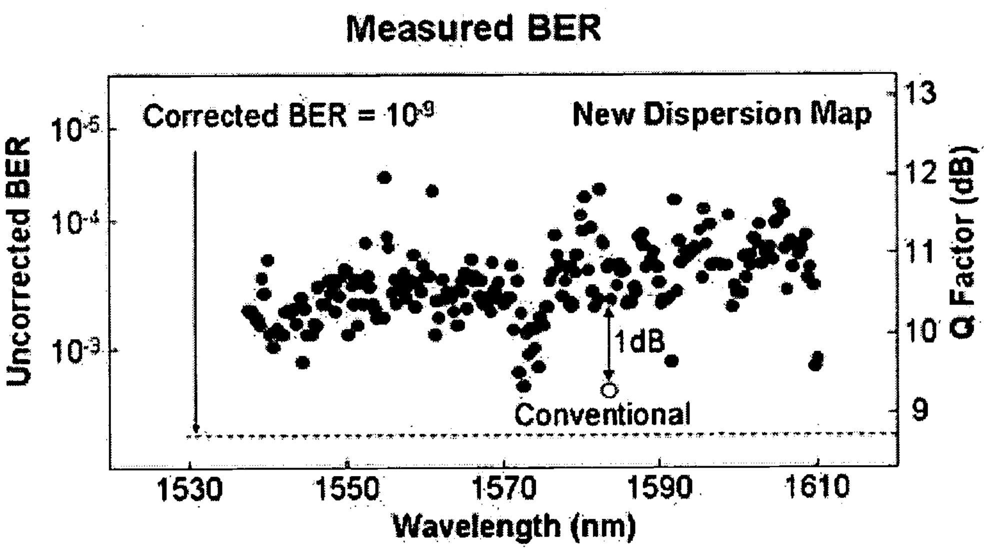
ECOC2001 PD Paper: 240 x 10 Gb/s x 7,404 km



Un-Corrected BER's & Corresponding Q-Factor

These experiments demonstrate the continuing progress of optical transmission technologies.

Impacts of Technology Options on Trans-Pacific Cables

Impact of Technology on Ultimate Capacity

With current technologies, the ultimate capacity for a direct USA - Japan segment is around 64 x 10 Gb/s. For systems stopping at Hawaii, around 96 x 10 Gb/s are achievable.

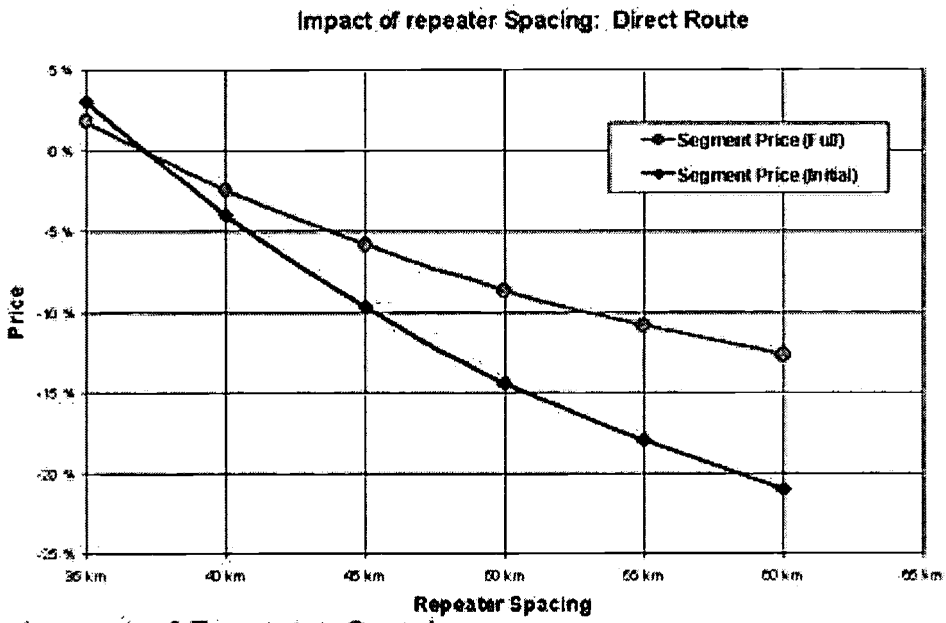
Near term technologies will increase the ultimate capacity possible for direct cables to over 128 x 10 Gb/s.

Impact of Technology on Price of Initial Capacity

The advantages of the new technologies may be employed to lower the price of cables, which have the same capacity as existing systems, or to increasing the ultimate capacity of new systems.

In particular, the initial price of systems equipped with only small capacity (but expandable to much higher ultimate capacity) is strongly dependent upon the number of submarine repeaters. And increase in repeater spacing, achieved by using new technologies, can have a significant impact on the price per bit of initially equipped channels. The impact of repeater spacing on the price per bit of fully equipped systems is :

FIGURE 20: IMPACT OF REPEATER SPACING ON

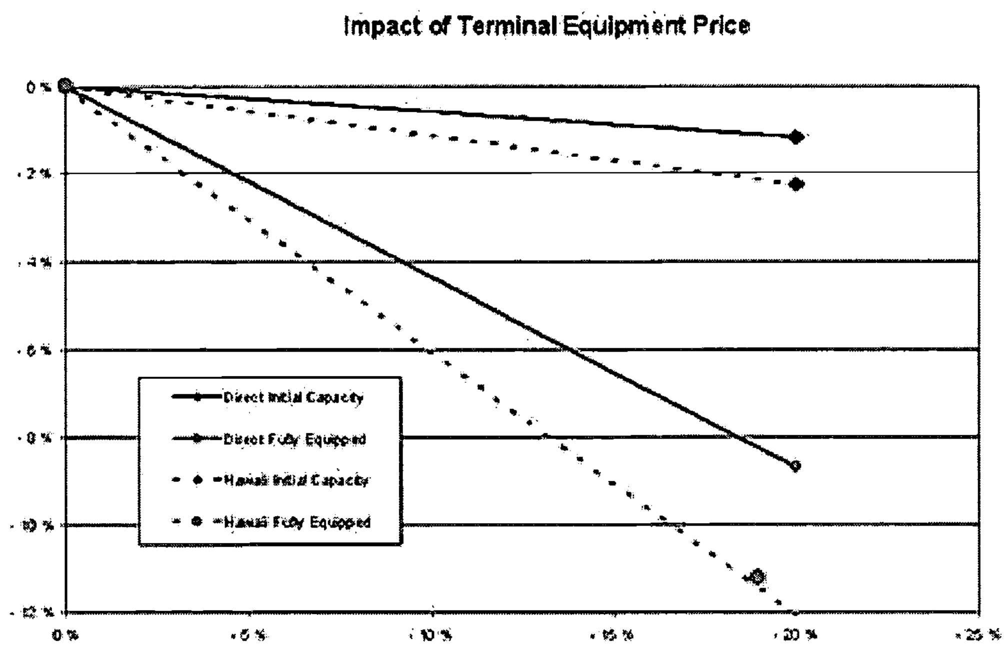


Impact of Repeater Spacing

PRICE

On the other hand, the price of the terminal equipment at the cable landing stations, has a more significant impact on the price per bit of the fully equipped capacity.

FIGURE 21: IMPACT OF PRICE OF TERMINAL EQUIPMENT ON PRICE PER BIT



Impact of Terminal Equipment Price

Impacts of Route Options

Impact of Route on Price of Initial & Ultimate Capacity

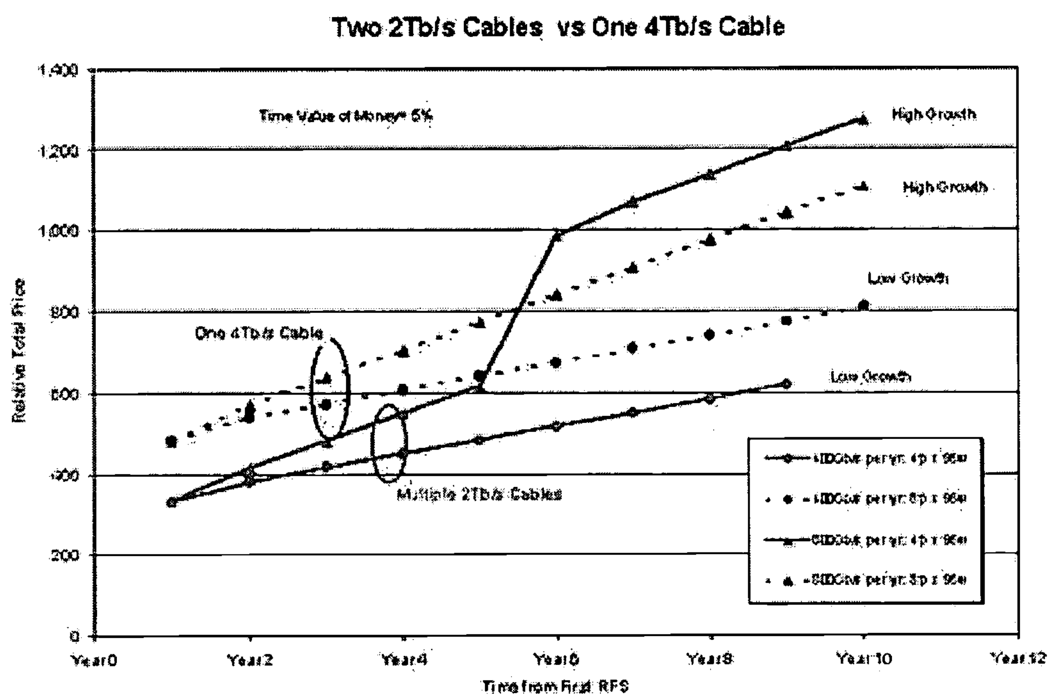
The choice of a route via Hawaii, rather than a direct route, can increase the price of initially equipped capacity by around 10 %. However the impact on fully equipped capacity is much greater - around 25 % ~ 35 %.

Economies of Scale

An analysis of the overall costs of deploying multiple cables with relatively small ultimate capacity on a route, rather than one cable with highest possible ultimate capacity, reveals that at moderate growth rates of capacity requirement, one large capacity cable may not be the most cost effective solution.

There are many variables, including the expected and actual capacity requirement growth, the time value of money, and the impacts of technology on cables of various different ultimate capacities. However in the current economic environment, where requirements for capacity have slowed, careful analysis is worthwhile.

FIGURE 22: MULTIPLE CABLES OVER TIME VS ONE SINGLE ULTRA HIGH-CAPACITY CABLE



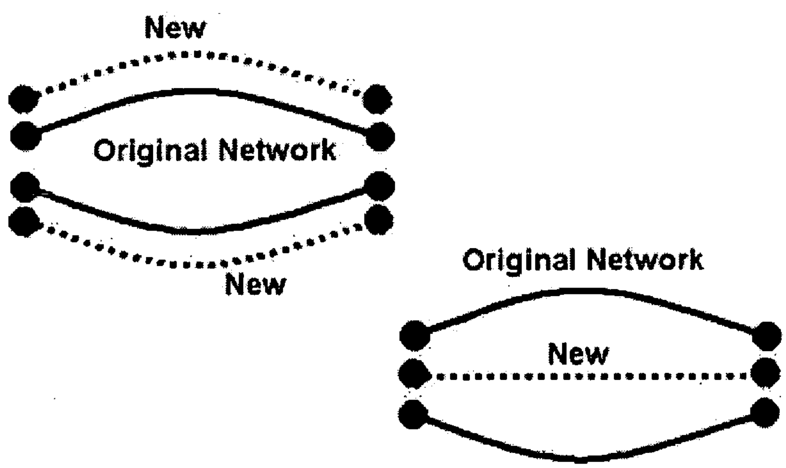
Economies of Scale ? Two Small vs One Large

Possible Overbuild Architectures for Ring Networks

As an alternative to overlaying an existing ring system a new cable system of higher capacity using the same or similar landing, another configuration warrants consideration.

Assuming the ultimate capacity of the initial cable system is N Tb/s, a single new system with capacity 2 x N Tb/s bisecting the initial ring, will allow two rings with capacity N Tb/s to be formed.

FIGURE 23: ALTERNATIVE NETWORK EXPANSION ARCHITECTURES



Two Overbuild Architectures for Ring Networks

Summary & Conclusion

Technology limits the bandwidth x distance product of un-regenerated spans, and if capacity alone is the driver then a mid-Pacific landing seems necessary. However the lowest cost per bit for initial capacity and also fully-equipped capacity is achieved with a lower capacity and a direct trans-Pacific route.

There will be situations where it is more cost effective to consider two smaller capacity cable separated by a few years, rather than one cable with very large ultimate capacity.

Repeater spacing has the biggest impact upon cost per bit of initial capacity, but terminal equipment has the biggest impact on the price per bit of fully equipped capacity.

New technologies continue to be developed to increase the repeater spacing for a particular capacity and segment span, and other technologies are being developed to reduce the price per unit capacity of submarine WDM terminal equipment.

In addition to the decision of direct versus indirect trans-Pacific route, system architectures other than the conventional 4-node ring architecture should be considered, perhaps combining existing and new cables into one network.

back to index

Abstract

In this paper, we study the impact of near-term new technologies on the price of future high-capacity trans-Pacific international submarine networks, and try to evaluate the merits and demerits of two key aspects of the design of trans-Pacific networks upon the price of network capacity at beginning of life and when fully expanded. These aspects are:

- the ultimate design capacity; and
- the route architecture, either direct or with a mid-Pacific landing.

We look at the latest enabling technologies for latest submarine networks, and evaluate their impact on the feasible architectures, bandwidth capacity, and price (in capital terms and price per bit terms) for large-capacity trans-Pacific submarine networks, either with landing at an intermediate station of utilising direct route.

back to index

Colin Anderson

Colin Anderson holds the position of Senior Account Executive, in the Sales & Marketing Department of Fujitsu Limited's "Global Business Group, Networks".

He was born in Wanganui, New Zealand, a small city approximately 200 km north-west of the capital city of Wellington, and received a BSc degree, majoring in physics, from Victoria University in Wellington New Zealand in 1975. From 1976 he worked for Philips New Zealand Ltd in engineering and marketing roles, until he joined Fujitsu New Zealand Ltd in 1986, as a senior marketing engineer for telecommunications systems.

In 1984 he started part-time post-graduate business study, and in 1988 received an MBA degree from the Victoria University Graduate School of Business and Government.

In 1992 he moved to Tokyo Japan, to take up a position in the International Telecommunications Business Group of Fujitsu Limited, initially as an assignee on a 2-year contract, primarily supporting optical and wireless SDH transmission business in the South Pacific region. Now, 9 years later, he is a full-time staff member of the parent company, Fujitsu Limited, and is currently responsible for business development in the Submarine Networks Division.

Mr Anderson is a member of The Institute of Electrical and Electronic Engineers (IEEE) Communications Society.

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He has recently had in-depth involvement in the project management of several projects including the SEA-ME-WE 3 Cable Network, the Southern Cross Cable Network, and the Japan-US Cable Network, as well as in the planning and bidding for future networks.

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back to index

From Giga-Hertz to Grapnel: The Interplay Between Terabit Plus Submarine Networks and Their Implementation in the Marine Environment

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View Abstract

1. Introduction

The transmission technology boundaries are being pushed forward relentlessly in order to satisfy the global hunger for more communication capacity.

Major increments of system capacity place additional constraints upon the parameters of the transmission medium — in this case the submarine cable. The impact of these constraints for the installation and maintenance of new submarine systems needs careful consideration. Ideally a collaboration between leading transmission system and marine technology providers should be formed early in the design stage. Failure to do so reduces the system lifetime and makes the operation and maintenance logistics expensive and unwieldy.

Figure 1 Growth in Americas-Asia cable design capacity

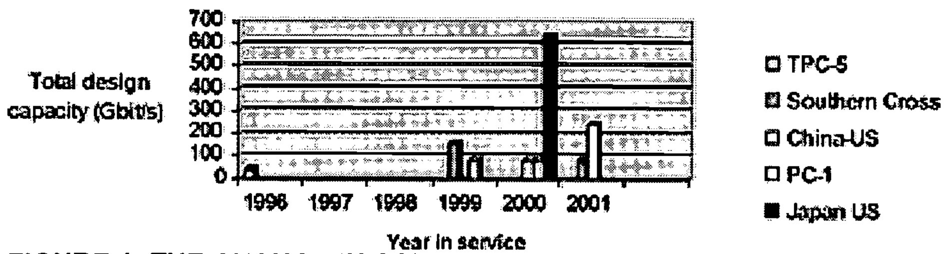

FIGURE 1: THE CHANGE IN CABLE CAPACITY OF AMERICAS-ASIA SYSTEMS OVER THE LAST 5 YEARS

2. High Capacity Systems

The installation and maintenance implications of such increase in capacity are immense. Firstly the availability of 'easy' routes through the crowded regions requires precision surveying and laying to ensure the security of these 'fat pipes' are not compromised. The cost and technical implications of restoring terabits of traffic requires 'intelligent' cable protection i.e. assessing what the risks of damage are for different parts of the route and protecting the cable appropriately. Analysis of a global submarine fault database shows that submarine fault rates can vary enormously according to who plans and installs the cable.

Efficiency and expertise in maintenance contracts are essential to bring the cable back to life in the shortest time possible. Every aspect from maintenance vessel location, to spare submarine plant, needs to be considered carefully. The objective is to restore these huge traffic capacities as soon as possible without compromising the system's long term performance and reliability.

3. New Systems

System designers have various options to choose from when designing a new, high capacity, submarine cable. This paper considers each of the three principal methods of increasing capacity in a single submarine cable in turn. In practice a combination of these approaches is chosen that minimises system cost and technical risk whilst maximising reliability and performance.

3.1 Higher number of optical fibres per cable

In un-repeatered systems high fibre count cables are common place with 48 fibre pairs typical but over 200 fibre cables are available. Because these systems do not carry electrical power, the implications of such increases in core fibre count have little effect on the mechanical characteristics of the cable. Thus the principal impact on marine operations is in the jointing and testing areas.

Until very recently the long haul or repeatered market limited their number of fibre pairs to four. The economic and political drivers for increasing beyond this limit are now strong enough to cause designs to be up to 12 fibre pairs to be planned. This can mean larger diameter cables, higher voltages and either larger, or closer spaced repeaters.

The main impact of these developments on the marine installation is the speed of operations. Operations with higher fibre count systems could take longer unless new processes/equipment are developed. This will need careful assessment during the planning stages.

There are also shipboard equipment issues' as cable ship's equipment is designed for the current generation of fibre optic cables. How substantial these changes are will depend on exactly what cable designs come to market. Power feed and jointing technology, that are needed for installation and , are likely to be the most effected. On the vessel side, ships could become volume limited for maximum load sizes, and repeater capacities could need to be changed. The higher voltages of these systems also have personnel safety issues.

3.2 Faster transmission speeds.

The most economic solution, in terms of both terminal station space and system cost, is usually to increase the transmission speed or bit rate of the system. However as bit rates increase so does the impact of one of the main limitations to long haul submarine systems: - namely chromatic dispersion.

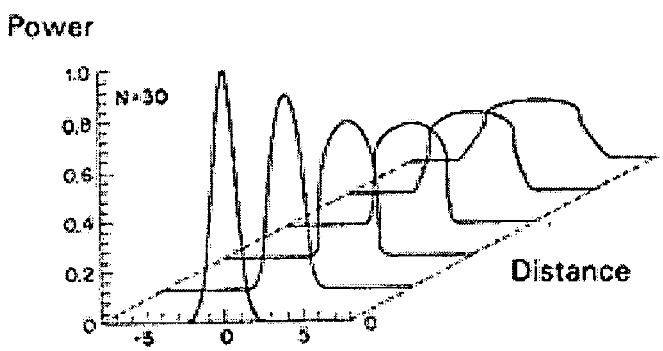

FIGURE 2: THE PULSE SPREADING EFFECT OF CHROMATIC DISPERSION

Chromatic dispersion is due to the fact that different components of the optical spectrum of pulse travel at different speeds along the fibre. Thus over substantial distances of cable, the pulses can spread or blur so much that they interfere with adjacent pulses causing loss of information. This effect is illustrated, for a single pulse, in figure 2. The impact of chromatic dispersion increases with the square of the bit rate, thus for new systems with bit rates of 10Gb/s and higher, complex dispersion management schemes are needed. The transmission characteristics of existing systems also have to be re-examined when upgrading the transmission speed of the terminal equipment.

These higher bit rates, and future upgrade requirements, mean that the dispersion budget for the entire lifetime of the system must be carefully designed to allow for the reality of the maintenance operation. Some dispersion management can be effected at the terminal stations. However, on long haul systems, an essential management tool is the combination of different combinations of fibre types both within the same the repeater span, and at the end of a block of repeater spans.

The basic principle of chromatic dispersion management by fibre compensation is illustrated in Figure 3.

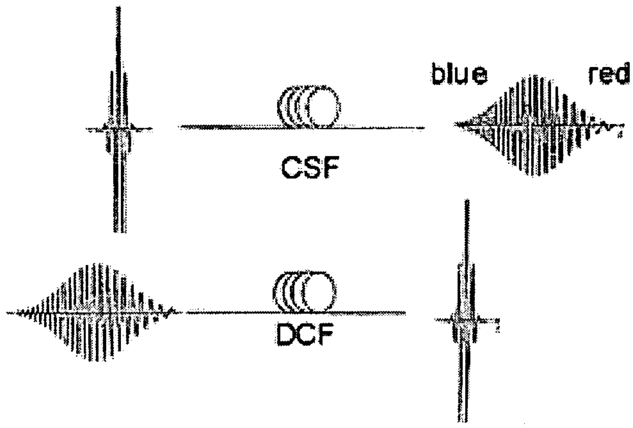

FIGURE 3: THE MANAGEMENT OF CHROMATIC DISPERSION CAUSED PURE SILICA CORE FIBRE (CSF) BY DISPERSION COMPENSATING FIBRE (DCF)

The location of the transition between fibre types varies between the fibres on the same cable. This means that the maintenance operation includes not only fault location, cable retrieval and cut back to the 'good' portion of fibre; but also it needs to identify the each type of fibre in each strand. Unless the cable is marked to identify fibre transition points special testing is required to do this.

Repair operations need to insert more cable into the system than is removed. In deep water this equates to additional lengths of more than twice the water depth. Thus the cable engineering staff need to 're-balance' the chromatic dispersion of the segment by choosing appropriate ratios of the different fibre types. If a combination of fibres is needed for this re-balancing, an additional joint is required in the system, which must be accounted for in both spares provisioning and system loss budgets. Any changes to the system have then to be logged and communicated quickly, not only to the system owners but also any other maintenance providers, who might be operating on the same system.

Each system has a unique repair methodology for dispersion compensation. The solution proposed varies not only with the approach of the particular supplier, but the particular transmission characteristics, length and upgrade specification of each cable system. Broad experience of maintaining different suppliers systems is needed, as most maintenance zones contain a wide variety of cable technologies from different suppliers. The system owner needs to ensure that the system maintenance documentation delivered with the system is sufficient. Otherwise their freedom to choose independent upgrade and/or maintenance solutions will be restricted.

3.3 Increased number of wavelengths

Increased number of wavelengths can be achieved either by packing the channels closer within the normal band that the systems operate in (i.e. reducing the spacing between adjacent ones), or increasing the range over which the system operates (i.e. increasing the bandwidth).

Packing the channels closer has problems in maintaining the discrimination between one wavelength or frequency channel and the next. This requires either tight tolerance components or clever modulation schemes to implement.

The increase of system bandwidth is mainly limited by amplifier technology. Although new developments in Raman amplification are promising, No 'ideal' wideband fibre amplifier is currently deployed. Thus increasing the fibre bandwidth means splitting the cable into two bands of wavelengths and amplifying each separately. Thus the size and or spacing of the submarine repeaters are effected and thus the spares logistics becomes more complex.

An important consideration in broadband systems is that the chromatic dispersion of the fibre varies with wavelength. The linear variation of which is referred to as dispersion slope.

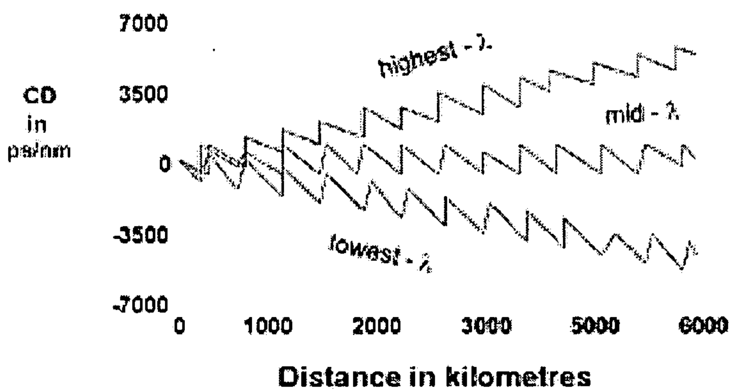

FIGURE 4: CD COMPENSATION AND VARIATION WITH WAVELENGTH (λ).

In Dense Wave Division Multiplexed systems this means that different channels will be experiencing different amounts of chromatic dispersion. This is illustrated in Figure 4

Thus not only the absolute value of dispersion has to be managed but the dispersion slope also has to be flattened using different combinations of dispersion slope compensating fibre[1]. As the number of repairs on a system increases the error budget allocated for the dispersion slope will have to be monitored and careful calculations made on the effect of new lengths and types of fibre inserted in the repair. It is vital to future proof the system by paying careful attention to dispersion over the whole of the planned bandwidth of the system. Even though the system may be early in its life and only transmitting a few number of wavelengths of the maximum designed wavelengths, failure to manage dispersion ab initio can result in the system being unable to reach its full design capacity.

4. Future developments and challenges

The pace of innovation in the submarine cable industry is relentless. In both repeatered and unrepeatered systems the optical powers are increasing to maximise un-repeatered distance or the number of wavelengths transmitted.

The increase in optical power in the fibre aggravates the non-linear effects that need correction by careful dispersion management. Higher powers can give rise to spontaneous damage or pre-mature ageing of the fibre[2]. Experiments have shown that this can occur by applying an external heat source to a 'live' fibre, touching the end with an absorbent surface, or even through bending of the fibre it self. The resulting phenomenum is spectacular, as a self propelled 'spark' of light is propagated back through the fibre, towards the transmitter and can destroy many kilometres of fibre. This 'self propelled, self focusing damage' raises two main issues for the marine installer when planning the very high power systems. Firstly the importance of protection from the external aggression, that might initiate such an effect on the powered cable, e.g. anchor damage. The second area is to make sure jointing practices are aware of the importance of not stressing powered fibres either mechanically or thermally.

5. Conclusion

The paper illustrates the need to take account of the impact of transmission solutions on the installation and maintenance of the network, in the marine , to enable realistic and robust whole life system solutions.

The expertise of the supplier's transmission engineers has to be augmented by drawing on the expertise of those who have equal experience in a wide range of marine maintenance operations, for both deep and shallow water.

The cable system life can be extended by terminal equipment upgrade and reduced by excessive operation and maintenance costs. Therefore it is vital that the supplier delivers a documented whole life design that is 'future proofed' so that customer choice of both upgrade equipment and maintenance providers is assured.

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Cable and fibre reliability concerns of subsea systems Edmund Sikora, Paul Delve BT exaCT *SubOptic 2001* Kyoto Japan

Abstract

Submarine Fibre Optic Telecommunications is the fascinating fusion between brand new 'just off the test bed' optical transmission technology and marine installation and maintenance methods that trace their origins to more than 150 years ago.

This paper examines submarine cable transmission developments from a unique viewpoint: that of the installation and maintenance of those cables on the seabed.

The future direction and impact of the four principal methods of increasing capacity in a single submarine cable are examined in turn.

1. Increased fibre count in long haul systems
2. Increased number of wavelengths
3. Increased fibre band width
4. Faster transmission speeds

This paper stresses the need to take account of the impact of transmission solutions on the installation and maintenance of the network in the marine environment. This enables realistic and robust practical system solutions. The holistic approach to designing next generation systems is promoted via practical system examples.

back to index

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back to index

The Role of Submarine Cables in Next Generation Communications

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View Abstract

1. The growth of the global network

The last few years have seen a massive increase in the capability of the global network of submarine telecommunication cables. This has been achieved both by an increase in the number of cables as well as by the increase in capacity of each cable deployed as transmission technology moves forward.

The construction rate of cable systems has increased from 20,000km per year in 1987 to 50,000km per year in 1997, reaching a peak of approximately 150,000km per year in 2000 and 2001. Today, the global network consists of 720,000km of operational submarine fibre optic cable.

At the same time the capacity of each cable has increased even more dramatically. This increase has been achieved by using higher bit rates, more wavelengths, and more fibres in each cable. Today a state-of-the-art transoceanic cable is designed for operation at 10Gbits/sec (rather than 560Mbits/sec in 1987), with 80 wavelengths (rather than one), and up to 8 fibre pairs (rather than two). This is an increase of over 5000 times capacity.

The result of this revolutionary advance in fibre optic technology is that a single undersea cable has far more capacity, over ten times in the above example, than the combined throughput of **all** the world's commercial communication satellites at 260Gbits/sec (Reference 1).

The explosive growth in submarine cable capacity over the last few years has ensured that the submarine network is not a bottleneck in the global telecommunication infrastructure today.

It is worth noting however that while a fibre optic cable provides massive bandwidth, it has limited geographical reach (whereas a satellite has the reverse characteristics). This is graphically demonstrated in figure 1, which shows Inter-regional Internet bandwidth. This illustrates that while there is substantial capacity between US and Europe, and US and Asia/Pacific, other routes tend not to be so well served, and it is estimated that almost half of the world's countries remain dependent on satellites for international connectivity (Reference 1).

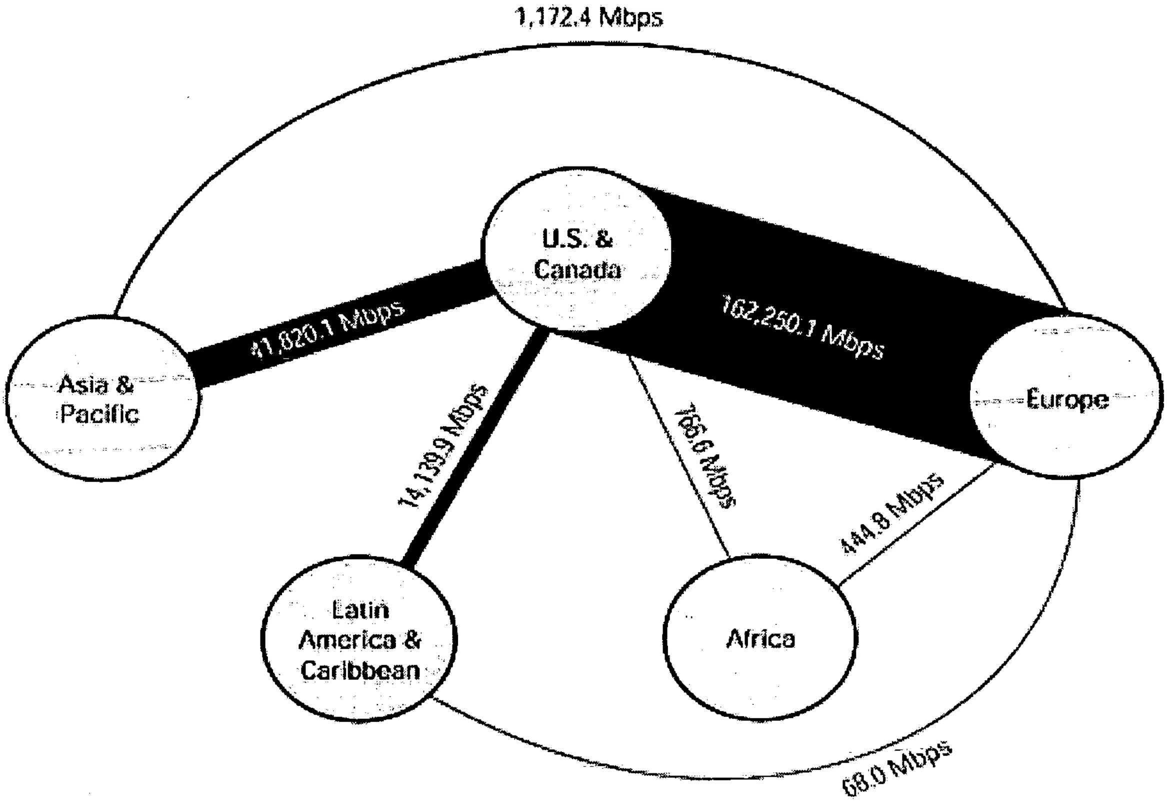

Figure 1: Inter-regional Internet bandwidth (© TeleGeography, Inc. 2001 www.telegeography.com)

These two facts, the massive relative capacity of fibre optic cables, and the geographical limitation of global connectivity today, point to the likely primacy of additional submarine cables in the future development of global connectivity.

2. Key issues for future infrastructure deployment

Whilst the rate of further expansion of the global network of submarine cables is difficult to foresee, two aspects of future system deployment are clear. Firstly, once the commitment for a new system has been awarded, the customer will want the system ready for service as quickly as possible and, secondly the customer will want the system to be as reliable as possible.

These are not new phenomena; the increased push for 'speed to traffic' seen in the last few years has typically seen project construction times halved. Historically a typical system has taken up to 3 years to conceive, design, build and deploy. Today, 18 months represent a more typical overall duration, and we can foresee this reducing further. The main driver is the need to generate revenue as early as possible so as to begin to recoup the large capital cost. However the trend to focus on speed to traffic is more particularly an important response to achieve better risk management.

Making the decision to construct a submarine cable system has always been a high risk activity. Recently these risks have become accentuated as a result of rapid technological innovation in transmission technology, an increasingly competitive global marketplace, as well as rapid and unpredictable changes in the demand and price relationship.

At the same time, once the construction of a new cable system is underway there is relatively little flexibility to make changes. In such an environment speed to traffic and risk management are key.

This trend will continue, as new systems are planned on slimmer margins, within a more exacting financing regime, demanding tighter risk controls and earlier revenue. It is inevitable that this will put even greater emphasis on quick and reliable deployment.

The marine operations service supplier has a prime role in enabling these accelerated time-scales. In the installation phase, time-scales can be shortened with multiple installation vessels working concurrently.

To realise these benefits requires the means to mobilise, control and manage a large fleet of cable ships and support facilities. On TAT-14, Global Marine used 5 main lay vessels in the course of installing 15,000km within a six month window and on APCN-2 11 main lay vessels were used to install 19,000km within an eight month window.

Apart from reducing time-lines, this approach provides improved risk management. With only one or two ships working long time-lines, any delays become cumulative and can seriously impact on the completion date. However, with many ships any problems are likely to be spread across the fleet, and in some cases the programme can be adjusted so that any ships that are ahead of schedule can assist in managing potential delays.

Global Marine is also developing other approaches to optimise speed of installation operations. Some aspects are difficult to accelerate, for instance the speed of surface lay over a mid ocean ridge tends to be limited by the physics of cable sink rates. However, other operations, such as increasing average burial speeds, have more scope for innovation. For instance the injector jet ploughing technology introduced by Global Marine in 2001, and described in the section below, has already enabled faster and/or deeper burial.

One potential bottleneck and major risk factor in the deployment of new systems is securing permitting approvals. A new submarine cable system will need to secure operators licences for each country involved, landing permits for each cable landing, and operating permits for each vessel installing cable in territorial waters. Delays in any one of these can directly lead to delays in the overall project completion, and permit requirements are tending to become more arduous. This can be the most problematic part of project implementation, and requires broad and timely consideration of local community interests, environmental considerations and obligations, as well as following public notification requirements and understanding governmental department perspectives.

In addition to permitting a second 'geo-political' issue is sharing the seabed with other users. This may range from liaison with fishing, dredging and shipping interests to agreements for pipeline and other cable crossings. As the number of submarine cables has mushroomed, congestion is becoming a particular issue in some areas.

This congestion may occur at the landfall (for instance the approaches to Hong Kong or Tokyo) or around other 'pinch point' areas (for instance the mid-Atlantic ridge, Gibraltar Strait, or the Bashi Channel), and often means that the 'best' routes have already been taken.

Since provision for new systems has not historically been a factor in cable system route design, existing routes tend not to run that parallel to each other, which leads to extensive cable crossings and re-crossings. Not only is each crossing a point of vulnerability, but also the available space on the seabed is not used in the most economic way, and can compromise cable maintainability. Adding each new cable inevitably and dramatically increases the number of crossings. As an example a typical Trans-Atlantic route now has over 30 crossings.

Three developments can help here. Firstly the use of 'triple crossings', where the new cable crosses two existing cables at their existing crossing point. This is suitable where crossing angles between cables can be kept high for maintainability, and a real example is shown in figure 2. The second is to plan new routes to be as parallel as possible to each other and also to existing routes. This minimises crossings and maximises availability of space for new systems. The third development is to reduce the minimum separation between cables. This is especially the case near landfalls, where the previous convention of a 200m separation can, with today's installation and positioning technology, often be safely reduced to 50m.

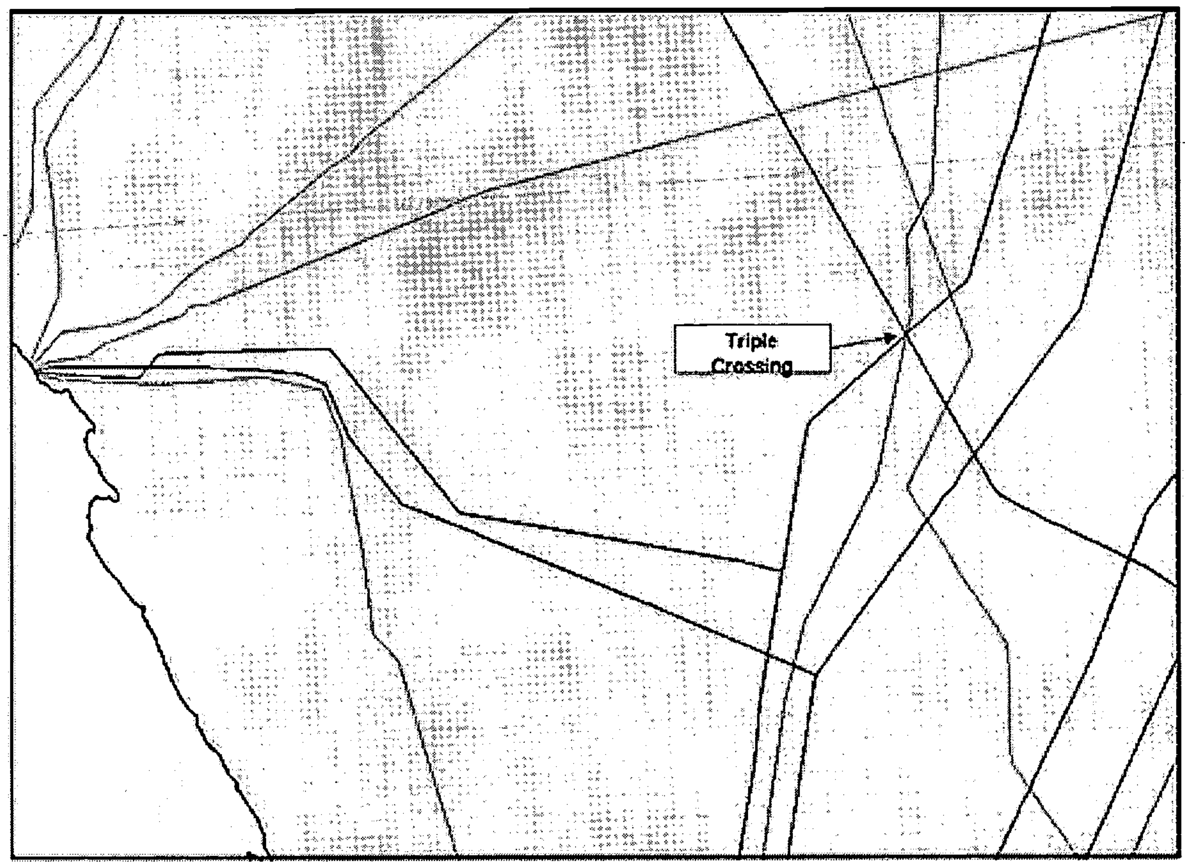

Figure 2: Triple Crossing Example

3. Reliability and Fault Rates

As access for maintenance is relatively difficult, it is critical that maximum reliability for the submerged portion of a cable system is achieved. Analysis of trends in historical cable fault data provides a key input from which to improve reliability further, and Global Marine maintains a fault database which aims to capture as many cable faults as possible.

The discussion below reviews some of the key trends; further detail is given in Reference 2. It is worth noting that all this analysis is for aggregated global data and there are significant regional variations, so care needs to taken in extrapolating this data to individual regions or cable systems.

The Global Marine fault database for 1997-2000 shows that 82% of faults are caused by 'external aggression', with 6% caused by system component failure, and the remaining 12% of faults caused by other, or unknown, causes. Compared to the period 1986-1996, this represents a shift to a higher proportion of faults attributable to external aggression (up from 69% to 82%), and a significant decrease in component-based failure (down from 17% to 6%).

Looking at the 'external aggression' faults, fishing (68%) is the principal cause, followed by anchors (17%), then dredging, and 'natural aggression' (such as deep water chafe and earth movement) accounting for the remainder.

Most faults are in shallower waters, 70% of all faults between 1997-2000 being in 20 to 100m of water depth, and some 82% of all faults occurring in less than 200m water depth.

As discussed above, the total amount of submarine fibre optic cable deployed has grown enormously over the last few years. Consequently examination of fault trends over time, for instance to establish whether fault rates are going up or down, needs to be normalised for length deployed to allow any reasonable comparison. Figure 3 shows annual length-normalised fault rate trends, with normalisation for shallower and deeper water using the total cable lengths in less than, and more than, 1000m of water depth respectively.

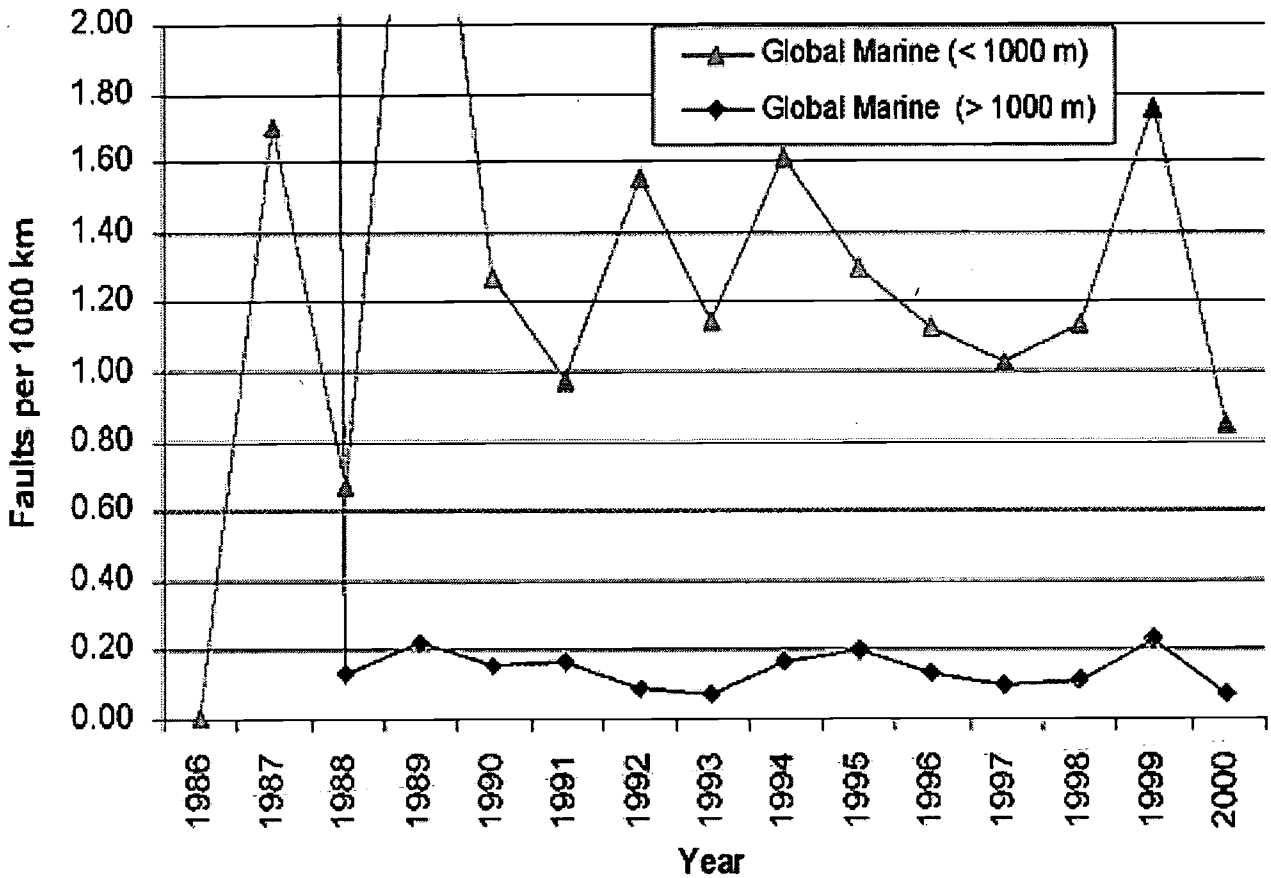

Figure 3: Length-normalised overall fault rates for depths < 1000m and depths > 1000m, by year.

Figure 3 indicates that fault rates appear to have stabilised over the last few years. A global annual average of around 0.125 faults per 1000km (or one fault per 8,000km) is seen for cable in deeper than 1000 metres. In shallower water (less than 1000 metres) the annual average is ten times higher at around 1.25 faults per 1000km (or one fault per 800km of cable). It is important to stress that these are global averages, and that there are very wide regional variations to this picture.

Figure 3 is based on all cable in the water for each given year, so doesn't highlight whether or not newer systems are proving more or less reliable than older ones. Figure 4 addresses this by examining the cumulative probability of faults occurring on cable systems installed between 1986-96 against those installed between 1997-2000. This shows, for instance, that the probability of a cable having one or less faults per 1000km per annum has increased from 90% to 94%, and for zero annual faults, from 62% to 67%. This demonstrates a significantly improved average performance of cable installed in 1997-2000 when compared with that installed in 1986-1996.

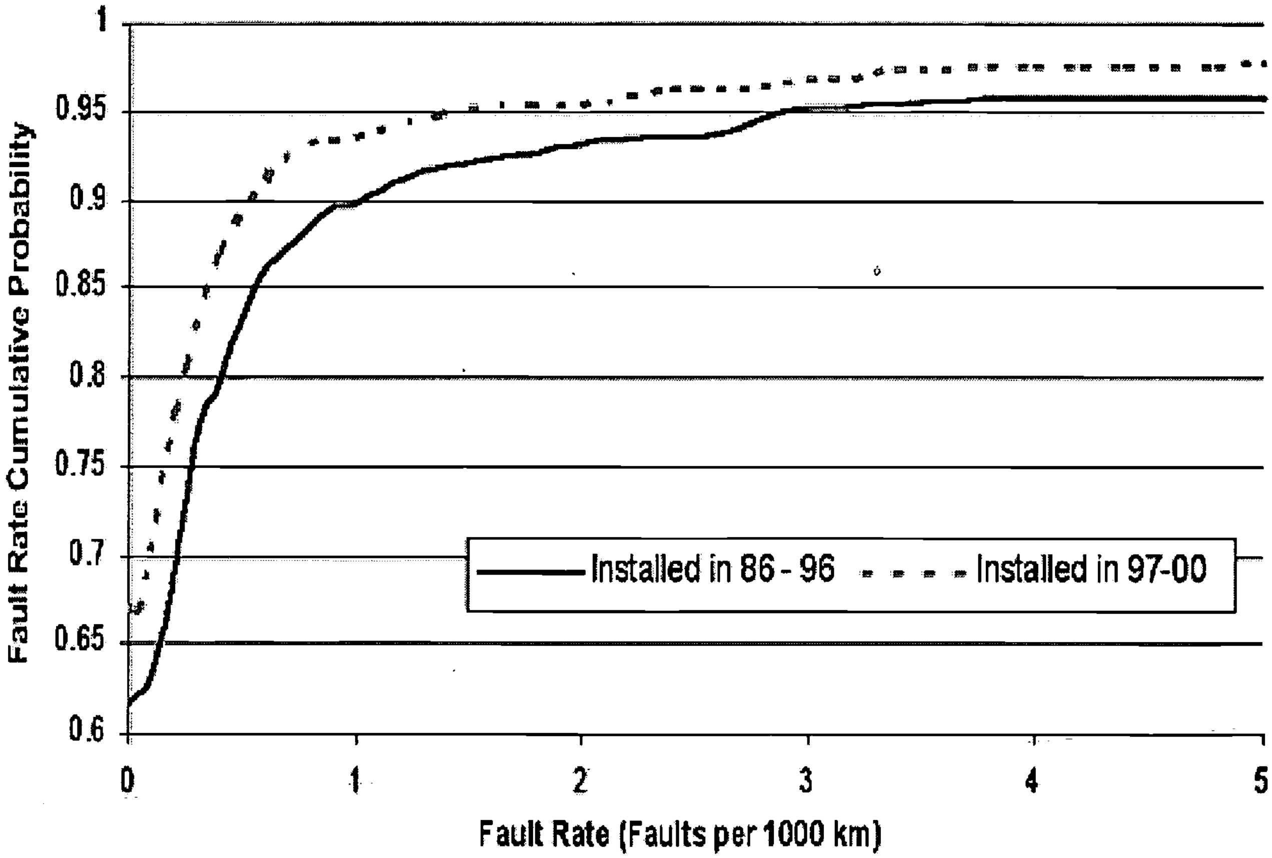

Figure 4: Cumulative probability distribution for annual length-normalised fibre-optic fault rates in all depths — cables installed in 1986-1996 compared with cables installed in 1997-2000.

However, Figure 4 also contains a cautionary tale! The data curves do not converge quickly to 100%. In other words, there is a small percentage (around 3-5%) of systems whose fault rates can be very high. A key question for the purchaser of a new system should be 'how can I ensure that the new system will not be in this 3-5% high fault group?' The section below addresses this question.

4. Enhanced Protection

We have seen in the section above that the predominant majority of faults are in less than 200m water depth and are caused by 'external aggression', principally fishing and anchor damage. Consequently, as a general rule, this is where most effort needs to be made in understanding the hazards, planning the system, selecting the route, deciding the cable armouring and burial depth specifications, choosing the appropriate burial tools, and liaison with other seabed users.

This process starts with the 'desk top study', where the emphasis should be on understanding the risks, particularly from other seabed users, and especially fishing. It also emphasises the importance of the burial assessment survey to manage the risks in selection of burial depth and armouring specifications.

Steel armouring can help minimise damage caused by entanglement of the cable with a hazard, but it is only through adequate burial that the cable can be placed out of reach of such interaction. Consequently, cable burial is commonly regarded as the most effective and important method of protection.

A major thrust in marine operations over the last couple of years has been the further development of burial equipment for deeper burial. Figure 5 gives a summary of nominal burial depth requirements to place the cable below the threat line (this should be viewed as a generic summary, local threats may be different).

Threat	**Hard ground** **(clay >72kPa, rock)**	**Soft-firm soils** **(sand, gravel, clay 18-72kPa)**	**Very soft-soft soils** **(mud, silt, clay 2-18kPa)**
Trawl boards, beam trawls, scallop dredges	<0.4m	0.5m	>0.5m
Hydraulic dredges	<0.4m	0.6m	N/a
Stow net fishing anchors	N/A	2.0m	>2.0m
Ships' anchors up to 10,000t DWT (50% of world fleet)	<1.5m	2.1m	7.3m
Ships' anchors up to 100,000t DWT (95% of world fleet)	<2.2m	2.9m	9.2m

Figure 5: Nominal required burial depths to place cable below threat line for different threats and soils (these figures include a 33% safety factor on actual threat penetration)

Looking down the columns, this table demonstrates the wide range of burial depths required to protect the cable from different threats. The likelihood of threat also needs to be taken into account in the burial specification. For instance, other than in known anchorage areas, it is not generally cost effective to provide burial protection against anchors.

Looking across the rows, the table also demonstrates the wide range of burial depths required in different seabed types to achieve protection against a given threat. This demonstrates the Burial Protection Index (BPI) concept, which takes into account that the level of protection afforded by burial varies strongly with the type of soil (see Reference 3).

A burial depth specification based on the BPI concept would keep the burial index essentially constant for areas of similar threats, but not necessarily the burial depth, which would vary with the seabed material encountered. This contrasts with the common burial specification, given primarily in terms of depth into the seabed. The critical factor is the level of protection; for instance a cable buried 0.5m deep into hard sediment may be better protected than a cable buried to 1.5m in soft or mobile conditions.

This type of thinking is an increasing trend in the industry, with the realisation that the optimum cost effective level of burial protection is achieved by a more sophisticated approach than a simple, blanket, target burial depth throughout the cable system.

Global Marine's latest response to meet deeper burial requirements has been the development of the Injector Hi-Plough ®, capable of burial to 3.25m deep, for simultaneous lay and burial operations, and the Excalibur ROV (Remotely Operated Vehicle) for matching post lay and remedial capability to similar depths, see figure 6.

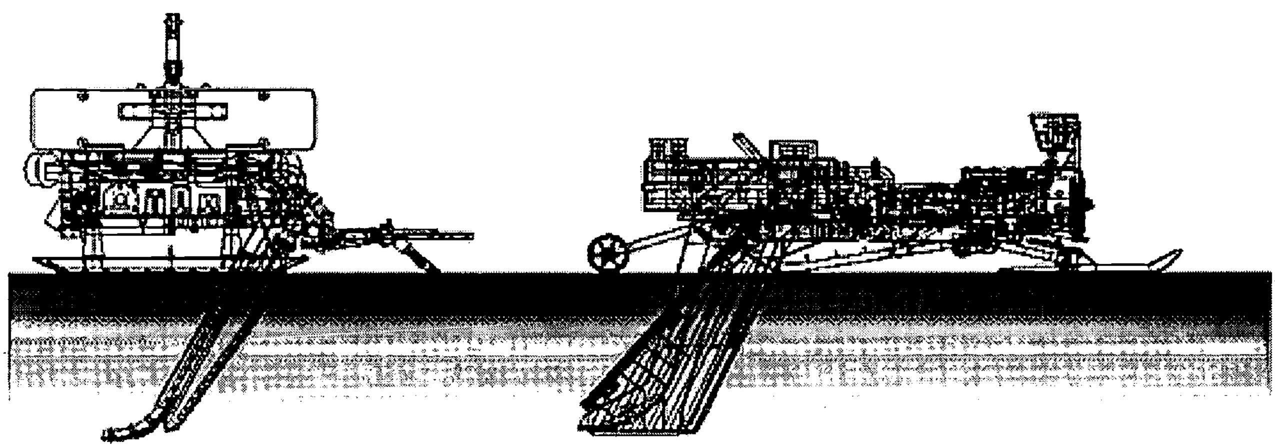

Figure 6: Matched Plough and ROV for 3m burial Global Marine's Injector Hi-Plough ® and Excalibur ROV.

Excalibur is a 900kW self-propelled machine with a range of burial tools to provide 3m burial in water depths up to 2000m, and burial to 1m deep in soils as strong as 100kPa.

The Injector Hi-Plough ® is towed by the installation cable-ship in the same way as a conventional plough, but is also fitted with a 500kW jetting package, using the 'injector' technology that Global Marine has developed over many years in shallow water barge mounted operations. This combination was introduced in 2001 and has already proved highly effective in operations in Asia.

5. Maintenance Philosophies

Having reviewed the key factors in getting the cable installed, we can now consider the through life maintenance aspects, and again examining fault rates provides a good context.

Figure 7 illustrates the average change in fault rate, as cables age, for water depths less and greater than 1000m. A significant decay in fault rate with age is seen in depths less than 1000 m, whereas the deepwater fault rates appear to remain static with age. This is attributed to the fact that faults in less than 1000m are dominated by human activity, and, on average, there is a 'learning' trend. This trend occurs through the efforts of owners, maintenance authorities and hydrographic offices to increase awareness amongst other seabed users of the location of new cables, and is also due to remedial marine activities on the cable to improve areas where faults have occurred.

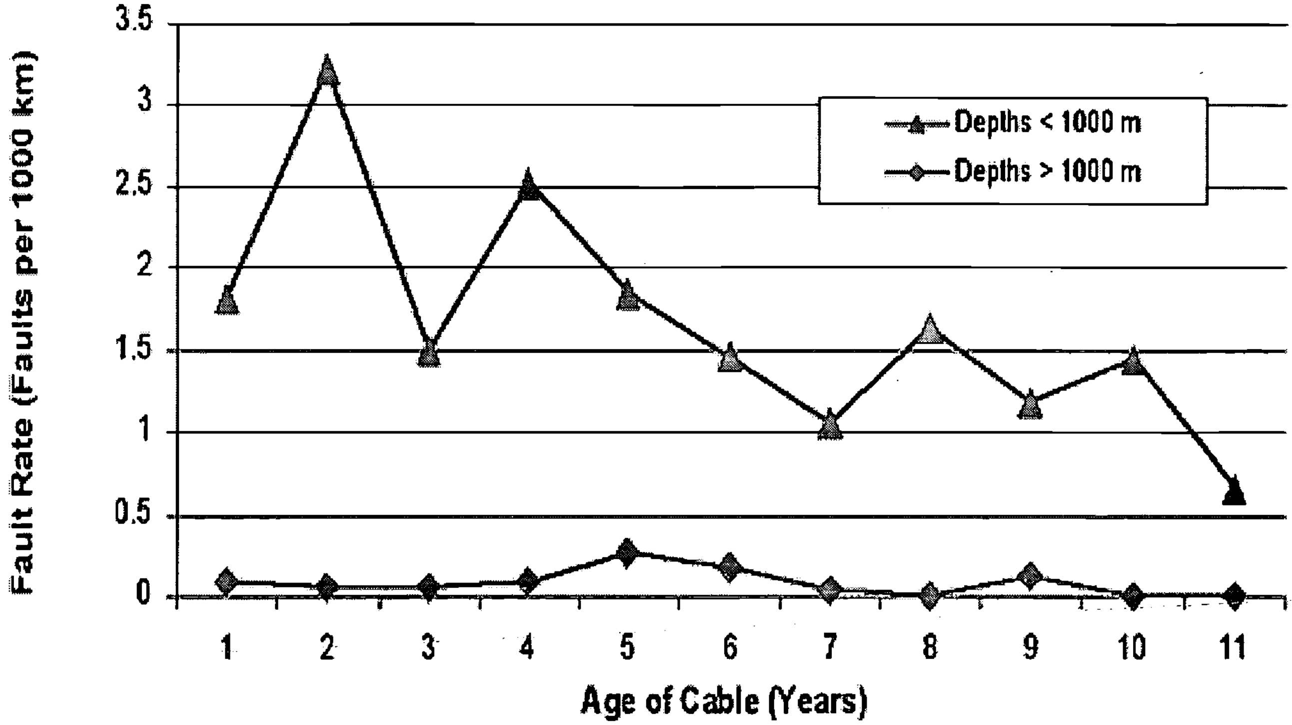

Figure 7: Average length-normalised fibre optic fault rate with age of cable for depths < 1000m and depths > 1000m, for global cable systems installed 1990-1999.

Most maintenance to date has been carried out as a 'repair' service, rather than incorporating preventative maintenance, due to the historical contractual structure prevalent in the industry. However the structure is changing, with a move to more privatised, and customised, maintenance provision. This provides a real opportunity to drive down this fault rate 'learning curve' further, with the appropriate combinations of remedial work, preventative maintenance and co-operative offshore liaison with other seabed users. These activities can now be co-ordinated and packaged to provide a truly effective maintenance service.

6. Conclusions

Submarine cables will continue to provide a vital, backbone, element of the global infrastructure for next generation communications. This paper has aimed to draw attention to the key marine issues in developing and supporting this infrastructure. In particular the need to provide customers with timely and reliable new capacity is highlighted, together with developing solutions for higher levels of service in the maintenance of cable systems.

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back to index

Abstract

The paper opens by charting the growth of the global network of submarine fibre optic cables and the resultant bandwidth capacity created in enabling next generation communications to be implemented. The paper then discusses how this role will develop in the future to provide a reliable international infrastructure to support the demands of new applications.

The need for rapid deployment of new infrastructure, where required, is discussed, together with how the marine supply industry can best respond to this demand. Potential bottlenecks in the process, such as permitting and route congestion, are highlighted and addressed.

Reliability is critical in the submerged portion of submarine cable systems, as access is relatively difficult. Fault rates are considered, together with a review of the latest technologies to increase the wet portion reliability.

Repair philosophies, to ensure reliability of service, are examined, as this too is an area of change as the technology, geographical spread, and ownership structures of the global undersea telecommunications network develop.

back to index

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back to index

Meeting Demands for Submarine Networks

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View Abstract

1. Latest Technology Accomplishments

Designing submarine networks to meet growing capacity demand have always been challenging and, in recent years, have been even more stressful due to the dramatic increase of data traffic. It becomes more evident that today's network must be designed to match rapid and unpredictable growth. The suppliers have been concentrating their efforts to provide advanced submarine systems to cope with such demands. Advanced technical features responsible for enhancing the transmission performance, are implemented in all parts of the system: terminal equipment, wet plant and optical fibers.

Terminal Equipment design requires advanced techniques in order to manipulate very small space among WDM channels, enabling to pack a large number of channels. Advanced Mux and Demux techniques associated with an appropriate modulation format, have enabled High Dense WDM transmission of10Gb/s per fiber pair.

Forward Error Correction (FEC) technique is also applied in order to overcome Signal to Noise Ratio (SNR) limit and enable high capacity transmission for longer distances. The standard FEC, largely used in commercial systems, employs the Reed-Solomon (RS) code for error correction and provides a gain of 5dB in the Q value obtained without FEC. More powerful codes, so called "Advanced FEC" have recently been recently developed by using additional coding functions associated with current RS code, which is so called Advanced FEC. Advanced FEC can provide approximately 8dB gain, which enables ultra-long haul transmission.

Among the features mentioned above, terminal equipment design has a series of other features to enhance the overall performance, such as scrambling and channel pre-emphasis technique, post and pre-amplification of the optical signal and dispersion compensation. An easy and straightforward solution in operation and maintenance is also available, with upgrades in a simple and speedy manner, without any readjustments of the wet plant.

Aiming at providing a competitive solution in terms of initial cost, a very compact size of terminal equipment has also been developed in order to accommodate up to 12 wavelengths per rack, which means up to 80% of footprint reduction of terminal equipment when compared with previous designs accommodating only 2 wavelengths per rack. This reduction in footprint provides significant reductions in station building costs and is essential for managing future building environments.

Submarine Repeater design supports DWDM application for large capacity transport with a high degree of reliability. The repeaters have a wide bandwidth that cover up to 128 DWDM channels with Erbium Doped Fiber Optical Amplifiers (EDFAs). Low noise and high power performance EDFAs with 0.98mm pumping sources provide the required pump power to achieve optimized repeater spacing. Moreover, broader and flatter amplifier gain peaks to allow for efficient channel packing density and a lower noise figure, which results in more capacity over longer distances. The higher capacity transmission can also be achieved by increasing the number of fiber pairs housed in a submarine repeater. Current design for submarine repeaters can support up to 8-fiber pair systems.

Optical Fiber development has also been influenced by the new requirements to meet growing capacity demands. For submarine repeatered network, where the signals are supposed to travel longer distances before being regenerated and high output power shall be applied to optimize the repeater spacing, a better control for the effects of chromatic dispersion and fiber non-linearity is the major challenge to achieve greater capacities and distances.

The chromatic dispersion is a fiber linear effect that represents the tendency of different wavelengths travel at different speeds in a fiber. It is accumulated by the factor of distance, and the pulse distortion caused by this linear effect can be recovered linearly using dispersion compensation fibers. The fiber non-linearities effects, such as the Cross Phase Modulation (XPM) and Four Wave Mixing (FWM), are caused by the high optical power interacting with the fiber. Although the end-to-end dispersion needs to be kept near to zero across the spectrum used, fibers for WDM systems are intentionally shifted from zero ps/nm/km in order to reduce the pulse distortion caused by non-linear effects. Reducing the optical power density in the fiber core by using large mode area fiber can also reduce the non-linear effects, allowing more power to be launched into the fiber. That is why today's submarine networks are designed mostly using two types of fiber: Large-area mode fibers (LMF) represented by LEAF (Large Effective Area Fiber) or NZDSF (Non-Zero Dispersion Shifted Fiber) and Dispersion Compensation Fiber, represented by a common single mode fiber (SMF). The SMF has reversed dispersion characteristic when compared to the large area mode fiber.

Nevertheless, due to the different values of dispersion for each wavelength, chromatic dispersion can be compensated to zero value only at the center of the transmission band, and the signal experiences a larger residual dispersion as the channel approaches to the band edge. This channel-to-channel dispersion difference within the spectrum is so-called dispersion slope. For long haul applications, the residual dispersion due the dispersion slope severely limits the transmission bandwidth, requiring a more accurate dispersion management by using a special hybrid fiber arrangement, so-called Dispersion Managed Fiber (DMF). The DMF solution is a combination of two types of fiber with reverse chromatic dispersion and slope, named DMF(+) and DMF(-). The DMF(+) is a large effective area fiber with positive dispersion. It is applied in the repeater output in order to better distribute the optical power launched into the fiber, reducing the impairments caused by non-linearities. Within the same span, a DMF(-) fiber is applied with chromatic dispersion and dispersion slope reversed when compared to DMF(+), compensating the accumulated dispersion caused by DMF(+) fiber and its slope. The final result is a low and flattened dispersion within this hybrid span. After 7 to 9 spans of such hybrid arrangement, a separate span of Dispersion Compensation Fiber (DCF) is inserted in order to bring the remaining overall dispersion value near to zero. This layout compensates both dispersion and its slope, providing a very low and flat dispersion over a wide bandwidth for large-capacity and long-distance transmissions.

Laboratory results considering all these technological advances applied to terminal equipment, submarine repeater and optical fiber, have already confirmed the feasibility of 10Gbit/s DWDN transpacific cables with extremely high capacity with adequate operation margins.

2. Emerging Technologies

The efforts to obtain more transmission capacity over longer distances in submarine systems will be continued as we advance into the new millennium. We are still in the first stages of Internet development combined with a very low penetration in many countries around the world. International traffic will continue to grow, stimulated by the geographical spread of users and hosts, and also due to emerging regions with the number of Internet users growing very fast in such areas as the Asian countries. The demands for faster Internet access using xDSL, cable modems, FTTH and wireless is starting to develop in many of these Asian countries, such as Japan, Korea, Honk Kong and Singapore. Another factor is the greater availability of high-speed connections, which enable the dissemination of bandwidth intensive applications, such as, corporate information systems, multimedia/video, digital TV, 3rd generation of mobile phones, etc. In order to cope with future requirements, the system suppliers will continue to pursue the following avenues to provide large-capacities and long-distance systems: Increasing the number of wavelengths, number of fiber pairs and transmission speed. Such pursuits are technically feasible, however surrounded by a lot of challenges to be overcome.

Increasing the number of fiber pair strategy would be considered the easiest way to enlarge the transmission capacity, however, there are important concerns related to repeater size, power consumption and fiber pair accommodation. Additional optical amplifiers inside the repeater imply an increase of repeater length, as experienced in the development from 4 to 8-fiber pair repeater. Since the installation and maintenance involve a series of standard tools and cable ship facilities, the repeater size must be optimized in order to fit into the current industry standards. Additional optical amplifiers also imply in extra power consumption, and transoceanic applications are limited by a power feeding supply voltage around 21,000 Volts end-to-end. Additional fiber pairs into the submarine cable also imply an increase of cable core, resulting in extra protection against bending loss and high pressure at deep sea depths. Current design for wet plant provides systems based on up to 8 fiber pairs, and further development for 12 fiber pair systems is ongoing.

Increasing the transmission speed with introduction of higher bit-rate systems, such as 20 and 40Gb/s, is recently the most disputed challenge among suppliers. The 40Gb/s-based system will probably be deployed skipping the 20Gb/s, considering the current tendency witnessed in the terrestrial networks. The system will initially be available with 16 or 32 channels for short-haul applications in year 2003-2004, driven by the following advantages: reduced footprint (terminal equipment), simplified network (less equipment), effective use of bandwidth and possibility of direct accommodation for high-speed (STM-256) traffic.

Certainly the requirements for 40Gb/s-based systems are much more severe than the requirements for 10Gb/s-based systems. Because the bit-rate is multiplied by four, the noise band of the optical receiver is four times higher and dispersion tolerance is 4 times more stringent. Therefore, the challenges for evolving the 40Gb/s based systems aim at the development of a higher optical SNR at the receiver end, suppression of nonlinear effects, new optical fiber and strict dispersion management. The required optical SNR for 40Gb/s-based systems is 6dB+ higher than the optical SNR for the 10Gb/s-case; requiring an optical repeater with higher signal power per channel, lower noise figure and probably Raman amplification. The non-linear effects generated by higher output power per channel will seriously degrade the transmission performance, requiring a fiber with large core area and a more efficient modulation format for transmission signal. In addition, the new optical fiber for 40Gb/s-based system applications shall be developed aiming at providing a smaller Polarization Mode Dispersion (PMD), 1/4 of that for 10Gb/s, and a smaller dispersion slope, followed by special hybrid fiber arrangements in order to allow a strict dispersion management. The 40Gb/s-based system would probably require intermediate regeneration for medium to long haul systems. All optical 3R (Re-shaping, Re-timing and Re-generating) devices are possible candidates for such applications. They will be inserted at every 2,000 to 3,000km along the transmission line to remove accumulated signal impairments. Since the 3R Regeneration is required for each one of the wavelengths, those 3R Devices will most likely be distributed to several concatenated repeater housings. Current research activities for 40Gb/s-based systems are focused on modulation format definition and more accurate dispersion management.

3. The Evolution of Submarine Networks Architecture

We have so far addressed the items related to technology and their impacts on the results to obtain higher capacities. However, besides capacity, the submarine networks architecture is also a very important item to provide more features and to optimize future networks. The data traffic market has grown exponentially over the last several years, changing the traditional business model of global carriers, in which they used to obtain revenues mostly from voice traffic. In addition, the global market involving terrestrial and submarine networks is expanding on a large scale, with large capacity terrestrial backbone networks and submarine cable projects linking major cities throughout the world. Under such circumstances, global network carriers have been seeking more efficient network architectures, in order to migrate their existing voice networks to data networks and also promote a better city-to-city interconnectivity.

Virtually, the ring network topology combined with a SDH Multiplexer as Network Protection Equipment (NPE), has provided satisfactory results in terms of network optimization, reliability and flexibility for voice/data traffic transmission. The majority of submarine networks today employ SDH Multiplexer as NPE, thanks to its flexibility, tributary interface, switching time and efficient protection scheme for self-healing rings. For submarine transoceanic applications, the SDH NPE can be equipped with an advanced transoceanic switching protocol, to reduce the transmission delay time over a diversity route. The SDH NPE has also evolved considerably with reduction of equipment size, powerful switch fabric and higher line capacity. Considering such developments, the SDH NPE will most likely cohabit for a long time with the next generation NPEs.

On the other hand, taking into account the current trends in the industry, the architecture of submarine networks is expected to evolve significantly in the coming years. The next generation networks will require more effective traffic restoration / management capability, regional and global connectivity, ultimate footprint reduction, high capacity and flexibility to accommodate unexpected traffic growth and new technologies. The well-known ring topology will not banish, but will coexist with other topologies, such as

Mesh Networks. The Mesh networks can provide shared protection facility, where a single active link may protect multiple service paths. This feature enables higher efficiency in the use of bandwidth compared with 1+1 or 1:1 protection schemes that allocate half of the dedicated bandwidth for protection. Services can be offered providing Quality of Service (QoS) with different levels of protection, depending on the needs of the user. Mesh topology are naturally more flexible than ring-based designs, without the scalability and planning problems associated with rings. They can grow more easily in unplanned ways, and each network link can potentially provide protection for several different segment failures, enhancing the protection against multiple failures. The optical switching and routing are essential to realize the Mesh networks and, it will be made by Optical Cross Connect (OXC) equipment thanks to the maturity of optical switching technology. The OXC offers more flexibility in the optical layer, providing wavelength level services and end-to-end provisioning over hybrid terrestrial and submarine networks in city-to-city applications. Furthermore, OXC allows mesh, ring and linear protection in the same network, with more scalability in terms of switching capacity, QoS, network elements supported, rapid provisioning and management. Current designs with all optical cross connection can provide smaller system footprint, less power consumption, faster switching time, transparency to the protocol or bit-rate, and the possibility to have different type of equipments and services, including SDH, SONET, IP, ATM, G-Ethernet, etc.

4. Reliability and Network Architecture

The reliability of submarine networks undoubtedly is another important factor to avoid lost revenue, customer dissatisfaction and to ensure economical success for the carriers. Transporting a huge traffic of information where a failure may compromise a lot of customers, the submarine networks must to be designed considering reliable components and architectures to avoid undesirable outage periods. The failure in the wet plant is more critical due to extend period for recovery, which involves maintenance cable ship mobilization, cable recovering, repair and consequently high costs. Current designs for wet plant components, such as repeater, branching units and equalizers, have achieved high degree of reliability by selecting the best qualified and screened components, assembly operations by qualified personnel in clean room, traceability of components, manufacturing process and special screening tests. The submarine cable and joints are also highly reliable and field proven for installation, maintenance and repair, followed by a long-term stability of mass production, high-level quality assurance and advanced design to protect the fibers specially designed for DWDM applications. The high quality in the assembly and testing process of wet plant components and submarine cable associated with the simple and effective design of repeater, resulting in a reliable wet plant with less than 2 failures expected within the system life of 25 years.

As presented before, besides the highly reliable wet plant components, the submarine networks also have efficient architectures and protection schemes to increase the network reliability. Now a great number of new submarine systems are being planned and installed continuously, generating an abundant capacity and lowering of costs, even the end users have the possibility of configuring their own network architecture to fit their specific requirements of reliability level by using multiple networks. In addition, adoption of the best cable protection scheme is also one of the key issues to increase network reliability. All cable laid in depths of less than 1000-1500 meters of water is designed to be suitably armored and buried into the seabed to obtain ultimate reliability.

5. Project Management Strategy

In today's submarine telecom market with rapid technological innovation, increasingly competition, unpredictable growth in the traffic and high investment requirements, system deployment in timely manner and most aggressive timeframes are becoming a competitive differentiator in this dynamic marketplace. The timing impact for submarine systems is especially significant due to the competition, large cost involved in the project, necessity of attending the demands and recovery of investments rapidly. Historically large systems have been completed in 3 years or longer, comprising the planning, design, manufacturing and deployment. Recently, large submarine projects have been completed in unprecedented durations of less than 2 years.

An effective management structure is the key factor to realize timely implementations. The project management team has an important role in the actions that can have a direct impact on the project time frame. Therefore, the management group structure has to be organized in an efficient manner, covering all areas of project implementation: system design, engineering, procurement, manufacturing, permitting, route survey, terrestrial and marine installation and test. Optimized number of persons allows a better communication in both sides from operators and suppliers, bringing ability to address issues that require an effective decision process and rapid actions. Experience and expertise in all areas of implementation, including commercial, technical and financial areas, are crucial to develop the activities efficiently. The team has to evolve the ability of anticipating potential problems, address unexpected problems and expedite activities, especially in case of delay.

One additional point to consider when attempting to implement large, complex submarine cable systems in reduced timeframes... is that it is essential to have complete cooperation between the supplier's and the purchaser's implementation teams. Both parties must work together for the common goal of mutual success. The shortened timeframes involved do not allow an "us" and "them" mentality. Only those teams that truly work together will be ultimately successful.

6. Managing the Permits and Licenses

Permitting requirements for submarine systems have always been a critical point for the project completion in the planned RFS. Varying from system to system, from jurisdiction to jurisdiction and project location, the complex activities of getting permits and licenses have increased the level of risk recently, mainly due to ever-aggressive lead times in the project deployment, more stringent environmental legislation and long permitting procedures. Recent projects have experienced considerable delays resulting from underestimating the complexity of the permitting process. In order to handle the potential permitting risks, the risks need to be delineated and addressed accordingly. Considering the permitting requirements from the early stages of project conception, defining and delegating responsibilities on a contractual basis, assigning the permitting tasks in the project management structure along with an expert, it is possible to reduce the permitting risks. Furthermore, strategic alliances with marine installers, which have long-term relationships with the majority of external authorities as a consequence of their marine activities, combined with past experiences, and external consulting to complement existing knowledge, also results in considerable reduction of permitting risks. The process of getting permits also needs to take into account of the short-term relationships, focused on cable installation, as well as the long-term relationship focused on cable maintenance.

The impacts generated by permitting problems may seriously compromise the project implementation. A continuous process of improving the ways of getting permits is required, in order to guarantee the RFS date and project success in such a competitive marketplace.

7. Conclusion

Submarine networks have expanded significantly in the recent years, breaking the terabit barrier with modern systems and breakthrough technologies, enabling the unprecedented changes in the submarine cable industry. It is clear that such changes will continue followed by the continuous advances in optical transmission technologies. Today's technology already provides submarine system capacity of 5~10Tb/s over transoceanic networks, and future technology will provide capacities beyond 10Tb/s, enabling massive reduction in the bandwidth cost and stimulating high-speed applications.

OXC and large-scale DWDM networks connected in mesh topology enable integrated, flexible and reliable networks. Utilizing the existing infrastructure, the mesh networks can provide more features and variety of services, meeting the carrier's needs for more optimized and cost effective solutions.

Reliable products and networks are essential to maximize the network revenues, and emerging multiple networks are offering to end-users flexible architectures to increase the network reliability even more.

Shorter and more aggressive time frames for project implementation are a common reality in today's marketplace. Effective management structures with optimized teams can realize timely and expedited implementations. With special strategies to address the items that might impact in the project time frame and also reducing the permitting risks, some of the recent projects have been completed in unprecedented durations of less than 2 years.

Such great technological achievements and changes in the submarine cable community, certainly will help the world to better communicate, linking countries and cultures, developing societies and human potential, enabling a vast information technology (IT) revolution.

back to index

Abstract

More than one century has been passed since the birth of the earliest submarine cable systems to those currently incorporating DWDM technology. The technology has been reshaped by means of significant achievements in optical fibers, wide band optical amplifiers and DWDM transmission technologies. The transmission capacity has grown tremendously, coping with the ever exploding capacity demands driven especially by the exponential growth of the Internet. In addition, due to the globalization, deregulation and privatization in the telecom sector, the submarine systems market has dramatically changed over the last few years. One of these changes is that project size has been significantly expanded with a focus on turnkey solutions, system architecture has become more complex and integration with terrestrial networks is becoming more prevalent, enabling a seamless global network. With the competition among the carriers, the suppliers are asked to provide the largest capacity with highest reliability, in the most aggressive timeframes for system delivery.

This paper describes the latest technology accomplishments, and details the challenges for increasing the transmission capacity and providing the most reliable systems. Increasing bit rate from 10G bit/s, 20G bit/s, and to 40G bit/s and increasing the number of wavelengths to cope with never-ending capacity demands from the carriers, are today's major challenges that all competitors in the industry must face. To secure the reliability of a network, it is very important to achieve extremely high reliability of the wet plant such as submarine cables and repeaters. Continuous efforts to realize the most reliable wet plant, targeting less than 2 failures within the system life of 25 years, has been the goal of undersea system suppliers.

This paper also describes the project management strategic plans that system suppliers utilize to successfully implement a huge submarine network in a compressed timeframe and in a very timely manner. Permits and licenses, which are sometimes critical factors to the successful completion of these enormous projects, are also discussed and introduced in this paper.

back to index

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W.3.4 Other Wireless Sytems

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W.3.4.1 Radio Network Optimization Model with Statistical Analysis in CDMA2000 1X System (View Abstract)

SE JUNG LEE; SANG JIN PARK; YONG HEE LEE; CHI YOUNG AHN; BOK CHUL SHIN; BYUNG CHUL AHN and JONG TAE IHM, Researchers, Network R&D Center, SK Telecom, *Republic of Korea*

W.3.4.2 A Strategic Methodology for Adapting Wireless Media (View Abstract)

TOM MCKEOWN, President and SAM VELARDE, Vice President, Technology, Vista Group International, *USA*

W.3.4.3 Study on Forward SCH Data Rate Decision Algorithm Based on Fast Power Control of CDMA2000 1X (View Abstract)

HO JUN LEE, Assistant Manager and SUNG HO JO, Assistant Manager, Access Network Development Team, SK Telecom, *Republic of Korea*

Radio Network Optimization Method with Statistical Analysis in CDMA2000 1X System

Se Jung Lee, Sang Jin Park, Yong Hee Lee, Chi Young Ahn,
Bok Chul Shin, Byung Chul Ahn, and Jong Tae Ihm
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View Abstract

1. Introduction

SK Telecom has provided CDMA2000 1X service from the year 2000 in Korea and 2G subscribers over 13 millions are its potential customers that can simply be CDMA2000 1X users with their new mobile handsets. In this point of view, radio access network optimization is essential to guarantee high quality voice and data services for CDMA2000 1X in coverage and capacity. Until now, skilled engineers have performed radio network optimization only with their experiences and senses. And they cannot refer to enough data that can be a decision making background of their optimization works. And know - how from their field works cannot be held in common throughout the company and restricted in individual knowledge.

In those reasons, SK Telecom started to develop radio access network optimizer (RANO) focused on next three points. Firstly, RANO provides information to operators for optimization of radio network with processing enormous data from various O&M (Operation and Management) system and RF monitoring system. Secondly, know- how from optimization process at fields is accumulated in knowledge database of RANO and systematic optimization is executed when performance of radio network is declined. And the last, through the trend analysis on statistics mainly influenced performance of radio network, RANO has a pre - notification function to inform the point in time of performance deterioration because of resource insufficiency. To develop radio access network optimizer (RANO) which has those characteristics, statistical analysis methods to process a large amount of data to information plays a very important role, and various statistical analysis method like descriptive statistical method, correlation analysis, and time series analysis are applied.

In this paper, configuration and function of radio access network optimizer (RANO) will be introduced and then, statistical analysis method of network data from network management system and RF monitoring system will be explained. In conclusion, systematic optimization process of RANO with statistical analysis and knowledge database will be summarized.

2. Configuration of the Radio Access Network Optimizer (RANO)

RANO is a system for providing solutions for radio link optimization based on optimization scheme and knowledge database with statistical analysis and diagnosis of radio link parameters (performance/ fault/ configuration/ RF monitor). And RANO interfaces with Network Management System (NMS), Base Station Management (BSM) System, Radio

Frequency Monitoring (RFM) System, Quality Management System (QMS) and static and dynamic radio network simulators.

Using those kind of data from the operation and maintenance (O&M) systems of radio network, RANO monitors key performance indicators (KPIs) of radio network and activates optimization schemes accumulated in knowledge DB to improve the performance of radio network. With statistical methods, RANO analyzes various radio network parameters and gets out of the special trends or patterns of such parameters. And finally, it provides solution to resolve the performance deterioration and call failures with systemized optimization schemes in knowledge database. Radio access network optimization system (RANO) of SK Telecom consists of RANO server, network data statistical analysis (NDSA) block, call fail cause analysis (CFCA) block, cell optimization analysis (COA) block, performance indicator monitoring (PIM) block, and graphic user interface (GUI). Main function of each block is explained at Table 1.

TABLE 1. FUNCTION OF BLOCKS

block	**function**
RANO server	Interface with O&M systems, database server
CFCA	Cause analysis of radio access network performance deterioration, solution providing of radio access network optimization
COA	Cause analysis of radio access network efficiency deterioration, solution providing of radio access network efficiency improvement
PIM	Periodic monitoring of performance(call answered rate, call completion rate, call drop rate) and efficiency(traffic channel usage, handoff overhead ratio, handoff success rate, paging response rate) indicator
NDSA	Correlation, time series, factor, discrimination, classification analysis of data collected from radio access network operation
Web GUI	Web graphic user interface

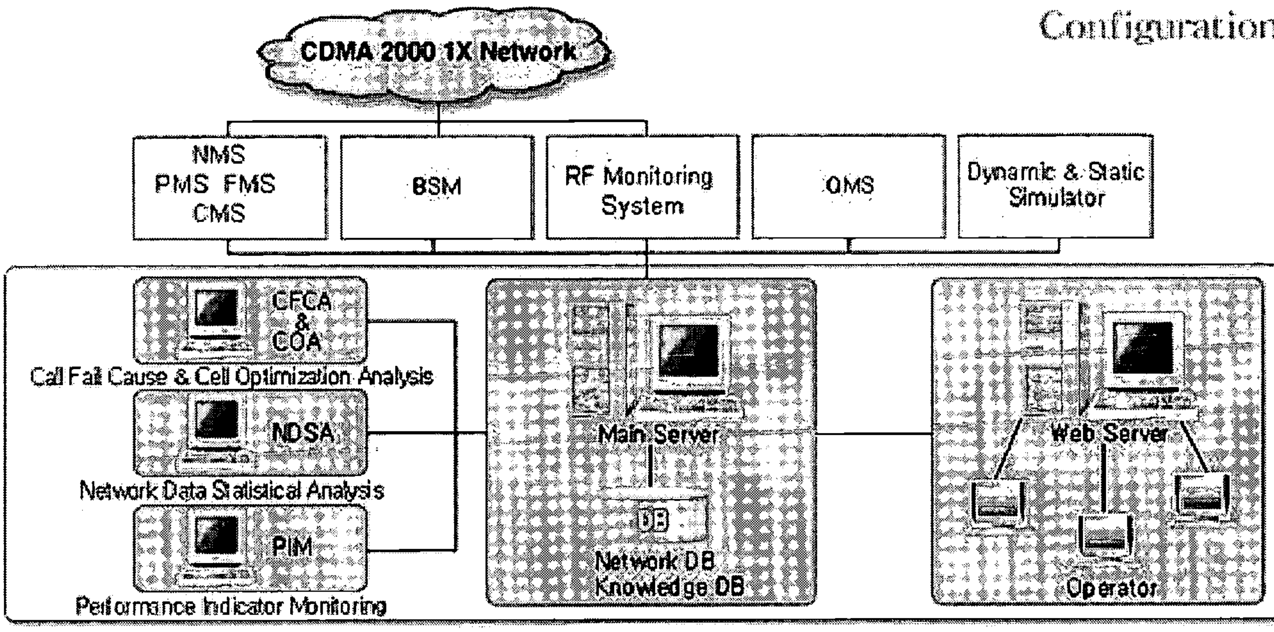

FIGURE 1. CONFIGURATION OF RADIO NETWORK OPTIMIZATION SYSTEM

3. Radio Network Performance Analysis with Statistical Methods

Radio network performance analysis with statistical methods is performed by network data statistical analysis (NDSA) block of RANO. NDSA provides decision - making background in radio access network optimization and it is done by statistical analysis combined with optimization scheme. NDSA interfaces with several O&M systems such as network management system (NMS), base station management system (BSM) and RF monitoring system to get the raw data from radio network operations. And NDSA also organically works together with call failure cause analysis (CFCA) and performance indication Monitoring (PIM) block.

Statistical analysis methods of NDSA are mainly divided into two parts as performance deterioration factor classification and trend analysis with appropriate analytic solutions. It is a case of applying data mining method highlighted in nowadays to radio access network operation data with world famous CDMA network operation know-how of SK Telecom. And it is a very important function to radio network optimization providing synthetic and analytic basis.

Performance deterioration factor classification of NDSA has two analytic methods such as statistical significance test and correlation analysis. Statistical significance test is an analysis method that detects outliers using statistical control chart describes key performance indicators reported to RANO server every 15 minutes. It employs statistical process control (SPC) which is widely used in statistical quality management to improve process productivity and quality. The monitoring method is as follow. In the first place, we assume that the observed variable - key performance indicator (KPIs; call answered rate, call completion rate, call drop rate) - has constant mean and standard deviation like this.
yt = ??????
where yt is an observed KPI, ??is a mean, and ??is a random error with variance ?t . Then we can get the control line (UCL, UWL, CL, LCL, LWL) which has 99% and 95% confidence intervals calculated using key performance indicators reported from Network Management System (NMS) every 15 minutes. After getting control line from calculation, the monitored KPI is called in statistically controllable state when it is located between upper and lower control line and otherwise, it is called statically out of control. In the latter case, the deteriorated KPI is reported to Network Data Statistical Analysis (NDSA) and NDSA starts to correlation analysis to classify the main reason of performance

deterioration.

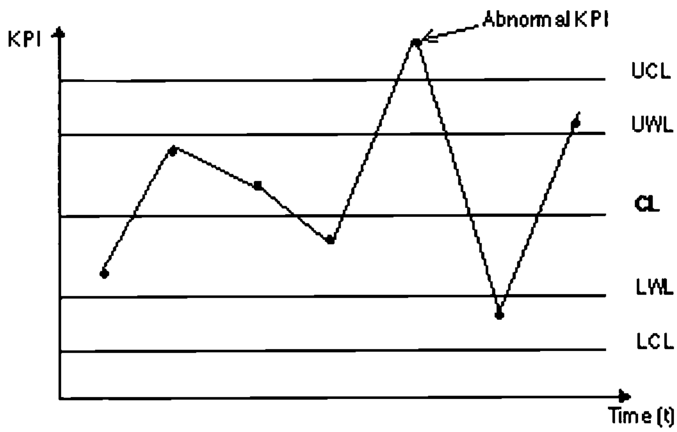

FIGURE 2. SHEWHART CHART

Most of the phenomena interested in researches are explained more effectively through the observations of the variables and their correlation. It is also applied to NDSA when it gets KPI deterioration report from PIM (Performance Indication Monitor). To reveal the cause of the KPI deterioration, it is essential to observe performance management data such as performance, fault, alarm statistics from network management system and execute correlation analysis with those statistics. It is a discriminative analysis method to examine the main reason of network performance deterioration compared with existing method. So far, operators regard most frequently appeared statistics in unit time as a main reason of KPI drop. With correlation analysis, it is not always a main reason. If specific statistic occurs constantly regardless of radio network performance deterioration, it is not the principal reason of specific time period. Instead, it has to be classified as a chronic performance deterioration reason of network, and needs long term efforts to improve the performance. Therefore, there is so much inconvenience to scan the data of several days of same time when operators use the method for distinguishing the main reason not by correlation but by frequency. With correlation analysis imported to avoid all those demerits, operators are offered just one statistic indicating main reason of performance, correlation coefficient.

To find out correlation between two random variables, introduction of the concept, 'correlation coefficient' is necessary. Correlation coefficient is explained as a degree of linear concentration and has a value between -1 and 1. If two variables X and Y has a perfect linear association like Y = a X + b, correlation coefficient of X and Y will be 1 or -1. In this case, we can guess the other variable if we already know the value of one variable. On the other hand, correlation coefficient of variables which do not have perfect linear combination will be an arbitrary value between -1 and 1, and + and - signs of correlation coefficient shows linear concentration between two variables. That means, we cannot get the value of other value, when we know the one. In general, scatter plot between two variables shows the shape similar with ellipse.

When NDSA receives the report on deterioration of key performance indicator (KPI) from PIM block, it calculates correlation coefficients between KPIs and other observations from NMS such as performance statistics, alarm statistics, fault statistic, and status statistics. And it is displayed as a correlation table through web graphic user interface to operators by base station transceiver. From this correlation table, operators can catch the main reason of KPI deterioration of their sites of interest. The following is the example of correlation coefficient table of SK Telecom CDMA2000 1X network, and we can see the fact that the main cause of the deterioration of origination call answered rate is ORG_NOT_ACQ (origination call not acquisition) and their correlation coefficient is -9701.

TABLE 2. EXAMPLE OF CORRELATION COEFFICIENT TABLE

Key performance Indicator	Main cause	Frequency	Correlation coefficient
Origination Call Answered rate	ORG_NOT_ACQ	41	-.9701
	ORG_MS_ATP	4	-.4333
	ORG_BAD_FR2	1	-.3316
Origination Call Completion rate	ORG_MOB_RL3	285	-.8099
	ORG_MOB_RL2	6	-.3228
	ORG_USR_BSY	5	-.2996
Termination Call Answered rate	TER_NOT_ACQ	17	-.9211
	TER_BAD_FR3	1	-.5682
	TER_BMP_MSC	1	-.3622
Termination Call Call Drop rate	TER_NO_FRM4	7	.815
	TER_BAD_FR4	8	.7774
	TER_AB_SCCP4	1	.2897

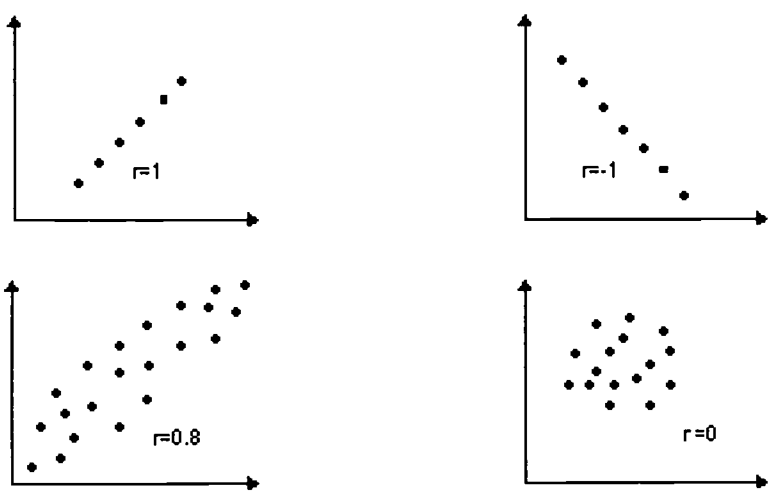

FIGURE 3. SCATTER PLOT ACCORDING TO THE VARIOUS CORRELATION COEFFICIENT

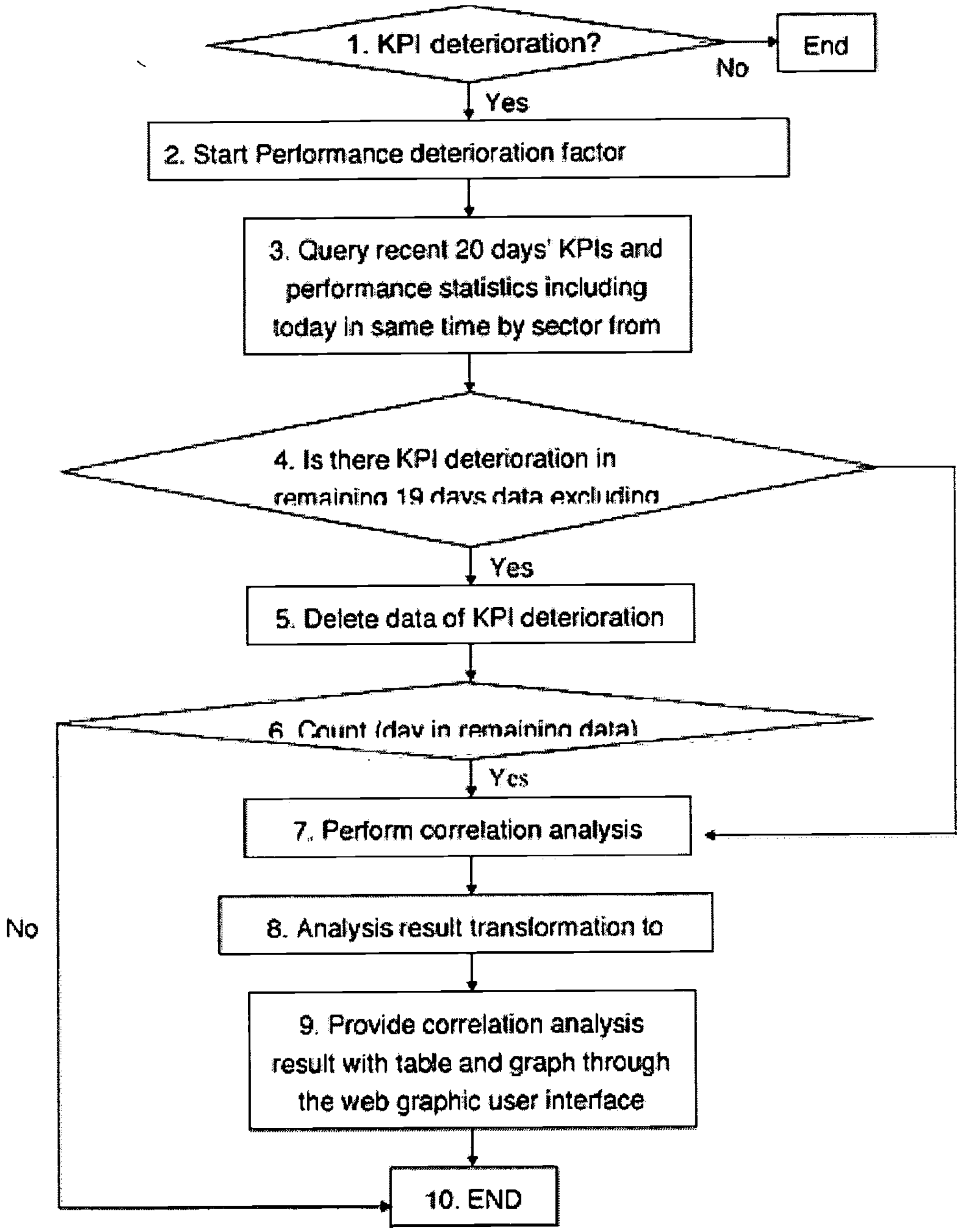

FIGURE 4. BLOCK DIAGRAM OF STATISTICAL CORRELATION ANALYSIS

4. Radio Network Trend Analysis with Statistical Analysis

Busy hour data collected from operation have significance in radio network optimization, and most of the engineering criteria are established based on busy hour traffic. In those reasons, radio access network optimizer (RANO) stores busy hour data gathered from network management system (MNS) and RF monitoring system at its database and analyzes those data with network data statistical analysis (NDSA) block. Objective statistics of trend analysis are listed at table 3. Trend analysis uses three kinds of statistical analysis method, descriptive statistical analysis, multivariate regression analysis, and time series analysis. We will look at applications of those statistical analyses through following examples from real data of SK Telecom CDMA2000 1X network.

TABLE 3. OBJECTIVE STATISTICS OF TREND ANALYSIS

items		statistics
Traffic		Origination(Termination) voice/SMS/data call attempt, Origination(Termination) average traffic Erlang
Mobility	Handoff	Soft(softer) handoff add, soft(softer) handoff drop
	Paging	First paging attempt, second paging attempt
	Location Registration	Location Registration attempt
Processor Load		CPU load of main processor (base station, base station controller)
RF Monitor		TX power, RX Interference, Average Forward Power Gain
Link Utility		BTS - BSC Link utility, BSC - GAN Link utility
Channel Usage		Average Channel Usage(various channel type of CDMA2000 1X)

Descriptive statistical analysis is simply explained as mean, variance and graphs like histogram and scatter plot of statistics. In the case of average forward power gain (AVR_FPG) of recent 60 days, radio network optimization (RANO) system displays 60 days' average forward power gain (AVR_FPG) values, 60 days average as well as 30 days average.

FIGURE 5. DESCRIPTIVE STATISTICAL ANALYSIS OF AVERAGE FORWARD POWER GAIN

Time series analysis is a method to observe and analyze given data changed according to time variation and then understand and model the stochastic process of the data. And it also used in forecasting future from the past data. Radio access network optimization (RANO) system classifies data from various O&M (Operation and Management) system into six categories - traffic, mobility, processor load, link utility, channel usage, RF monitor as explained in Table 3, and do the time series analysis with those data. In the case of origination voice call attempt in traffic category, RANO applies Winters' additive seasonal smoothing method for analysis. The stochastic model of Winters' method is given by,

Yt = ???????????????????

where ?? and ?1 are coefficients that represent trend factor, and st is a seasonal factor and ?? is a fluctuation factor.

As observed in trend graph, origination voice call attempt has an increasing trend and also has a seasonal trend by the day of the week. Through this trend analysis, RANO can give notice to operators about the point in time to increase system resources and system engineering guidelines as well as trend forecasting.

o : Actual data : Forecasting : Lower and Upper 95% confidence Interval

FIGURE 6. TREND OF ORIGINATION VOICE CALL ATTEMPT USING TIME SERIES ANALYSIS

5. Conclusion

In this paper we presented configuration of radio network optimization system and statistical analysis methods of network data. In conclusion, let's look at the summary of the systematic optimization process of radio access network optimizer (RANO). When RANO gets data every 15 minute from network management system (NMS), performance indicator monitoring (PIM) block begins statistical significance test to find out the statistically significant deterioration of radio network performance. And PIM reports the result to network data statistical analysis (NDSA) block to request correlation analysis. From the correlation analysis, mainly influenced statistic of performance deterioration of radio network is clarified. With this main cause revealed by correlation analysis performed by NDSA every hour, call failure cause analysis (CFCA) block starts up optimization process with the scheme accumulated in knowledge database. And the last, by web graphic user interface, RANO provides analysis and diagnosis result of radio network optimization to operators. And trend analysis result is also displayed at web and it is used in establishing long term engineering plan

back to index

Abstract

This paper presents configuration of radio network optimization system of SK Telecom and statistical analysis methods of network data - correlation and time series analysis. And this paper also shows the systematic optimization process with the result of statistical analysis combined with optimization scheme.

back to index

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back to index

A Strategic Methodology for Adapting Wireless Media

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View Abstract

1. Background

Next generation communications will overwhelmingly include wireless and mobile technologies. This is especially true for developing nations, where wire or fiber infrastructures are not yet adequate. But most apparent, our modern world increasingly is bent on staying in touch and no longer will accept a wire tether to exchange data or conversation. Wireless subscribers worldwide, estimated by Nokia, reveal the rapid adoption of this stay-in-touch technology: from 300 million at the end of 1998 to a projected 1 billion by end of 2002. Yankee Group recently predicted that wireless data services will be the key driver for Asia-Pacific market growth, and Yankee Group predicted earlier that the overall Asia-Pacific region will be the largest mobile market in the world by 2005. However, the individual user and the business enterprise face a multitude of choices when adapting wireless technologies. Each choice with its unique characteristics can be confusing, and most of all limit communications objectives. When applied to business objectives, loss or inability to stay in touch can be financially disastrous. There are so many variations of transmission techniques and data formats coming down the pike, that users can easily opt for the wrong solution. Because of the diversity of solutions by customer base, geography and technology, every enterprise must engage in wireless strategic planning in order to match and align business objectives with the correct selection of wireless capabilities. Choosing the wrong solution can mean not staying in touch, and that is totally unacceptable.

2. Strategic Methodology

As so many variations and uses of wireless evolve, quick or large-scale solutions may be financially fatal for any enterprise or business endeavor. Sensible solutions should be focused on corporate strategy clearly identifying value, and the technical decision should be a result of professional analysis. For example; the technical environment tells us the type of usage; voice, email, Internet browsing, wireless data, video and technical characteristics (standards) by geographical region. Business values focus on strategic directions for various uses such as; wireless enterprise applications; order entry, training, product installation or repair, customer access or supplier coordination.

By following a formal process of planning, strategic directions are reached through a careful methodology that will identify risks and rewards, and most important, avoid rash, quick and costly judgment. Wireless media adaptation is a critical and significant choice. A strategic methodology is a wise business process that generates careful, correct decisions. The following four phased, strategic methodology is a proven process:

2.1 Analyzing the Environment

This is the most critical phase of Strategic Planning. It involves internal and external drivers that are relevant to the users' or enterprises' industrial sector, e.g. services, manufacturing, pharmaceuticals, travel, product installation, repair, knowledge management, etc. We need to find out what is going on in our industry, what is the competition doing, will wireless communications add to our bottom line? Will wireless make us more competitive? Can we put wireless to work so that it aligns with our overall business objectives? Then there is the Technical Environment for which this paper is dedicated.

2.2 Goal or End-States to be Achieved

An end state or a goal is a picture of the user or enterprise engaged in action, conducting valuable, profitable operations. After analyzing the internal and external drivers, including the technical environment, we are ready to create one or more goals of just how we are going to use wireless media to our benefit. We may create several goals depending on functionality desired, technical strength or limitations, geographical deployment, cost savings, profitability, competitive strengths defined.

2.3 Issues Identified

Before reaching any end state or goal, there will be many Issues to solve. For example, we need to decide on cost, implementation schedules, policy, regulations, and feasibility of the technology. These are all issues, and there may be many more, that require solutions. Compare goals and decide which should stay in the Strategic Plan and which are most important-prioritize them. For example, it may be a goal that every sales person and service repair attendant has a Cell Phone, or even a Data Assistant. What are the Issues? Will there be different phones or devices for different geographical regions? Do we use one or many Service Providers? How do we budget for this? Do we implement slowly so that we collect test results, or be flexible to adapt new technology?

2.4 Strategic Directions

Strategic Directions are "action decisions." They solve the Issues and achieve the Goals, or end-states. Strategic Directions define exactly what course to follow, the timeliness involved and the implementation guidance. A Wireless Strategic Plan is now complete. A Wireless project is ready to begin.

3. Technical Diversity in Solutions

3.1 Cellular Personal Communications: Wide area communications

Interest and attention in wireless data transmission in the local loop through cellular personal communications systems continues to be on the forefront of network operators, equipment manufacturers, application developers and industry analysts. However, it is not progressing as quickly as once projected. From the operators' perspective evolving standards, rapid changes in technologies, high cost of network adaptations and regulatory uncertainties regarding spectrum allocation are factors in their cautious planning. From the consumer and business perspective, slow data rates of current Personal Communications Systems, combined with applications important to businesses use too much bandwidth, make wireless impractical for most applications.

Most companies understand the economic benefit and strategic competitive advantage wide area wireless access can have on campus mobility and field operations. Linking to the corporate knowledge base and applications anywhere, any time has tremendous implications. With high-speed wireless data access, workers can remain connected to the enterprise IT infrastructure from virtually anywhere in the world.

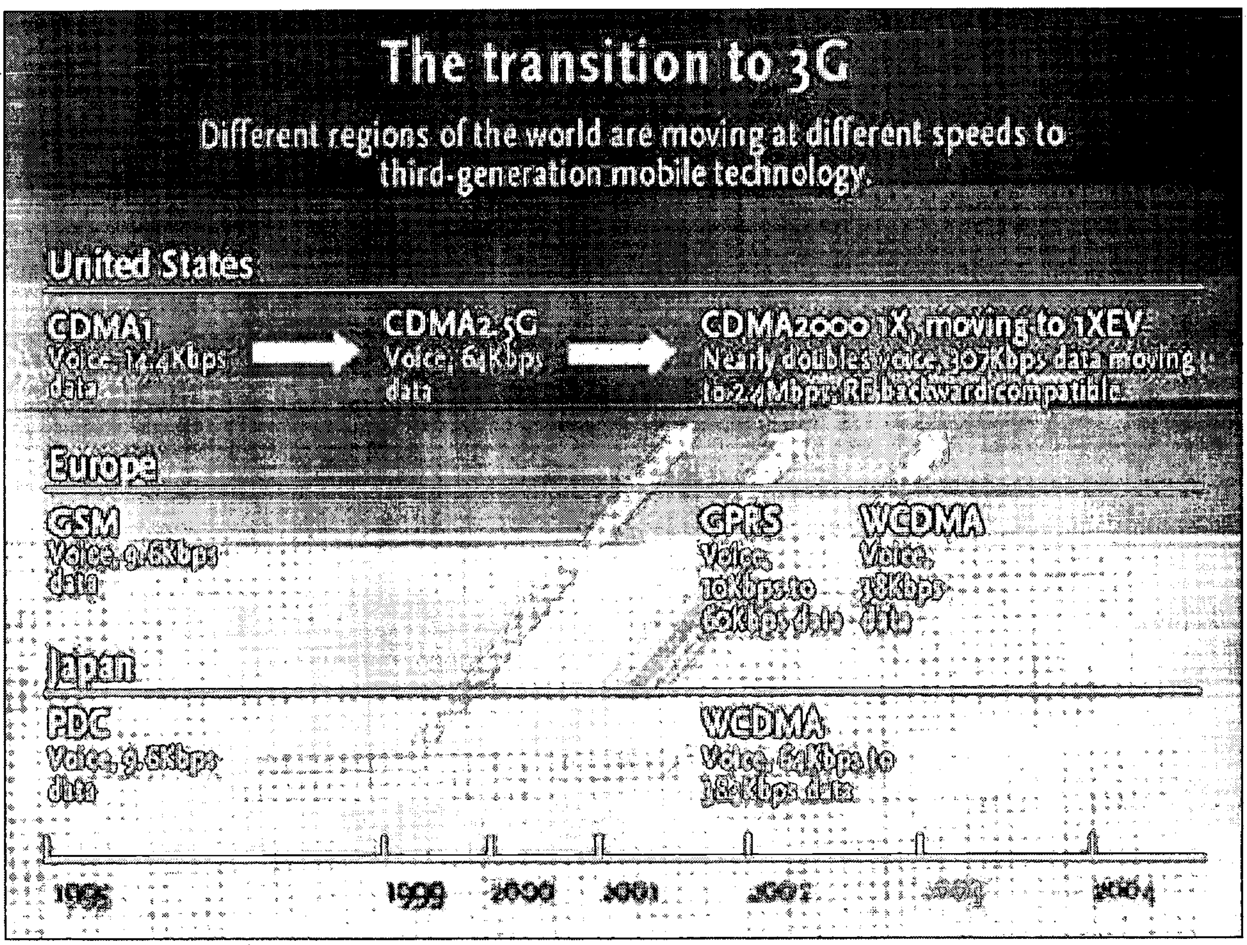
The long-term communications industry's solution to the bandwidth problem is called 3G, with the short-term solution in so-called 2.5G technologies (GPRS, EDGE and CDMA2000 1XRTT and 3XRTT). 2.5G implementations are designed to introduce higher speed data rates quickly in to the market and as a technology migration path to 3G. These implementations permit using much of the existing network infrastructure to offer data rates up to 144 kbps. An added plus of this strategy is wireless operators and application developers are presented with a means to hone their high-speed data services and products as the industry progresses towards data access rates all the way to 2.4Mbps promised by 3G.

Technology	Generation	Transmission Type	Max Data Rate
TDMA	2G	Circuit Switched	9.6 Kbps
GSM	2G	Circuit Switched	9.6
CDMA (IS-95)	2G	Circuit switched	14.4
GPRS	2.5G	Packet switched	115 Kbps
EDGE	2.5G	Packet switched	384
CDMA2000 1XRTT	2.5G	Packet switched	144
CDMA2000 3XRTT	3G	Packet switched	2.4 Mbps
WDCDMA	3G	Packet switched	2.4 Mbps

TABLE 1: CELLULAR TECHNOLOGY CIRCUIT AND DATA RATE COMPARISON

For GSM operators deploying 2.5G technologies will provide some advantage over other technologies on the expectation that all GSM operators will follow the same upgrade path from GPRS and EDGE to WCDMA. In this way the WCDMA route promises operators the ability to offer its customers a consistent and coordinated migration strategy leading to global-roaming capabilities anywhere WCDMA services are offered. Similarly GSM operators stand to benefit from economies of scale for network equipment and subscriber terminal equipment. The migration path to 3G, however, will require a complete replacement of the network infrastructure representing and enormous investment. GSM networks will require a different network infrastructure, air interface, cell planning, network support nodes and backbone network.

CDMA operators on the other hand have a more straightforward migration path towards 3G in the form of CDMA2000. Far less equipment changes in the network infrastructure will have to be made. In many cases changes in base station channel cards and upgrades the core network software may all that my have to be done. But, this will still prove to be a costly and challenging undertaking just the same for base station upgrades and other infrastructure changes.



Source: INFOWORLD

FIGURE 1: TRANSITION TO 3G

Many issues will still daunt operators and developers. Migration to 3G implies operating two-network infrastructure as the phase-in is implemented. It will take careful planning to switch over subscribers with new equipment as subscriber equipment is replaced. If users are to continue to roam where 3G infrastructures are still in transition, then complex dual-mode sets must be devised to be backward compatible with 2G networks. The prospect of offering levels of services will raise issues about the cost of multi-mode handsets and the added network complexity for backward compatibility.

4. Major Issues facing operators and developers

- On a global basis the industry has yet to settle on one of two standards- WCDMA and CDMA2000
- Spectrum allocation for 3G and the cost to operators for spectrum
- Costs to carriers to upgrade systems are significant
- The degree to which maintaining backward compatibility to 2G

For equipment developers, the issue of power consumption in the handsets for the high data rates will pose development challenges in both component and battery technologies. Many new developments in chip technology particularly more functional integration on fewer and fewer chips can radically reduce power consumption while improving processing capability. Chips that support multiple formats are in development that will at the same time simplifying system designs and solve backward compatibility issues. The importance of offering robust roaming capabilities to subscribers will weigh heavily in operators strategic planning since this can be a significant part of their revenue expansion plans.

Application	Preferred Technology
Voice over IP (VoIP)	3G
Moving Images	3G
File Transfer	3G
Downloading Software	3G
Virtual Home Environment	3G
Web Browsing	GPRS/ 3G
Document Sharing/ Collaborative Working	GPRS/ 3G
Audio	GPRS/ 3G
Home Automation	GPRS/ 3G
Remote LAN Access	GPRS/ 3G
Electronic Agents	GPRS/ 3G

Dynamic Authoring	GPRS/ 3G
Job Dispatch	GPRS
Still Images	GPRS
Information Services- Qualitative	GPRS
Unified Messaging	SMS/ GPRS
Internet Email	SMS/ GPRS
Chat	SMS/ GPRS
Remote Monitoring	SMS/ GPRS
Instant Messaging	SMS/ GPRS
Mobile banking	SMS/ GPRS
Corporate email	SMS/ GPRS
Information Services- Quantitative	SMS
Affinity programs	SMS
Simple Person to Person Messaging	SMS
Voice and fax mail notifications	SMS
Prepayment	SMS
Electronic commerce	SMS
Customer Service	SMS
Vehicle Positioning	SMS
People Location	SMS
Remote Point of Sale	Circuit Switched Data
Adapted from MOBILE LIFESTREAMS	

TABLE 2: APPLICATIONS AND PREFERRED TECHNOLOGY

The introduction of more capable chip sets that provide multimode support will be closely watched and anticipated to keep the cost of handsets down and insure wide roaming capabilities, important to subscribers and network operators alike. Application developers will in turn be further motivated to continue development efforts targeted towards mobile users.

5. Wireless Data

Wireless data and messaging systems are packet-switched asynchronous networks. Operators of wide-area data and messaging systems use licensed spectrum, and except for one way paging systems serve a large metropolitan markets. As such nation-wide or regional roaming are not supported customers. Conversely, wireless local area networks (LANs) are usually privately owned and operated, and provide high-rate data communication over a small area. Wireless LANs are unlicensed and typically operate in the ISM bands (except for the infrared systems). **Motient (formerly ARDIS)** and **RAM Mobile Data** offer wireless packet data messaging service over their dedicated networks in the SMR frequencies around 800/900 MHz. ARDIS offers services such as Blackberry in over 400 metropolitan areas in the US and Canada. Ram Mobile Data offers service over its Mobitex network, providing coverage in over 216 metropolitan areas in the US and Canada. Mobitex networks are installed in UK, France, Sweden, Finland, Belgium, the Netherlands, and Australia. The Mobitex architecture was originally developed by Telia, the Swedish national operator. The recently announced demise of **Metricom** running Ricochet wireless packet data system used a microcell architecture with small, inexpensive, base stations mounted on the tops of street light posts, utility poles, and in and out of buildings. The network was accessed through a wireless modem connected to the serial port of a notebook computer or PDA and provided data rates of up to 128 kbps. **Cellular Digital Packet Data (CDPD)** is a packet-switching data protocol and not part of any data network. CDPD is generally offered as a data service in analog cellular networks. It is designed to operate on the analog cellular networks using idle voice channels to establish packet-switching data links to subscribers. CDPD service is found in 195 market areas in the US and in 36 international markets.

All of these services have enjoyed limited success. The primary reasons for the limited success is the high cost for theses services, limited national or regional accessibility and in some cases inconsistent service levels. Rapid network expansion, equipment and base station location issues contributed to many of the technical and operational problems faced by these data services, in the case of Metricom, bankruptcy filing. For CDPD, the most widely used data service; the rapid transition of analog networks to digital formats will put considerable pressure to remain viable as a value added service. Moreover, these services have some difficult challenges ahead of them clouding their long-term viability. As 2.5G and 3G cellular networks begin to rollout with high-speed data services they will have an increasingly difficult time to compete. Even if they can increase data rates, extensive national and regional networks, international roaming and data rates approaching 2 Mbps from the 3G operators will render these services obsolete. Moreover, the availability of equipment manufacturers will increasingly become scarcer and less cost effective, making continued service viability difficult at best.

COMPARISON OF MOBILE DATA SERVICES			
	RAM Mobile (Mobitex)	**Motient (formerly ARDIS)**	**CDPD**

Data rate	Up to 19.2 kbps	4.8 - 19.2 kbps	Up to 19.2 kbps
Frequency	450 MHz, Europe 900 MHz, US/Can	800 MHz	Cellular frequencies
Mobile Equipment	Handheld terminals, radio modems	Handled terminals two way pagers, radio modems	Handheld terminals, radio modems

TABLE 3: COMPARISON OF MOBILE DATA SERVICES

6. Wireless LAN

Wireless LANs (WLAN) can be categorized as low-mobility high-speed data communications usually from a few meters to several hundred meters and function as wireless extensions to the enterprise IT network. WLANs have been evolving over the last few years creating a wide variety of products from many different vendors. Some proprietary, some based on quasi-international standards like IEEE 802.11 and HiperLAN2. Data rates, range from 1 Mbps than 54 Mbps. As high data rate WLAN adoption continues it will evolve and grow from data-centric functionality to supporting an increasing number of multimedia applications including voice and video. Moreover, high-speed wireless networking in the 5 GHz band will make possible real-time communication for voice, video, and data applications from anywhere in the enterprise, and in public access areas such as airports, meeting and conference centers, and from vehicles and public transportation.

To fulfill the service and networking capabilities expected of these technologies will have to support robust networking and bandwidth intensive data services. These requirements include support for:

- Strong security;
- QoS provisions for dynamic bandwidth, multi-media sessions, voice and video streaming;
- Mobility between local area, and between corporate and public environments;
- Equipment interoperability, ease of use, deployment and maintenance;
- Scalable for multi-level, multi-service internetworking.

In order to create a mass market, interoperability is a critical factor that must be reached. However, early introductions of 802.11 standard used proprietary variations that limited or prevented interoperability between vendor equipment. Current 802.11b based products have begun to show the necessary degree of interoperability required to bring confidence to the market and has rapidly gained ground globally as a standard of choice. 11 Mbps 802.11b products are already being shipped with a significant installed based. Products for the higher data rate 802.11a standard supporting voice and video streaming with data through puts of up to 54 Mbps are expected to ship during 4Q 2001.Products based on HiperLAN2 technology developed the European telecommunicates Standards Institute (ETSI) are expect to ship in the last quarter of 2001. The features and characteristics of HiperLAN/2 technology fulfill virtually all of the above requirements and prerequisites, although it remains to be seen how affordable it will be as compared to 802.11a. HiperLAN/2 products are expected to be available on the market during the latter half of 2001. Interoperability will, of course, also have to be proven. But HiperLAN/2 has been specified with the clear objective of achieving interoperability.

Mass-market development is also a matter of geographical scope in which the availability of spectrum worldwide is critical.

Well-publicized security breaches of 802.11b are likely not to have lasting effects. These vulnerabilities are diligently being examined by the Standards committees and will be strengthened in subsequent implementations. Just as in the wired network world, the hacker community will continue to reveal reported breaches and vulnerabilities in WLAN security. Much is at stake regarding industry confidence in the technologies security and reliability. Fixes and strengthening will quickly follow any incidents and reports of vulnerabilities. 802.11a,/b and HiperLAN2 incorporate robust key negotiation; authentication and encryption to protect the network from unauthorized monitoring and prevent unauthorized use of the network. As in wired network technologies these mechanisms will be the focus of continuous review to make sure network integrity and reliability are assured with WLAN networking to provide robust security.

As these technologies spread, it is to be expected that end users will want to move between various networks-whether they be voice or data networks and possibly networks based on different international standards. Chip manufacturers are moving to tightly integrated components that will support multiple of wireless networking standards. Several chip makers have announce multi-protocol capabilities and plan to ship products with these chips during 2002

Two distinct WLAN technologies with limited networking capabilities have also emerged, Bluetooth and HomeRF. Bluetooth and HomeRF are designed around a concept of a wireless personal area network (PAN) and operate in the 2.4 GHz band. Bluetooth is targeted primarily for device to device connectivity such as computer to computer, PDAs, cell phones, and a host of peripherals such as printers, scanners, video and still cameras and so-called digital walkman liked devices. The technology also targets household appliances such as microwaves, refrigerators, entertainment systems and home alarm systems. The technology has gained wide acceptance by device and appliance manufacturers incorporating it in virtually all-handheld products and many consumer orientated products. The HomeRF working Group created the HomeRF specifications for small office and home networking.

While both Bluetooth and HomeRF have gain significant industry acceptance and will be widely available in a range of consumer products, these technologies are too limited for business use. Limited networking capabilities and scalability and weak security are the primary detractors of these technologies for anything more than home use.

WLAN TECHNOLOGY COMPARISON

WLAN Standard	Origin	Frequency band	Data rates	
802.11b	IEEE	2.4 GHz	Up to 11 Mbps	Networking, Data only
802.11a	IEEE	5 GHz	Up to 54 Mbps	Networking, Data, voice and video
HiperLAN2	ETSI	5 GHz	Up to 55 Mbps	Networking, Data, voice and video
Bluetooth	Bluetooth Consortium lead by Chinese Taipei	2.4 GHz	Up to 720 kbps	Limited networking, primarily device to device oriented
HomeRF	Microsoft and others (HRFWG)	2.4 GHz	1.6 - 10 Mbps	Limited networking designed for low node environments such as small office or home networking

TABLE 4: WLAN TECHNOLOGY COMPARISON

7. Broadband satellite

The broadband satellite market is on the verge of becoming a viable means to deliver voice and high-speed data services. Once relegated to the role of niche technology, the satellite market is being transformed into broadband satellite networks in which Internet-based applications and services will be provided on a global basis. These services represent a move to mass-market applications

The first generation satellite networks entered service with voice, paging, low speed data, and fax services for the mass market. Iridium, Globalstar and ICO are examples of these networks. However, they met with disappointing subscriber interest. High service and equipment costs and operational difficulties were key reasons. But more importantly, their poor performance resulted from a single strategic miscalculation: their bet that they could compete favorably with terrestrial wireless personal communications. Moreover, their entry into the market came at a time when terrestrial networks built-out extensively including sparsely populated areas where it was thought a good portion of their service demand would originate.

Broadband satellite networks will offer high-speed data services with intelligent switching and routing that will compete directly or support wired networks. They are being developed to deliver high-speed multimedia data services. Their prospects for success are considerably greater than the first generation satellite networks. Not only will they compete with terrestrial services they will also provide complementary services to fill voids in coverage, and provide mobile services. Both new and old satellite companies see growing opportunities to deliver broadband services. Given the wide geographic coverage and multicast nature of satellite technology, broadband opportunities seem to be a sound fit for the satellite market.

Much speculation and anticipation surround the broadband satellite market. Their development is continually being assessed and reviewed. Projections for service initiation are constantly being revised, rapid technology changes force design changes, and the cost of building and launching satellites continues to rise. From this perspective, companies are well advised to forego any serious planning for broadband satellite services until more certainty in the market develops.

8. A Business Prospective

For companies anxious to deploy wireless solutions as soon as possible, three questions are key: Which combination of technologies to choose, who will offer a high-speed wireless services and how will the technologies be deployed on a global basis. The latter is important to companies with international operations and as such present interoperability and integration challenges as deployments of the various technologies spread across the globe.

Many companies are in the process of developing and in some cases deploying wireless data solutions to meet the needs of mobile workers. In mobile computing applications communicate on an on demand basis and mobile users may communicate using variety devices. Thus, information needs to be formatted and filtered appropriately for each device. With these issues in mind, here are a few areas to consider for wireless implementation planning:

- **Information Delivery** - How much information should you deliver to mobile devices? With the exception of laptop computers, most mobile devices have small screens, limited input keyboards and are constrained by processing and memory resources and battery capacity.
- **Multiple Devices** - How will enterprise applications adapt for use with a variety of mobile devices? The IT infrastructure will have to recognize these devices to deliver content format suited for those devices.
- **Push Technology** - Should you employ push technology? A critical component of a successful mobile application is the ability to push data to users. Remember that mobile workers operate in a disconnected fashion and often roam in and out of coverage. Thus, they cannot be expected to constantly check to see if they have any data or messages waiting for them.
- **Security** - Do you need to build in a separate level of security for mobile workers? The same level of security you implement within your organization should extend beyond the walls to your mobile users. Consider implementing firewalls as well as security and privacy technologies, such as user authentication and data encryption, as part of your mobile solution.

9. Conclusion

Wireless communications will profoundly enable the exchange of information among and between the peoples of all nations. Ease of use, rapid connectivity, mobility and accessibility of are the driving forces. The challenge is to select the preferred wireless technology that meets user needs and market utilization. A strategic methodology is essential to guide the selection process. A process that conducts an environmental scan to comprehend the variety of technical selections by function and location, and then matches capabilities with the definition of goals to be achieved. The environmental scan will identify Impending new products and standards so users and providers are able to correctly follow technical trends.

Finally, adoption of wireless media remains a complex issue that could be costly if it fails to fit users needs or correctly meet a business prospective. Although wireless communications will be a major boom for next generation communications, making it work requires careful planning.

back to index

Abstract

Enterprises face a multitude of choices when adapting wireless technologies. Each choice has unique technical characteristics that can be confusing when applied to business objectives. There are so many variations of transmission techniques and data formats that users can easily opt for the wrong solution. This paper defines a strategic methodology for choosing the right wireless adaptation. A well-planned strategy based on sound business and technical analysis is essential if users are to avoid costly miscalculations.

back to index

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back to index

Study on Forward SCH Data Rate Decision Algorithm based on Fast Forward Power Control of CDMA2000 1X

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View Abstract

Chapter 1. Introduction

To provide stable data service on mobile communication network is much different from that on wire communication environment. In case of wire network, channel error rate is much lower than that on mobile network, and the change of error rate depends mainly on the number of users, unless there is any disconnection of resource like physical link. However, the environment of mobile communication is much different from that of wire communication.

Mobile network has following differences (features) in comparison to the wire network. First, channel stability in mobile network is much lower than that on wire network due to the change of RF environment. Second, data loss or error rate is much higher on the mobile channel. Third, data rate depends on the subscriber's RF environment and the assigned power, as well as on the bandwidth on the channel. In order to use the existing wire network service, the mobile network should accept the protocol and the protocol structure that are best fit to the wire network. However, it is hard to optimize the protocol and the protocol structure to meet the mobile network. The above-mentioned features make it hard to actually implement the maximum data rate defined in the standard, and the data rate may vary in accordance with the channel environment and the system algorithm.

CDMA2000 1X system provides high speed data service as the SCH (Supplemental Channel) Scheduler function changes the data rate, using the data rate decision algorithm, in accordance with the environment. To support this function, the data rate decision algorithm should be implemented to provide stable high speed data service, to use the system resource in maximum efficiency, to give less interference to other channels, and to minimize the system load.

This study presents the method and effect of fast forward power control based FFPC(Fast Forward Power Control) data rate decision that could minimize the data throughput drop caused by rapid channel environment change and make up for the unrecovery when the data rate is decided in accordance with forward FCH (Fundamental Channel) power & available power in BTS (Base station Transceiver

Subsystem).

Chapter 2. Fast Forward Power Control of CDMA2000 1X

2.1. Fast Forward Power Control of CDMA2000 1X

It is decided to adopt fast closed circuit power control in forward link for CDMA2000 1X system. The fast closed circuit power control that has been adopted in the reverse link of the existing IS-95A/B system can lead in much improved system performance than the slow closed circuit power control performed by external circuit.

In the existing system where the low speed data rate voice call takes the major portion of the traffic, there has not been much variation in interference to the traffic channel. On the other hand, in the CDMA2000 1X system where the high-speed data traffic takes the major portion of the traffic, the characteristic of the interference to a specific channel varies. Because the high-speed data service call requires higher signal quality than the voice call, higher power is allocated in accordance with the data rate and QoS (Quality of Service) required by the traffic.

In the CDMA system where the power allocated to a channel becomes the major interference to other channels, the power allocated to a channel that requires much higher power than a voice channel becomes a substantial interference to other channels, and gives direct influence to the system performance. The amount of interference by high-speed data call is also changed remarkably in conjunction with the fast-changing channel features. In order to overcome such environmental restrictions, it is necessary to introduce the fast closed circuit power control with shortened channel control time, rather than the existing slow closed circuit power control. Figures 1 and 2 show the functional blocks for multiple data rates and the Tx part model for closed power control, respectively.

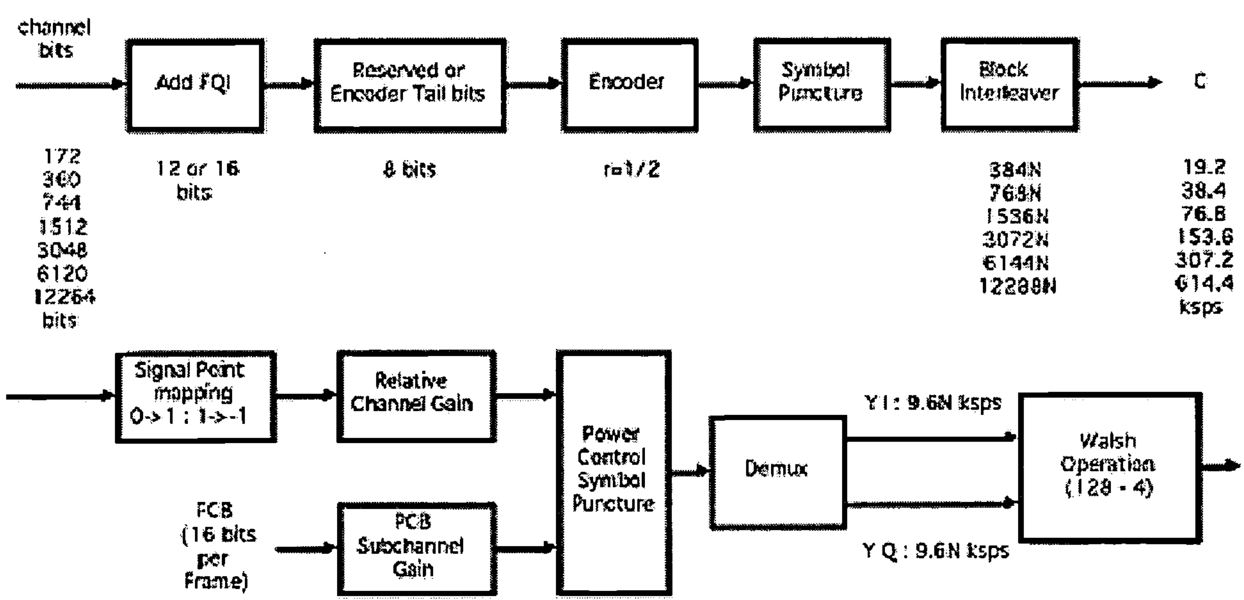

FIGURE 1. TX PART FUNCTIONAL BLOCKS FOR MULTIPLE DATA RATE

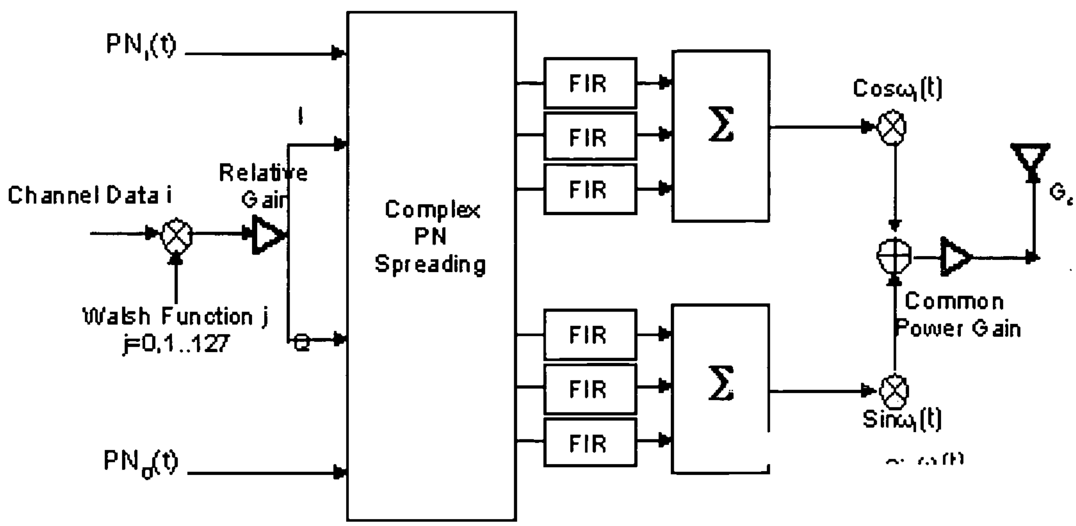

FIGURE 2. TX PART MODEL FOR CLOSED CIRCUIT POWER CONTROL

The CDMA2000 1X system, unlike the 64 chip length orthogonal-spread codes used in the existing IS-95A/B system, adopts the 128 chip length orthogonal-spread codes. Therefore, a BTS can support more traffic channels, and in the case of a low speed data rate voice call, the receiver can acquire twice more process gains than the existing system. And to support various Tx rate for traffic, 4~128 chip length orthogonal codes are allocated.

The data of Channel j spreads with one of 4~128 chip length orthogonal-spread codes, and is assigned with the relative digital gain of each channel. Each orthogonal-spread coded channel data is complex PN scrambled by the Pseudo Noise code (PN code) that identifies the BTS in the whole system, and is filtered to minimize interference between the data symbols. After the digital gain, in accordance with the cell service zone and characteristics of PA, is taken to each channel, all channels are gathered at the end part of BTS, and transmitted over the antenna. Unlike the existing IS-95A system, the CDMA2000 1X system adopts QPSK(Quadrature Phase Shift Keying)modulation and the complex PN circuit to decrease the mean power for the maximum power. In this study, the Spreading Rate 1 RC3 (Radio Configuration 3) environment defined in CDMA200 1X standard is used

Chapter 3. Simple Data Rate Decision

3.1 Simple Data Rate Decision Algorithm

The most improved feature of the CDMA2000 1X system in comparison to the existing systems is the high-speed data service. However the data rate is restricted in accordance with the RF environment of MS location. In order to use the system resources in efficient manner and to provide the desired data rate in stable manner under the restricted data rate environment, it is required to provide the service with the appropriate data rate at each time point.

The CDMA2000 1X system decides the data rate at each time point, and transmits the data in the decided data rate in consideration of system resource environment. The CDMA2000 1X standard defines 2 forward SCHs, but only 1 forward SCH is available at the moment. Reverse SCH is also available for Reverse high-speed data service, but this study describes only the forward SCH data rate decision method. In this study, the existing data rate decision method is referred to as the simple data rate decision method in contrast to the improved data rate decision method with fast power control.

The most distinctive feature of the simple data rate decision is that the system compares the power available for forward SCH and the power required for the data rate, and provides the resulted data rate.

The system calculates the power required to allocate 9600bps forward SCH, compares it with the power available in BTS, and if the power available in BTS is lower than the power required to allocate forward SCH, the system finishes the algorithm and does not allocate the forward SCH. It is because the minimum data rate is 9600bps.

If the power available in BTS is higher than the power required to allocate 9600bps forward SCH, the system increases the data rate to 19200bps. If the power available in BTS is lower than the power required to allocate forward SCH, the system finishes the algorithm and allocates 9600bps forward SCH, and if it is higher, keeps increasing the data rate gradually to 153600bps.

After all, the concept of simple data rate decision is to allocate the maximum data rate available for the forward SCH. The most distinctive feature of the simple data rate decision method is that the system compares the power available in BTS with that required to provide the data rate, and provides the resulted data rate. In this process, the RF environment of MS or frame error rate is not considered, and the data rate decision is performed with the system data only.

3.2. Problems of Simple Data Rate Decision

The features of the simple data rate decision algorithm are summarized as follows. The system calculates the forward FCH power for data call setup, adds offset for forward SCH, applies different offset per data rate in RC3, calculates the power allocated to forward SCH, compares it with the available power, and provides the data rate available. The simple data rate decision algorithm may fail to reflect, in realtime, the frame error caused by MS environment or fading. Because, once the data call is set up, signaling message forward FCH is used for signaling message, but high speed data is transmitted via forward SCH. Therefore, in order to provide the service in seamless manner, the system should check the forward SCH environment at each time point before it provides the appropriate data rate.

If the system sends the data in high data rate, despite the poor forward SCH environment, to provide excessive data, excessive forward Eb/No(The ratio of Energy to Noise Density per Bit) setpoint and error may result in frequent retransmission in RLP(Radio Link Protocol) layer, and even 0 data throughput.

In addition to the above problem, excessive data rate that does not meet the forward SCH environment may drop the data throughput even lower in connection to the congestion control that is implemented on the upper TCP(Transfer Control Protocol) layer. Congestion control on TCP Layer decreases the sliding window size for data transmission, in case retransmission and reset become frequent due to poor channel environment in forward SCH. Therefore, although the forward SCH environment is improved by the decreased sliding window, the own data throughput is small due to the TCP flow control. Even if the channel environment gets better, TCP protocol does not recover the sliding window immediately, but gradually with slow start with congestion avoidance. Therefore, although the mobile environment gets better, the data throughput is not recovered immediately.

When deciding the data rate, it is better to allocate low data rate to meet the system environment, than to allocate high data rate and to deteriorate overall performance with frequent retransmission on RLP layer and slow start by TCP flow control. Because recovery of flow control like TCP from error takes too much time, it is more efficient for average performance to decrease the data rate and to block the error from the start. To implement the concept in the system, it is important to decide the appropriate data rate in accordance with the forward SCH environment. It is hard to reflect the concept with the simple data rate decision algorithm because many forward SCH elements are excluded in the algorithm. In the simple data rate decision algorithm, like forward SCH, the system collects power of forward FCH allocated for data call at every 20ms, and decides the data rate based on this value. And it is not completely free from the forward SCH. Because forward FCH and forward SCH make different results on the same channel environment, it is hard to reflect the accurate forward SCH environment in the simple data rate decision algorithm.

Due to this problem, the test on the system with simple data rate decision algorithm resulted in overall deterioration of throughput and quality with TCP flow control caused by frequent error and RLP protocol reset. The test result and considerations are specified in Chapter 5.

Chapter 4. FFPC Data Rate Decision Algorithm

4.1. Implementation of FFPC Data Rate Decision Algorithm

In FFPC Data Rate Decision Algorithm, a new concept of SCH_power_margin_DB is introduced in addition to the simple data rate decision algorithm. CH_power_margin_dB is sent from MS at every 2.5ms, and is collected by BTS at the cycle it decides the data rate of forward power control bit. If the power up forward power control bit (1) in the entire cycle exceeds the threshold, the system adds SCH_power_margin_dB to the simple data rate decision algorithm when calculating the power for data rate with forward SCH, and compares the result with the power available in the current BTS to the forward SCH.

Collecting forward power control bit indicates that forward frame to MS and forward link quality are poor if the power control bit from MS to BTS is Up, and that forward frame to MS and forward link quality are good if the power control bit is Down. The FFPC data rate decision algorithm decreases the data rate to appropriate level if power control bit from MS to BTS has many Ups as forward link is poor, and prevents from excessive data rate being allocated as in the simple data rate decision algorithm. In other words, the power allocated to forward SCH from BTS with the simple data rate decision algorithm is identical with that with the FFPC data rate decision algorithm under the same conditions. But in FFPC data rate decision algorithm, SCH_power_margin_dB is also considered. As a result, the data rate allocated in FFPC data rate decision algorithm is lower than that of the simple data rate decision algorithm.

This may seem as if the overall data rate is dropped. However, as mentioned above, the biggest problem of the simple data rate decision algorithm is to allocate excessive data rate, causing high error rate and retransmission, and in the end, dropping the data throughput to 0. Therefore, the FFPC data rate decision algorithm that drops the data rate to meet the mobile environment will result in increase of overall performance. While the simple data rate decision algorithm is performed based on the power allocated to FCH 20ms before, the FFPC data rate decision algorithm uses the value measured at every 2.5ms. Such fast fading of the FFPC data rate decision algorithm enables the system to apply the value to the correction of power fluctuation in flexible manner in accordance with the channel environment.

Chapter 5. Improvement Test and Result

5.1. Test item and environment

This chapter describes the analysis and the result of the test for the effect of the FFPC data rate decision algorithm. The simple data rate decision algorithm and the FFPC data rate decision algorithm are compared through the lab test, and the field test with actual test environment implemented on BTS.

To perform independent lab test and field test, 2 MSCs (Mobile Switching Center) and 3 BSCs (Base Station Controller) were installed, and the data core network for data services was configured in 1 system so as to be shared by the systems. To perform the comparison between the algorithms for actual fading and fast movement, the systems were implemented at Shinlim, Nangok and Shindaebang base stations.

As shown in figure3, the CDMA2000 1X network for data service test is configured with MSs, notebooks, BTSs, BSCs, MSCs, HLRs (Home Location Register) and DCNs(Data Core Network). The MSs and notebooks are required for the users to access the data service. The MSs are implemented with CDMA2000 1X physical layer and RLP protocol, and notebooks are implemented with protocols like TCP/IP (Transfer Control Protocol / Internet Protocol). The network includes BTSs for mobile link setup with MSs, BSCs for call process, handoff process and RLP process, MSCs for connection to other networks, and DCNs that manages users and provides paths to the Internet network and general servers.

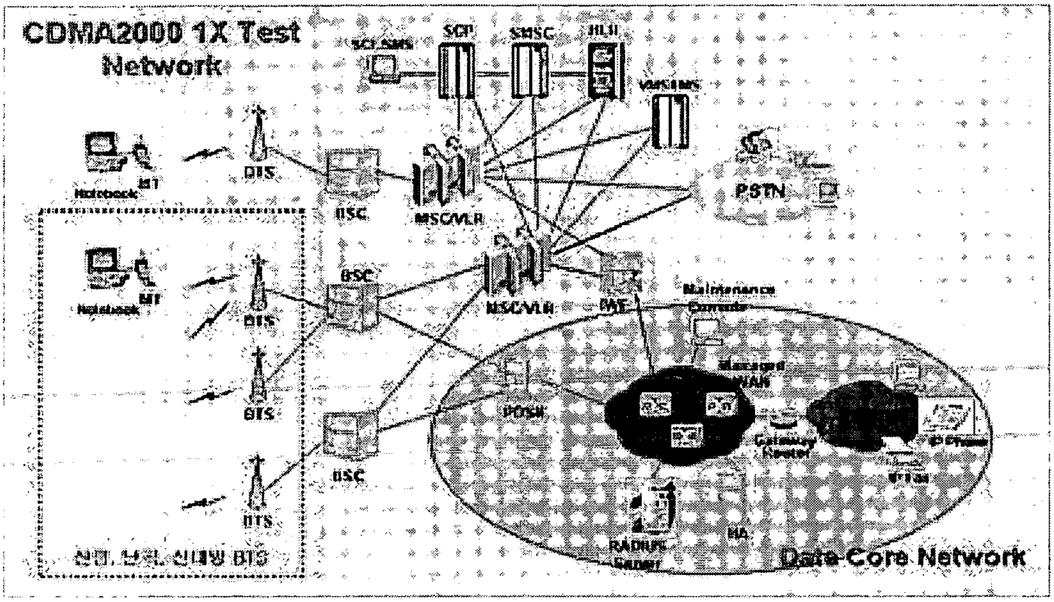

FIGURE 3. CDMA200 1X TEST NETWORK CONFIGURATION

Comparison between the simple data rate decision algorithm and the FFPC data rate decision algorithm was made through the lab test and the field test performed 10 times respectively with the above-mentioned systems. Analysis was made on the following items.

- RLP Data Throughput
- Number of Pending
- Forward FCH FER (Frame Error Rate)
- Forward SCH FER

In the above items, Number of Pending indicates the number of the data throughput drops to 0 and remained for over 1 minute during the test, and then returns to dormant status.

5.2 Test result and analysis

Under the three types of test environment as below, it is found that the mobile environment is fine with almost no fading, and when mobile environment is poor or at fast movement, the FFPC data rate decision algorithm provides much better service than the simple data rate decision algorithm.

The results of the tests performed for the three cases are summarized in the following table.

TABLE 1. COMPARISON TEST RESULT AND EFFECT OF IMPROVEMENT

Item	Type	Lab	Field(30km)	Field(70km)
RLP Throughput	FFPC/Simple	117.2/117.9	92.5/89	85.2/77.6

	Effect	-0.06%	+3.93%	+9.79%
# of Pending	Simple-FFPC	0.1	0.1	0.4
	Effect	0.1	0.1	0.4
Forward FCH FER	FFPC/Simple	1.139/1.132	1.757/1.775	2.157/2.255
	Effect	-0.05%	1.11%	4.65%
Forward SCH FER	FFPC/Simple	5.201/5.255	5.826/6.008	6.212/6.805
	Effect	1.11%	3.17%	8.8%

As shown in Table 1, for RLP throughput, the FFPC data rate decision algorithm shows improvement to the simple data rate decision algorithm by -0.06% at no movement, by 3.93% at 30Km/hr, and by 9.79% at 70Km/hr. For the number of pendings, the difference between the algorithms gets wider as the mobile environment goes poorer, and as the movement speed grows.

For forward FCH FER, the FFPC data rate decision algorithm shows decrease to the simple data rate decision algorithm by -0.05% at no movement, by 1.11% at 30Km/hr, and by 4.65% at 70Km/hr. For forward SCH FER, which, like RLP throughput, is closely related to the mean data throughpu, the FFPC data rate decision algorithm shows decrease by 1.11% at no movement, by 3.17% at 30Km/hr, and by 8.8% at 70Km/hr.

Chapter 6. Conclusion

The CDMA2000 1X system can transmit up to 153.6Kbps data via a forward SCH. The system should select the data at every point in consideration of system resource environment. This study presents a new data rate decision algorithm called as the FFPC data rate decision algorithm, where the fast forward power control based algorithm with realtime fast forward power control bit from MS to BTS is added to the simple data rate decision algorithm, in order to improve the problems of the simple data rate decision algorithm in which BTS decides the data rate by comparing the available power for forward SCH and the required power for high speed data service.

In the simple data rate decision algorithm, BTS compares the power available for forward SCH and the power required for high speed data service at each data rate, and therefore, may fail to reflect the actual mobile environment of MS in real time. Especially, if the system sends the data in high data rate, despite the poor forward SCH environment, to provide excessive data, excessive forward Eb/No setpoint and error may result in frequent retransmission in RLP layer, and even 0 data throughput. This problem can become the critical point in providing the service.

In order to overcome this problem, this study compares the existing simple data rate decision algorithm with a new data rate decision algorithm called as FFPC data rate decision algorithm where the algorithm of realtime fast forward power control bit from MS to BTS is applied. The test was performed for the two algorithms in the lab environment where the mobile environment is in well-controlled static status, and in the field test for which actual BTSs are implemented for handoff, fading and low/high speed movement test.

As a result, for RLP throughput, the FFPC data rate decision algorithm shows improvement to the simple data rate decision algorithm by -0.06% at no movement, by 3.93% at 30Km/hr, and by 9.79% at 70Km/hr. For the number of pendings, the difference between the algorithms gets wider as the mobile environment goes poorer, and as the movement speed grows.

For forward FCH FER, the FFPC data rate decision algorithm shows decrease to the simple data rate decision algorithm by -0.05% at no movement, by 1.11% at 30Km/hr, and by 4.65% at 70Km/hr. For forward SCH FER, which, like RLP throughput, is closely related to the mean data throughput, the FFPC data rate decision algorithm shows decrease by 1.11% at no movement, by 3.17% at 30Km/hr, and by 8.8% at 70Km/hr. Taken all the results together, although there is not much difference in the area where RF environment is good, the proposed FFPC Data Rate Decision Algorithm shows excellent improvement to the simple data rate decision algorithm for each parameter as a whole, and especially for RLP throughput and forward SCH FER that are closely related to the data service, results in even greater improvement. In addition, the FFPC data rate decision algorithm shows much better improvement to the simple data rate decision algorithm as MS moves faster, and as the mobile environment gets poorer due to fading.

back to index

Abstract

This thesis is the study on the FFPC Data Rate Decision Algorithm using CDMA2000 1X Fast Forward Power Control to improve Simple Data Rate Decision Algorithm, which causes many RLP retransmission, TCP/IP back_off and data throughput "deadlock"

back to index

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back to index

Policy / Regulatory

Wednesday, 16 January 2002
0845–1015
Tapa I

W.1.5 E-Commerce

Chair:
RAMESH KUMAR NADARAJAH, MANPEC, Malaysia National Information Technology Council (NTIC), *Malaysia*

W.1.5.1 E-Commerce and Regulation in the Asia Pacific Region—United We Stand? (View Abstract)

RICHARD PASCOE, Partner, Gilbert & Tobin Lawyers, *Australia*

Presenter:
JONATHAN CALLAGHAN, Partner, Gilbert & Tobin Lawyers, *Australia*

W.1.5.2 Regulating Consumer Protection in the Online Marketplace (View Abstract)

PHILIPPA LAWSON, Counsel, Public Interest Advocacy Centre, *Canada*

back to sessions

ECOMMERCE AND REGULATION IN THE ASIA PACIFIC REGION - UNITED WE STAND?

Richard Pascoe
Gilbert & Tobin Lawyers
Australia

View Abstract

1. Introduction

Although the April 2000 "tech wreck" saw the end of much of the hyperbole regarding the potential of the Internet and e-commerce, there is still a consensus that using e-commerce infrastructure and capabilities to conduct business will provide long term benefits for businesses and consumers alike.

While the gold rush may be over, the "gold" is still valuable, even if it requires more thought, patience and effort to extract, and there are far fewer overnight fortunes to be made.

What the "tech wreck" did was highlight the fact that e-commerce business models cannot be so different from traditional business models in their fundamental economic assumptions and objectives.

In a sense, the benefits of e-commerce are a subset of the benefits of improved communications infrastructure and services generally. It is clear that for economies to develop fully, improved communications is essential. Advanced communications systems can effectively remove distance (and time) barriers to the conduct of international business.

For economies in the Asia-Pacific region, the closing of distance and time barriers to the American and European business centres is important. In that context, improving access to and encouraging the use of e-commerce is and will continue to be an important economic development tool.

So can governments "regulate" to make e-commerce more viable, more affordable and more usual?

2. You Can't Do Nothing

"Governments need to recognise the amazing benefits of the Internet and do nothing to cripple it." [1]

Although the catchcry of Internet industry participants is often "no regulation", it is clear, on closer examination, that there is no such thing as no regulation. It may be that minimal regulation is the best way to encourage the development of e-commerce and online business, but there will always be a need for some level of government action. Simply fostering a neutral environment for the evolution of e-commerce, where it is no more difficult to do business online than in the real world may require some regulation to alleviate the inhibitory impact of legislation written before e-commerce became a reality.

For example, the legal recognition of electronic forms of "writing" and digital signatures is one area where there is almost universal agreement that governmental action is required. There are now many examples of this type of legislation such as are the United States Electronic Signatures in Global and National Commerce Act 2000 and the Australian Electronic Transactions Act 1999.

3. The next step - Building e-commerce foundations

Increasingly, industry and government alike are realising that some additional level of regulation may be necessary to ensure the continued expansion of a vibrant, competitive online services industry.

The value of regulation and other forms of government action that move beyond a minimalist approach is even more clear in countries where the foundations for effective e-commerce are less advanced. Where e-commerce basics such as communications and IT infrastructure and an appropriately skilled workforce are lacking, a pro-active government stance is essential for the development of a healthy online economy.

3.1 Encouraging physical infrastructure development

It is impossible to exchange information, goods and services with the rest of the world without reliable infrastructure basics such as electrical power and transportation systems for people and goods, let alone high-speed Internet networks and Internet applications. To stimulate the growth of e-commerce, a critical mass of businesses and consumers must have access to wireline and (increasingly) wireless communications services, computer hardware and software and to affordable and reliable Internet connectivity.

Inadequacies in these areas are a primary reason why the majority of the many countries have been slow to get online. Particularly in developing countries, effective government regulation can play a key role in encouraging infrastructure investment and deployment - the first vital step towards a fully functioning online economy.

3.1.1 Government Internet access development programs

Governments in many countries have engaged in successful programs to promote IT infrastructure development; the early adoption of Internet and IT technology for business, education and social institutions; and programs to assist in the attainment of universal Internet access.

For many developing countries, wireless Internet access will be a key way in which people access the

Internet. It is also expected that, in the next two to three years, interactive television will become a major source of Internet delivery in many countries. For example, whilst PC penetration in the Asian region is low, the penetration of cable television is much higher. [2]

3.1.2 Access and capacity pricing policies

ISPs providing backbone infrastructure require economic incentives to expand that infrastructure through an ability to recover the costs of building additional backbone. One way to help provide this incentive is to refrain, for an initial period, from interconnection regulation in respect of new types of networks - such as fibre optic cables for broadband conveyance services - and to allow infrastructure providers to negotiate interconnection rates with other service providers on a commercial basis. This was the approach taken by the Telecommunications Authority in the Hong Kong SAR in 1997, which declared a 3 year moratorium on such regulation, commencing in March 1998.

Another important pricing issue is the development of an appropriate payment systems for the flow of international Internet traffic between ISPs. The ITU estimates that developing countries could soon be faced with bills of net US$5 billion a year for Internet traffic generated by United States based users.[3] The recent ITU Recommendation on International Internet Connection would go some way towards correcting this imbalance. The Recommendation calls for arrangements to be negotiated and agreed upon on a commercial basis when direct Internet links are established internationally, taking into account the possible need for compensation for elements such as traffic flow, number of routes, geographical coverage, and the cost of international transmission among others when negotiating such commercial arrangements.[4] Other mechanisms for helping to redress this imbalance include stimulating increased Internet infrastructure and content development in countries outside North America, as well as the ongoing development of additional transPacific cable systems.

3.1.3 Appropriate competition policies

"...in order to flourish, e-commerce requires ...an underlying competitively provided, state of the art communications infrastructure which is reliable, efficient, accessible and affordable ...a competitive telecommunications marketplace is the most effective means of ensuring a sustained, long-term trend towards lower costs, increased quality and thus expanded access to the telecommunications infrastructure..."[5]

In many parts of the world, it has been the incumbent telephone company that has moved to place itself as the dominant ISP (across retail, backbone infrastructure provision and content hosting). This has meant that competitor ISPs entering the market face a fully integrated telephone company/ISP competitor with inherent advantages in terms of customer reach and infrastructure. Fostering competition to stimulate a country's online economy in such an environment often requires appropriate regulatory intervention to prevent the incumbent telephone company from unfairly competing in the ISP market.

That said, it is difficult to regulate potential anti-competitive conduct of the incumbent without imposing overly onerous obligations on new entrant infrastructure owners. Striking the right balance in this regard is imperative if the regulation of competition is to successfully stimulate infrastructure investment for the digital economy, and not instead act as an impediment to it. Often it will be necessary to continue to engage in asymmetric regulation well after the monopoly of the incumbent has ended.

3.1.4 Tax incentives

Online success requires investment in the tools of Internet business. Increased connectivity and competitively high levels of information and communications technology will not happen without an environment that encourages private sector investment.

Examples of incentives being put in place to encourage take-up of new services in some countries include; the subsidised purchase of PCs in Singapore and Sweden through tax breaks[6] ; the removal of import taxes on computer related equipment in the 1980s by the Government in Costa Rica; and the recent decision by the Indian Government to lower import duties on IT equipment.

Another example is the moratorium on the imposition of Internet taxes put in place by the United States Congress. Many predict that the complete United States Internet tax moratorium will not last much longer. [7] However, a temporary Internet tax moratorium with frequent review dates is a crucial example of a regulatory approach designed to give vendors the incentive to get online now, and also to allow time for regulators to work out exactly how, in the future, they are going to successfully tax Internet transactions.

3.1.5 A stable and transparent regulatory framework

"...The second component of independent regulation is the necessity to shield the regulatory agency from political pressure. Doing so ensures the integrity of the policymaking process. It also limits arbitrary changes in rules, and encourages greater confidence on the part of investors. Historically, changes in governments lead to changes in regulatory policy. If the regulator is tied closely to the incumbent government, changes in government can introduce an element of uncertainty which heightens investment risk, and can serve potentially to deter future investment." [8]

As the fast pace of e-commerce itself creates great uncertainties, predictability, openness and transparency in governmental decision making and a clear and evenly enforced regulatory system is of great value to business investors. Attention to the rule of law and open government can be a crucial competitive edge in the online world. Countries such as Singapore have publicly acknowledged the importance of being seen as a "trusted node" if they hope to establish themselves as e-commerce hubs.[9] Where competition is stifled or the rule of law is weak, international investors will demand greater premiums for the risks they face, or will be deterred altogether.

Further, in many countries embarking on a program of reform, there has been a multi-year program of privatisation, liberalisation and other reforms involving a range of technical and managerial issues. Successful implementation of such a program requires stability and continuity of policy during the transition - both to ensure investor confidence and to see longer term schemes reach fruition. Often this will require ensuring that the reform process is independent from the ever-changing dictates imposed on the legislature by the electorate.

3.1.6 Positive foreign investment policies

There is understandably a reluctance on the part of many regulators to open up their economies to unrestricted foreign investment. However, for the vast majority of countries, it is equally a reality that enabling investment and participation from foreign firms interested in forming strong local partnerships will be crucial to the success of their online economies. Often incentives for foreign investors include tax incentives and a stable and transparent regulatory system.

3.2 Training and keeping the best people

There has been a global shortage of people qualified to help build the global digital economy.

3.2.1 Education and Training policies

Governments have a key role to play in creating and supporting a knowledge-based society with a culture of local creativity and information sharing and a skilled and efficient workforce, and many governments have already started to realise this. One of many possible examples is the Singapore Government's incentive program to encourage businesses to invest in re-skilling their employees to meet the challenges of the digital economy and plans to introduce specialised e-commerce business and professional courses in its universities and technical colleges.

3.2.2 Immigration policies

Another important element of a successful strategy to build-up a country's human resource base is the tailoring of immigration policy to welcome skilled technical workers from overseas. International competition for skilled workers will only increase as the digital economy expands, and the use of incentives to educate, attract, and retain skilled people will weigh heavily in a nation's future economic success.

3.3 The importance of local content

Experience is showing that attractive local content can command a significant audience. Whilst many English language websites have gained from a first mover advantage, that advantage will diminish if multi-lingual capabilities are not incorporated. Even in the Australian market, which shares many cultural similarities with the United States, most of the very popular sites are domestic sites. Indeed, many of the most popular Internet services - news services, consumer shopping services, dating services, online property auctions etc - are most attractive when designed for a particular regional market. According to Forrester Research, business users on the web are three times more likely to make purchases when addressed in their native language. Currently only just over 50% of Internet users are native English speakers, yet 78% of websites are in English and 96% of e-commerce sites are in English.[10]

Particularly in the Asia Pacific region, the demand for regionally focused content in languages other than English will be expanding rapidly over the next few years. The number of Chinese websites has grown exponentially from 3,700 in July 1998 to over 27,286 in July 2000. [11]

Having local web content is a valuable online asset. Local content provides direct revenue from advertisers, increases traffic and hence carrier revenue, attracts customers and aggregates transactions, decreases reliance on mirror and cache arrangements, and is likely to reduce volume based charges payable for connection to overseas ISP backbone providers, such as those in the United States. Popular local content also provides bargaining power in peering negotiations with other ISPs - increasing the leverage to negotiate more favourable peering arrangements.

The approach taken to Internet content regulation in a particular jurisdiction will also have an important bearing on the health of the domestic online economy in that jurisdiction. If regulators propose to engage in some form of Internet content regulation, then it is important that consideration is given to appropriate liability safe harbours for ISPs. Experience is showing that regulators who do not allow for such safe harbours will be faced with an exodus of ISPs who all relocate to countries with more favourable regimes.

3.4 Encouraging awareness of e-commerce

Intense publicity about the benefits of the Internet has still left a significant number of businesses and consumers without a clear understanding of e-commerce. For many, the online world is still an untried, untested and unfamiliar one. The slow progress being made by B2C e-commerce is indicative of the inhibitory impact on the growth of online economies that this can have. By putting key government functions online and by engaging in public awareness campaigns, governments can do much to improve consumer and business awareness of, and familiarity with, the Internet.

3.4.1 Governments can be Model Users

Governments are often a country's biggest purchaser of goods and services. Consequently, Governments have the potential to make a very large impact on consumer and business familiarity with the Internet by promoting and offering e-commerce in government-to-government, government-to-business and government-to-individual transactions. Among many possibilities, successful government online initiatives include:

- tender and procurement of goods and services;
- delivery of governmental services - for example, matching employers and job seekers;
- government information;
- statutory registration processes (eg companies, businesses, censuses, social security etc);
- voting;
- completion and submission of taxation returns and other reporting obligations; and
- linking of governmental organisations and personnel.

4. Taking the risk out of online transactions

Access to and use of electronic transactions provides considerable benefits to consumers, in terms of improvements in transaction convenience, choice, range and even price. For businesses, online market mechanisms are attractive because they offer access to a broader market (and information about that market), entail low start-up and operating costs, and provide cheap and efficient marketing and distribution media. The majority of e-commerce transactions will be completed satisfactorily and without incident. However, for e-commerce markets to reach their full potential, consumers who do encounter problems need to have access to remedies that are quick, effective, inexpensive, and easily accessed. Businesses need certainty about the security of their online transactions and the scope of their liability when engaging in e-commerce. Overall, there must be an environment of trust, security and certainty before business and consumer inhibitions about doing business on the net will be shaken off, and the true potential of e-commerce unleased.

4.1 Privacy

Expectations of privacy vary widely across cultures, however almost all individuals are concerned to some extent about the handling of data about themselves.

The evolution from paper-based systems to an online environment has made a far greater range of uses of personal information possible and has made it much easier to transfer that information. The Internet makes it easy to solicit and collect information. Reassuring consumer privacy concerns when trading in an online environment is essential to the continued growth in e-commerce. Effective privacy regulation is essential to providing that reassurance.

The extra-jurisdictional nature of e-commerce has reduced the power of governments to effectively protect the privacy of citizens. However, governments and local regulators are not powerless to prevent undesirable privacy infringements. Governments can foster cooperative approaches to privacy protection, which encompass a variety of national approaches within internationally accepted principles and which also encourage effective industry self-regulation.

4.2 Security

A recent poll found that 67 % of Americans feel either concerned or threatened by possible cybercrimes and 61% indicated that because of these concerns they were less likely to business online. [12] Another recent study regards lack of information security as being Asia's greatest drawback in terms of "e-readiness". [13] Improving these sorts of perceptions will require clear, enforced legal frameworks and public education about security.

4.2.1 Encryption

One of the best ways to protect electronic information is through encryption, which is the use of mathematical algorithms to scramble information into digital codes. Simply by refraining from prohibitive legislation, governments can make it easier for companies operating internationally to use strong encryption, and for domestic technology vendors to develop and sell cryptography products both within a country and abroad. Governments can also help by themselves gaining operational experience with encryption so as to make it more useful to the commercial sector.

Further, governments can be involved in acting as a trusted third-party organisation or institution that administers the keys to unlock the digital codes. Governments can either fulfil this role themselves by acting as certification authorities, as has been done in the EU, or they can agree with industry to bear some of the liability of private certification organisations.

In a number of countries, certification authorities are organised hierarchically into what is referred to as a public key infrastructure (PKI) or public key authentication framework (PKAF).

Establishing a PKI is a way to provide confidence that:

- a signer's public key in fact corresponds to their private key;
- keys are generated and managed in a trusted and legally based manner;
- different encryption systems are interoperable; and
- there is an effective framework for the distribution and management of public certificates, including provision of information on key revocation and key compromise.

One fear with legislated PKI structures is that they will impose a set of flawed rules that will fundamentally skew a dynamic infant marketplace and "lock in" a set of business models that the market would otherwise reject. While public key cryptography is playing an important role in emerging e-commerce practice, e-commerce is still in its infancy and technology neutrality generally is still very important. Legislation should not encourage the use of one technology over others, and must be able to accommodate differing commercial needs for varying levels of security, legal effect and liability.

4.2.2 Safe online payment mechanisms

The success of online economies depends to a large extent on trust amongst consumers and businesses in the integrity of online payments systems. Much of this trust in turn will stem from appropriate apportionment of liability between consumers, credit providers and vendors. It will also depend upon speedy, cheap and effective dispute resolution mechanisms. There is much to be said for the role of industry self-regulation in this regard, however government regulators also have an important role to play in setting broad frameworks and acting in a consumer protection role.

Building consumer trust in electronic payment systems is not only related to the inherent security of those systems, but also to familiarity with the systems through use. Providing one's credit card number to an e-commerce merchant is significantly more secure than doing so over the telephone to confirm a hotel reservation or even, in some situations, handing it over to a merchant in a physical store. Indeed, the 4 or 6 digit customer PIN and plastic card with signature used in most credit and debit card payment systems have a low level of inherent security. Yet consumers in countries all over the world, and particularly in places such as the United States, have developed a very high level of trust in these systems.

The importance of consumer trust in the companies that they are doing business with is also important. Privately initiated marketing and public reassurance campaigns have a large role to play in this regard. In an online environment, where many of the e-commerce merchants are unknown entities to consumers, governments may usefully be able to supplement this consumer reassurance role. In Singapore, for example, a series of eSale events have been held to promote awareness of the general public about online shopping.

4.3 Intellectual property protection

It has long been recognised that the growth of e-commerce, and the ability to perfectly copy electronic data and distribute it instantly on a global basis, raise a number of issues regarding how to appropriately protect intellectual property rights in this sort of environment. International agreements that establish clear and effective copyright, patent, and trademark protection (and consistent enforcement of these rights) are necessary to prevent piracy and fraud and to encourage the preparedness of content and technology developers to proffer their wares on the net. Without confidence that they will be rewarded for their work, content creators - from artists to software engineers - have little incentive to create, in turn hampering the development of local content and a strong local software industry. Inadequate intellectual property right protection is also a significant deterrent to international trade.

4.4 Jurisdictional issues

E-commerce is subject to the existing legal frameworks in countries respecting choice of law and jurisdiction, but the Internet's ubiquitous reach creates many difficulties when traditional concepts of jurisdiction are attempted to be applied in an online environment. Jurisdiction has historically been based on geographic and physical characteristics. e-commerce vendors and customers alike need to understand their exposure to liability in foreign jurisdictions.

The application in the online environment of national consumer protection laws, criminal laws and a whole raft of other laws designed for public protection, is complex. Greater reliance will need to be placed on the practical penalties that can be imposed through self-regulation.

4.5 Consumer protection

E-commerce holds the potential to increase consumer choice, stimulate price, quality and service competition, and better inform consumer decision-making. At the same time, e-commerce opens new possibilities for schemes to defraud consumers (for example, because of limited opportunities to examine goods before purchase), and brings to the forefront the difficulties of enforcing consumer rights in foreign jurisdictions. To encourage the participation of consumers in online economies it is important that consumers feel that they are no less protected when making electronic purchases than they are when they perform traditional commercial transactions.

More market sensitive and flexible means of market regulation, such as guidelines, charters, standards, codes and co-regulatory approaches that place significant emphasis on industry self regulation are also useful. Governments across the globe have recognised the need to form new relationships with industry. The United States, EU and Japan have all opened up channels of dialogue with industry leaders to permit this relationship to take hold. Successful industry leadership and self-regulation requires that industry is willing to cooperate and enforce a set of standards and practices. Open dialogue between industry and government is crucial to achieve that co-operation.

4.6 Online securities trading regulation

Securities regulation can be amended to foster online share trading and ensure that online share trading is efficient and reliable. In addition, the development of fully integrated financial services will also require an integrated framework for regulating financial institutions and markets as historical differences between segments of the industry such as banking and brokerage, equities and derivatives, may become meaningless.

"Depending on how the exchanges, their members, and the regulators anticipate and respond to the various scenarios under consideration, Hong Kong could emerge as the leading financial centre in the region, or at the other extreme it could become marginalized".[14]

Another important issue for governments is the impact of the Internet on traditional stock exchanges by virtue of its tendency to reduce access barriers to investment by domestic investors in foreign equities. Stock exchanges in the Asia Pacific Region are already losing trading volume to the United States securities markets. To meet this threat, local stock exchanges may need to consider developing derivatives on foreign equities, and related products. The SEHK forecast that it could have lost up to 40% of its trading volume if it had no online strategy. Creating an attractive overall environment for e-commerce through the other initiatives discussed in this paper will also play a key role in attracting and retaining foreign and local capital.

5. Conclusion

This paper has outlined some of the governmental actions that can further stimulate the growth of domestic e-commerce. Those initiatives range from a government's own attitude and use of the Internet and e-commerce in its dealings with its citizens, through to specific regulatory initiatives to ensure that e-commerce can thrive and produce localised economic benefits.

There is no "right" answer to regulating the development of the Internet and e-commerce. There is much that is attractive in the view that governments should just "get out of the way". However, it is not always the case that simply getting out of the way produces the most beneficial policy outcomes. Different jurisdictions have different policy objectives, different cultural imperatives and different starting points for the development of online services. Evaluating what regulatory initiatives best serve desired policy outcomes is a difficult and ongoing task.

What is apparent, however, is that technology will almost certainly continue to outpace regulation. On that basis, what regulation must do is work with the changing nature of technology rather than attempt to fix a mandated technological outcome. Only in this way will regulation play its part effectively in stimulating, rather than hindering, the growth of e-commerce and the benefits that come with that growth.

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back to index

Abstract

The Asia Pacific region is a unique blend of developed and developing countries with a large population from a wide range of cultural and ethnic backgrounds spread across a geographically large and diverse area.

The Internet and the opportunities it presents has the potential to reshape the way in which countries in the region deal with each other, the Americas and Eurasia.

The features of the region, combined with the traditionally North American centric nature of the Internet, pose unique challenges for Governments and businesses in the region attempting to utilise fully the potential offered by the Internet and ecommerce.

Although regulation and the Internet are often viewed as being mutually exclusive, many countries in the Asia Pacific region do not have the luxury of adopting the "hands off" regulatory approach favoured by the United States. However, overzealous or ill-informed regulation is equally as problematic, as it inhibits the growth of Internet related infrastructure and services.

So what can Governments of the Asia Pacific region do to stimulate the growth of their online economies in a manner consistent with the fundamental principles and economics of the Internet?

This paper will examine some of the options (supported by current examples) that are available to Governments looking to stimulate that growth. Those opportunities include:

- fostering equitable and economically efficient telecommunications capacity pricing especially international capacity pricing;
- facilitating correct broadband access policies to support the next generation of Internet services to homes and businesses;
- establishing logical regimes for tax application/concessions that efficiently promote Internet based industries;
- revising securities regulation to foster efficient online share trading environments that are both reliable and broaden and deepen the equity base of local exchanges;
- ensuring that local financial institutions are able to operate as intermediaries for ecommerce transactions;
- developing appropriate liability "safe harbours" for ISPs and carriers that avoid unnecessary exposure to various levels of content regulation;
- developing policies to facilitate local players as strong regional portals for language groupings other than English;
- developing policies to encourage portals with local content that avoid an overly US-centric view of the world;
- ensuring appropriate immigration rules to encourage Internet-literate workers to be able to live and work in the jurisdiction; and

- developing and enhancing rules for online contracting, security and electronic evidence to give the economy the confidence to pursue ecommerce environments.

The paper takes the position that regulating appropriately in these areas is possible and can boost the growth of services that the Internet and ecommerce can offer.

Key words

- Internet
- ecommerce
- regulation
- liberalisation
- infrastructure

back to index

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back to index

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back to index

Regulating Consumer Protection in the Online Marketplace

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View Abstract

1. Introduction

Until recently, consumer protection was considered primarily a domestic issue. With globalization of the marketplace, this is changing. Nowhere is the need to act globally to protect consumers' interests more apparent than in the context of electronic commerce. As an instantly global medium with no location, the Internet poses tremendous challenges as well as opportunities for businesses, consumers, and regulators alike.

Unscrupulous merchants now have a new medium through which to take advantage of consumers, and they can do so from foreign locations, making law enforcement difficult, if not impossible. Moreover, the online marketplace does not reside in any particular jurisdiction, clouding issues of which laws and whose courts apply to any particular cross-border transaction. Online merchants must try to win over skeptical consumers, who are reluctant to engage in electronic transactions for fear of compromising their privacy or because they don't have sufficient reassurance of the merchant's reliability.

This paper examines the unique challenges posed by electronic commerce for consumer protection, the various initiatives being taken at both the domestic and international levels, and the new principles of regulation represented by these trends.

2. Problems in Retail E-Commerce

Numerous studies have highlighted continuing problems with retail e-commerce, including security breaches, unauthorized use of personal customer information, inadequate privacy policies, lack of key information about the merchant (e.g., address); failure to provide key contract terms prior to sale, and failure to deliver (either on time or at all). While such problems may be expected in the "early adoption" period of a new medium such as e-commerce, as retailers race to take advantage of the Internet before they are really prepared, the continuing nature of these problems raises concerns about consumer confidence and trust in the electronic marketplace. Market surveys show continuing consumer reticence to engage in e-commerce precisely because of these risks.

Problems specific to B2C electronic commerce include anonymity of the parties, lack of direct contact, ease of keystroke error, instant international presence, new opportunities for fraud and deception, vulnerability of personal data, vulnerability of electronic systems, and inability to control unsolicited email marketing. In addition, the tremendous increase in distance selling as a result of e-commerce has put a spotlight on redress problems associated with distance sales, especially where the transaction is across borders.

For these reasons, much attention, both domestic and international, has focused not only on updating existing general consumer protection laws to cover the electronic context, but also on developing new rules and guidelines specifically for the electronic context. These initiatives fall into three general categories: policy, legislation, and marketplace initiatives.

3. Policy
3.1. Government

At the domestic level, many countries have developed national e-commerce strategies designed to position themselves as leaders in the global marketplace. These strategies often include a consumer protection element, recognizing that retail e-commerce cannot succeed without consumer trust and confidence. In some cases, these policy documents are government-generated. In others, the government is just one stakeholder among many involved in the creation of the policy document. Where the document is in the form of a Code of Practice, it sometimes forms the basis for a trustmark or seal program, under which merchants can be certified as meeting established criteria of reliability.

Canada's "Principles of Consumer Protection for Electronic Commerce" , for example, were developed by a multi-stakeholder group including key representatives from business and consumer organizations. They cover eight topics: Information Provision, Contract Formation, Privacy, Security of Payment and Personal Information, Redress, Liability, Unsolicited Commercial E-mail, and Consumer Awareness. Among other things, they require that online retailers:

- provide consumers with clear and sufficient information to make an informed choice;
- take reasonable steps to ensure that the consumer's agreement to contract is fully informed and intentional;
- obtain the consumer's consent before collecting, using or disclosing that consumer's personal information;
- offer fair, timely, effective and affordable means for consumers to resolve problems with any transaction; and
- refrain from transmitting commercial e-mail to consumers without their prior consent, unless the vendor has an existing relationship with the consumer.

On the basis of these guidelines, the same multi-stakeholder group is currently developing a more detailed Code of Practice, for potential use in conjunction with a Canadian-based seal program.

Since 1999, national codes and policy initiatives in this area have been guided by the OECD's Guidelines for Consumer Protection in the Context of Electronic Commerce. The OECD Guidelines, the product of 18 months of discussion amongst OECD member governments, business and consumer representatives, were designed to help ensure that consumers are no less protected when shopping online than offline, without erecting barriers to trade. They call for fair marketing practices, clear and sufficient information disclosure by online vendors, a transparent process for the confirmation of transactions, secure payment mechanisms, fair, timely and affordable dispute resolution and redress, privacy protection, and consumer and business education.

The emergence, indeed proliferation, of Codes of Practice aimed at boosting consumer confidence in e-commerce has prompted further governmental efforts to guide the development of such Codes. Surveys of e-commerce seal programs show widely differing content, from those narrowly focused on privacy or security, for example, to those covering all transactional issues of relevance to consumer protection. Some Codes contain detailed rules with high standards, while others demand only minimal and basic consumer-friendly practices from their members. Compliance regimes range from rigorous to lax. Yet, the appearance of the trustmark has little bearing on the content behind it. Hence, the whole point of seal programs (to provide consumers with a simple means of assessing merchant reliability) is being undermined.

In order to provide consumers with some way of assessing the various seals in use by "e-tailers", some governments are developing guidelines for Codes themselves. Others, in cooperation with market players, have gone so far as to develop "umbrella seal" programs, designed to certify seal programs with an overlay seal.

The UK government launched a pre-Christmas campaign in late November 2001 to reassure consumers "that they can buy their presents as safely from the web as they can on High Street". The campaign emphasized laws giving consumers a 7 day cooling off period and protection against credit card fraud, as well as trustmark programs and common sense tips for safe e-shopping. Other governments have issued warnings, shopping tips, and other consumer information designed to assist online consumers.

3.2. Policy - Non-government

At the same time, similar initiatives are underway in the private sector, led primarily by business interests who wish thereby to influence both marketplace practices and government policy. The Global Business Dialogue on E-Commerce (GBDe), for example, has issued a number of policy papers on e-commerce issues, including, under the rubric of "consumer confidence", detailed recommendations on consumer data protection, trustmarks, and alternative dispute resolution.

The International Chamber of Commerce (ICC) issued guidelines for Advertising and Marketing on the Internet as early as 1998. An international consulting firm, working with e-commerce businesses and interested parties throughout the world, published "The Standard for Internet Commerce" in December 1999, in an attempt "to accelerate the successful growth of global e-commerce by catalyzing the adoption of online business practices that serve both the customer and the Internet merchant". Similarly, a group of seven large American e-commerce businesses calling themselves the "Electronic Commerce and Consumer Protection Group", issued guidelines for consumer protection online in June, 2000.

Consumer groups, despite their meager resources, have also been working together to influence policy. Consumers' International has issued a series of recommendations for policy development and reform as a result of its studies on cross-border shopping, data protection, and online dispute resolution. The Trans-Atlantic Consumer Dialogue ("TACD"), an EU-USA initiative, has issued numerous resolutions on a number of e-commerce-related topics, including unfair contracts, minimum disclosure standards, consumer data privacy, unsolicited commercial e-mail, payment card redress and protections, alternative dispute resolution, and jurisdiction in cross-border disputes.

While many of the initiatives to enhance consumer confidence in e-commerce have been developed by multi-stakeholder groups, most policy documents emanate from either the business or the consumer camp, and reflect the different perspectives and interests of each. One notable exception is the recent agreement between the European consumer organisation ("BEUC") and the Union of Industrial and Employers' Confederation of Europe ("UNICE") on a European framework for e-commerce trustmark schemes. BEUC and UNICE hope the scheme will help establish an EU-wide framework for trustmarks with the support of the European Commission. The BEUC-UNICE agreement has been presented as joint input to the European Commission in order to feed into the Commission's developing policy on e-commerce and e-confidence.

Formal standards initiatives, both national and international, are also underway with a view to influencing marketplace practices in the field of e-commerce. The Swiss Association for Standardization (SNV) has developed proposal for a B2C e-commerce standard in Europe, entitled "E-Business - Legal Compliance and Trust". Canada is also considering a formal national standard of consumer protection in e-commerce, based on the Principles discussed above. At the international level, the Consumer Policy Committee of ISO (the International Organization for Standardization) recently recommended that ISO consider developing a formal standard for B2C e-commerce.

4. Legislation

The rapid evolution of e-commerce has prompted a spate of e-commerce-enabling legislation worldwide. The UNCITRAL Model laws on electronic commerce and electronic signatures have provided templates for domestic legislation designed to facilitate electronic commerce. These statutes, however, are designed merely to remove impediments to e-commerce; they do not address the consumer protection issues mentioned above. Indeed, by facilitating electronic transactions without concurrent consumer protection legislation, these legislative developments can exacerbate consumer problems with e-commerce.

A number of countries, however, recognize that a legislative framework to enable e-commerce must include new and strengthened consumer protections to deal with the new problems for online consumers. Europe, for example, has led the world with its legislation on data protection and consumer protection in respect of distance contracts. Canada has enacted data protection legislation at the federal level, and has begun a nation-wide process of updating and harmonizing provincial consumer protection legislation in the area of e-commerce. This process involves a common template for regulation of Internet contracts by provinces, covering contract formation, cancellation rights, credit card charge-backs and information provision. Some provinces in Canada have already updated their laws to address online consumer problems.

Credit card chargebacks are an important method of consumer redress in e-commerce, given the predominance of credit cards as online payment methods. Chargebacks are regulated in some countries, but not in others. In the USA, for example, the Truth in Lending Act gives consumers rights to dispute charges on their credit cards, and requires credit card companies to provide detailed disclosures of the process for such disputes. In contrast, credit card chargebacks in Canada are an entirely voluntary mode of redress for consumers, with the recent exception of some provincial regulations limited to Internet sales contracts. Clearly, the chargeback mechanism offers a particularly efficient and powerful tool for consumer redress in online transactions. The OECD Committee on Consumer Policy is currently studying this issue with a view to improving consumer confidence in e-commerce.

Efforts to negotiate an international Convention covering jurisdiction in cross-border disputes have been mired in controversy over a number of issues, including the appropriate rule for jurisdiction in respect of B2C disputes. Europe has again taken the lead in this area, with its rules permitting consumers to sue and be sued in their own countries on cross-border sales contracts. However, other (mainly common law) countries are not comfortable with such rules, arguing that they could impede global e-commerce by discouraging companies from selling to countries whose laws they are unfamiliar or uncomfortable with. In the meantime, the rules on jurisdiction re: cross-border consumer contracts outside Europe remain gray and unpredictable.

5. Marketplace Developments

While policy and law regarding consumer protection in e-commerce evolve, the marketplace continues to develop apace, and in so doing, creates de facto standards where policy and legal voids exist.

5.1. Trustmark Programs

As noted above, numerous trustmarks and seal programs have emerged in the online retail market, all purporting to offer guarantees of reliability to the consumer, and added value to subscribing merchants. Typically, these programs provide businesses that meet certain criteria with the right to use the program's trustmark or seal in their advertising. Trustmark criteria are usually set out in a Code of Practice, which typically includes requirements for information disclosure, fair marketing practices, data protection, security, contract fulfillment, complaint handling and dispute settlement.

There is a wide range among trustmark programs, not only in respect of substantive requirements set out in the Code of Practice, but also in respect of compliance assessment and enforcement practices. Some trustmarks focus entirely on one narrow aspect of online consumer protection, while others purport to cover all aspects of consumer protection online. Some have very minimal requirements, while others establish high standards of consumer protection. Redress requirements, for example, range from a simple requirement that members deal effectively with complaints that come before them, to detailed procedures for handling complaints as well as requirements to submit unresolved disputes to an independent third party for resolution. Some programs rely on business self-declarations of compliance, while others monitor and assess their subscribers to ensure ongoing compliance.

Such widely differing standards among trustmarks serve to confuse and mislead consumers. Hence, as noted above, a number of initiatives are underway to establish international standards for trustmark programs, to coordinate trustmark programs in different parts of the world, and to provide a "seal of seals" designed to assist consumers in navigating among the increasing number and range of online trustmarks.

5.2. Online Dispute Resolution

In addition to trustmark programs, a variety of online dispute prevention and redress services have emerged over the past few years in response to perceived consumer demand, as well as to the widespread acknowledgement that for retail e-commerce to achieve its global potential, consumer need effective online means of resolving problems with distance transactions. Many of these services make innovative use of the Internet to provide convenient tools for dispute prevention and resolution, especially where parties are geographically distant and wish to avoid engaging the judicial system.

Given its high cost, legal redress via the court system is of limited usefulness to consumers embroiled in small value disputes. Moreover, cross-border lawsuits raise thorny issues over whose courts have jurisdiction, and whose laws apply. "Choice of law" and "choice of court" clauses in consumer contracts are not necessarily enforceable, especially where consumers are not expected to have noticed or appreciated such terms of contract. While businesses and consumers can't agree on the appropriate forum in cross-border disputes, they do agree on the need to reduce unresolved complaints. Hence, the high level of interest in online mechanisms to prevent and resolve disputes.

Some online consumer redress services are part of broader trustmark programs , while others are stand-alone providers of information or alternative dispute resolution (ADR) services . Trustmark programs can enhance online ADR by vetting merchants in advance, providing a Code of Practice (which can substitute for applicable law), offering incentives for compliance (e.g., loss of trustmark, adverse publicity), and offering complementary services (e.g., compensation where the merchant fails to comply). However, stand-alone services have the advantage of being available regardless of membership in a particular trustmark scheme.

Preventative online consumer redress services include trustmarks themselves, other screening tools for online shoppers, consumer information (in the form of complaints publicity and/or business rating services), and escrow services.

Ex post facto redress services currently available to online shoppers include complaint assistance, insurance, credit card chargebacks, and online dispute resolution. Online dispute resolution can be classified into six increasing formal and/or "heavy" types: complaints assistance, facilitated negotiation, automated negotiation/settlement, mediation, non-binding arbitration, and binding arbitration. Arbitration can, in addition, be binding on the merchant only - an appropriate approach given that the driving force behind these programs is to cultivate consumer trust and confidence in e-commerce. In all cases, the aim is to settle the dispute to the satisfaction of both parties, at the least cost.

Effective B2C dispute resolution services need to satisfy a number of criteria: they should be voluntary to consumers, independent and impartial, transparent in terms of rules and processes (as well as of association with stakeholders and of the qualifications of individual "neutrals"), fair in terms of offering due process, and affordable to consumers. They should also be easy to find and to use, offer timely results and competent ADR officials, be binding on businesses and enforceable by consumers.

A study in 2000 by Consumers International, updated in 2001, found app.30 providers of B2C online dispute resolution, few of which were designed for consumers, and none of which met all of the above criteria. Most were too costly and/or cumbersome for small consumer disputes, provided no help with uncooperative merchants, and operated in English only. As a result, Consumers International has called for international standards for B2C online dispute resolution, as well as neutral third party oversight. A number of international organizations - business, consumer and governmental - are attempting to achieve agreement on principles for B2C dispute resolution, and are exploring the potential for coordinated international ADR in the online context.

6. New Principles of Regulation?

It is clear from the developments described above that traditional government regulation cannot meet all the needs of consumers and businesses in the new global marketplace. Greater international cooperation and harmonization in the area of consumer protection are needed if the promises of the global electronic marketplace are to be achieved. In the same way that intellectual property rules have been established internationally, minimum standards of consumer protection need to be agreed upon.

Nor can industry self-regulation meet the needs of this new marketplace. Experience to date clearly shows that, while there is an important role for voluntary industry self-regulation, even the best efforts cannot ensure widespread compliance with basic consumer protections. Industry self-regulation will continue to have a significant influence on general standards of business practice in the online marketplace, and on the ability of consumers to discriminate among good and bad players. However, increased levels of government intervention will be needed to deal with cross-border fraud and related scams, as well as those areas, such as consumer privacy, in which the business interest does not coincide with the consumer interest.

For these reasons, a mix of domestic legislation (in the areas of privacy and liability, for example), international conventions (on jurisdiction and cross-border enforcement), and private sector initiative (e.g., trustmarks, security) is needed if consumer confidence in e-commerce is to be built and maintained.

An important element of this new regulatory paradigm is the multi-stakeholder forum, in which standards, both formal and informal, are developed and implemented. In order for non-governmental rules to be accepted by all parties, it is essential that they be developed by a balanced group of knowledgeable stakeholder representatives, and that compliance with them be monitored and enforced by a neutral, reputable body. It is not yet clear what international forum and/or body, if any, can fulfil that role. It is clear, however, that we have entered a new age of retail commerce, with new challenges and new models of regulation emerging to satisfy the needs of both businesses and consumers.

Endnotes

1. See, for example, Consumers International, "*Should I buy? An international comparative study of electronic commerce*", (Sept.2001); and "*Consumers@shopping: An international comparative study of electronic commerce*" (Sept.1999). See also: Consumers International, "*Privacy@Net: An international comparative study of consumer privacy on the internet*" (Jan.2001); Boston Consulting Group, (March, 2000); Business 2.0 magazine (April 2000).
2. E.g., Statistics Canada, "Internet Use in Canada", tables re: concern about security and privacy on the Internet, 1999 and 2000, http://www.statcan.ca/english/freepub/56F0003XIE/tables.htm; UK DTI, 2001 survey results showing 47% concerned about credit card fraud, and 32% about giving out personal information: http://www.dti.gov.uk.
3. Business-to-Consumer ("B2B" = Business-to-Business)
4. E.g., UK Dept. of Trade and Industry, White Paper "Modern Market: Confident Consumers" (July, 1999); New Zealand Ministry of Consumer Affairs, Australia's "Building Consumer Confidence in Electronic Commerce: A Best Practice Model for Business" (Treasury Dept., May, 2000); "New Zealand Model Code for Consumer Protection in Electronic Commerce" (October 2000); US Federal Trade Commission, "Consumer Protection in the Global Electronic Marketplace: Looking Ahead" (Sept.2000).
5. E.g., The Australian National Advisory Council on Consumer Affairs, "Consumer Protection in Electronic Commerce: Principles and Key Issues" (April 1998); "Principles of Consumer Protection for Electronic Commerce: A Canadian Framework" (Nov., 1999), accessible at http://strategis.ic.gc.ca/SSG/ca01180e.html; The Dutch "Model Code of Conduct for Electronic Commerce" (Nov.1999) (www.ecp.nl); Denmark's Code of Conduct for Electronic Commerce, part of a "WebSeal" scheme for businesses (see www.e-fokus.dk).
6. E.g., the Danish Electronic WebSeal Scheme, ibid..; TrustUK:
7. See http://strategis.ic.gc.ca/SSG/ca01180e.html
8. http://strategis.ic.gc.ca/SSG/ca01180e.html
9. approved 9 December 1999 by the OECD Council.
10. For example, see the European Commission's draft "Principles for e-commerce codes of conduct", http://econfidence.jrt.it.
11. See the UK's "TrustUK" initiative, http://www.trustuk.org.uk, as well as the more recent Singapore "TrustSg" programme, http://www.trustsg.org.sg. A similar Canadian initiative is being considered, and interest in a European-wide "TrustEU" program has been expressed.

12. See http://www.dti.gov.uk.
13. The US Federal Trade Commission (FTC) has provided leadership in this area - see http://www.ftc.gov/bcp/menu-internet.htm. See also http://strategis.ic.gc.ca/sc_consu/consaffairs/engdoc/i_main.html and http://www.consumersonline.gov.au/.
14. See http://www.gbde.org
15. See http://www.iccwbo.org
16. See Ziff-Davis, Global Information Infrastructure group, http://www.gii.com/standard/index.html
17. AOL/Time Warner, AT&T, Dell, IBM, Microsoft, Network Solutions, Visa USA
18. See http://www.ecommercegroup.org
19. See http://www.consumersinternational.org/campaigns/index.html#electronic
20. See http://www.tacd.org
21. See http://www.beuc.org/public/BeucAgreements/beucuniceen.pdf .
22. This is a joint project of CSA International and the Bureau de Normalization du Quebec.
23. See COPOLCO Resolution 14/2001 (May 2001), referencing the report entitled "Desirability and Feasibility of ISO E-Commerce consumer standards: Report for the Oslo ISO Consumer Policy Committee meeting".
24. See http://www.uncitral.org/en-index.htm
25. Directive 95/46/EC of the European Parliament and Council, 24 Oct.1995, on the protection of individuals with regard to the processing of personal data and on the free movement of such data.
26. Directive 97/7/EC of the European Parliament and Council, 17 Feb.1997.
27. *Personal Information Protection and Electronic Documents Act*, S.C. 2000, ch.5.
28. Alberta's "Internet Sales Contract Regulation" under its "Fair Trading Act", and Manitoba's "Internet Agreements Regulation" under its "Electronic Commerce and Information Act", both enacted in 2001.
29. 15 U.S.C. § 1601 *et seq.*, implemented through "Regulation Z", 12 c.f.r, part 226.
30. See Hague Conference on Private International Law, draft Convention on Jurisdiction and Foreign Judgments in Civil and Commercial Matters, http://www.hcch.net/e/workprog/jdgm.html
31. s.4 of Council Regulation (EC) No 44/2001, 22 Dec.2000, on jurisdiction and the recognition and enforcement of judgments in civil and commercial matters.
32. See the GBDe's trustmark inventory at http://consumerconfidence.gbde.org/t_inventory.html.
33. For example, TRUSTe certifies sites solely on the basis of their privacy policies.
34. E.g., BBBOnline's Reliability seal.
35. E.g., http://www.better-internet-bureau.org/ .
36. E.g., Which WebTrader: http://whichwebtrader.which.net/webtrader/code_of_practice.html .
37. E.g., WebTrader, a UK-driven online trustmark now with partners in several countries, operated by consumer organizations in each country; and the Better Business Bureau's (BBBOnline) recent "International Online Trust Initiative for Ecommerce Self-Regulation" - see http://www.bbbonline.org .
38. See Consumers International's inventory and assessment of online dispute resolution services for consumers, at http://www.consumersinternational.org .
39. As noted above, attempts to reach agreement on this issue via the Hague Conference on Private International Law have been unsuccessful.

40. The OECD, ICC, European Commission, FTC, Australian government, American Bar Association, and others have initiated work and sponsored conferences on this topic in recent years.
41. E.g., BBBOnline, SquareTrade, WebAssured.
42. E.g., Online Resolution, Internet Ombudsman, e-Resolution.
43. E.g., Bizrate.com, WebAssured.com, AOL's online marketplace.
44. E.g., Bizrate.com, planetfeedack.com, eBay's "Feedback Forum".
45. E.g., i-escrow.com.
46. E.g., planetfeedback.com.
47. Insurance for small consumer transactions may be automatically provided to consumers purchasing via an online marketplace (e.g., AOL) or from a merchant who subscribes to a seal program (e.g., TrustedShops, WebAssured.com).
48. Credit card chargebacks are in some cases required by law (e.g., Manitoba's -____ regulation), but are at a minimum potentially available at the discretion of the credit card issuer and acquirer.
49. E.g., BBBOnline.org, Online Ombuds Office, WebTrader
50. E.g., SquareTrade.com, NovaForum.com
51. E.g., Cybersettle.com, clickNsettle.com
52. E.g, SquareTrade.com, NovaForum.com, eResolution.com
53. E.g., The Virtual Magistrate, iCourthouse.com
54. E.g., eResolution.com, BBBOnline.org
55. E.g., WebAssured.com, BBB
56. "Disputes in Cyberspace: Online dispute resolution for consumers in cross-border disputes - an international survey", 2000; see http://www.consumersinternational.org
57. For a detailed analysis of industry self-regulation as a potential new source of global governance, see Virginia Haufler, *A Public Role for the Private Sector: Industry Self-Regulation in a Global Economy*" (2001, Carnegie Endowment for International Peace).
58. I.e., via ISO or national standards bodies.
59. As recommended in the BEUC/UNICE agreement on trustmarks, cited above.
60. Some have suggested that there needs to be a new body established to focus on consumer protection needs in the global marketplace, in the same way that WIPO was established to deal with intellectual property issues.

back to index

Abstract

The potential for electronic commerce is limited by consumer reticence to shop online. Efforts to enhance consumer confidence in electronic commerce through legal and self-regulatory consumer protections are therefore underway at both domestic and international levels. These efforts suggest that a new model of regulation may be developing, one which involves an active role by all stakeholders.

back to index

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back to index

Policy / Regulatory

Wednesday, 16 January 2002
1400–1530
Coral II

W.2.5 Wireless & 3G

Chair:
CHARLES COSSON, Public Policy Senior Counsel, Vodafone Americas Asia Region, *USA*

W.2.5.1 The Challenges of the Unwired Economy (View Abstract)

CLAIRE WRIGHT, Partner, Allen & Overy, *Hong Kong SAR, China*

W.2.5.2 Allocation and Licensing Process of 3G Spectrum in Japan (View Abstract)

MASAYAKI AIZAWA, Senior Corporate Officer & General Manager, Operation and Maintenance (O&M) Dept., J-PHONE Co., Ltd., *Japan*

Disscussant:
PERTTI JOHANSSON, Senior Vice President, Motorola, *USA*

back to sessions

The Challenges of the Unwired Economy

Claire Wright
Partner
Allen & Overy
Hong Kong

View Abstract

1. Background to the 3G telecommunications market

1.1 Introduction

The latest generation of mobile telecommunications network infrastructure represents a significant technological and commercial advance on the voice and limited data transmission facilities available over current 2G digital networks and handsets. Telecommunications operators are spending billions of dollars to acquire licences and build 3G networks. The fees paid by 3G licensed operators in order to acquire the licences necessary to operate 3G infrastructure represent a substantial cost and issue in the development of the 3G telecoms industry. The way in which 3G licences have been offered throughout the world has differed from country to country. The table contained in Figure 1 summarises the licensing process and cost in several key jurisdictions. In addition to the licensing costs, new 3G networks will need to be rolled out by the operators with a far greater number of base stations than has been adequate to support 2G. This has led to what has been described as "astronomical" debt in the telecoms industry leading to grave concern about the future of the mobile industry. Clearly what everyone is looking for is a credible strategy to address this debt burden and one, which will preserve the anticipated launch, dates for 3G services. This paper discusses the problems associated with 3G development and possible strategies, which 3G operators and other players may adopt in the light of these problems.

2. Problems of 3G development

2.1 Technological

There is mounting concern amongst service providers, industry analysts and consumers alike that the technology needed to provide 3G services may not be available in time to allow operators to meet the launch deadlines imposed by 3G licence conditions. Delays have been blamed on the failure of handset and systems manufacturers to provide equipment capable of accepting video streaming and transmission speeds that are 10 times faster than those accepted by existing handsets.

Japanese operator NTT DoCoMo was one of the first operators in the world to launch a trial service. However, test-runs were plagued with problems and this prevented NTT DoCoMo from meeting its initial target date for providing a full commercial 3G service in Japan (30th May, 2001). Similarly in South Korea, 3G service providers have received complaints about the standard of the service on offer. BT was forced to delay its high profile launch of 3G mobile services in the Isle of Man (UK) earlier last year due to technical problems. Commentators in the UK are now claiming that initial forecasts of a 3G launch sometime in 2002 were too optimistic and that 2004 is a more realistic target.

There can be little doubt that there will continue to be teething problems as service providers and equipment manufacturers attempt to roll out 3G networks worldwide. The jump in the level of technology required to allow high speed multimedia services such as full motion video, internet access and videoconferencing will continue to provide operators with significant technological challenges. Nevertheless, any problems must be addressed and remedied quickly if launch deadlines are to be met and consumers reassured that, whilst the much heralded 3G services are as groundbreaking as the publicity suggests, they are reliable as well.

2.2 Costs

(a) Operators - 3G operators have incurred huge costs in setting up and developing their businesses. In particular, operators have incurred licensing costs (as set out in section 1.2 above and the graph in Figure 2) and infrastructure costs. 3G infrastructure requires approximately 4 to 5 times as many base stations as 2G infrastructure. Therefore, a vast number of new base stations will be required in order for 3G networks to be commercially operational and for licensees to meet the roll-out requirements invariably contained in their licences. The cost of this infrastructure is significant, e.g. in the EU the infrastructure cost is expected to equal the cost of 3G licences. The costs will be higher in jurisdictions with greater populations or where the population is more widely dispersed.

(b) Suppliers - Infrastructure and hardware suppliers have incurred massive costs in developing 3G hardware and infrastructure components. In addition, many suppliers have incurred further costs and liabilities by offering vendor financing to operators (see section 3.3 below).

2.3 Debt burden

Telecommunications operators and network suppliers around the world have cumulatively incurred approximately US$650 billion in debt over the past few years. 3G expenditure forms a significant part of this debt. Losses to investors are expected to approach the US$150 billion mark. Global syndicated loans to telecoms companies in 2000 exceeded US$343 billion. In addition, a further US$87 billion worth of bonds were issued to telecoms companies in 2000. The chart in Figure 3 shows how the debt levels of the major European telecoms companies soared during 2000 largely as a result of investment in 3G.

Many of the operators are still in need of funding. Significant sums are required to finish networks and meet interest payments until profits are generated. Even the big players in the industry have been affected. In Europe, the particularly costly 3G licensing process increased the debt problems faced by operators. By the end of 2000, total debt among Europe's six largest 3G operators had reached US$212 billion (the equivalent of the GDP of Belgium). The worst off include Deutsche Telekom, France Telecom, KPN in the Netherlands and others, who have spent more than US$100 billion in aggregate on the 3G licences. The two key reasons for the increase in debt are a pattern of substantial acquisitions (US$62 billion spent by top six European operators in 2000) and the huge prices paid for the 3G licences (see above).

By the end of 2000, European operators were reporting debt at 4.5 to 6.5 x EBITDA (earnings before interest, tax, depreciation and amortisation). The rating agency, Moodys, recently reiterated its negative outlook on the European telecoms industry, saying that cash flow from 3G is "very uncertain, both in terms of amounts and timing". In the short term, vast debt has weakened the balance sheet of the incumbent operators and led to a reduction in their credit ratings (as shown by the graph at Figure 4 below). This reduction in ratings has led to banks pulling out of a number of financing projects affecting growth forecasts and ensuring slimmer prospects for the whole of the telecoms sector. However some traditional operators stand to benefit as they have greater debt reduction capabilities (i.e. through self generated cash from earnings and particularly share issuance). In the past few months, European operators have issued or announced plans to issue more than US$182 billion worth of new equity.

Casualties in the wider telecoms industry so far include Winstar, Teligent and 360Networks. Fortunately debt has been spread widely in the financial world. The banking system has supplied around US$250 billion worth of debt to the telecoms industry over the past two years. Some equipment manufacturers have also been affected under the vendor financing deals and consequently many operators and suppliers in the telecoms industry are seeking to reduce the level of debt. Proposed methods of achieving this reduction are set out below in section 3.1.

2.4 Legal

(a) Licence fees

The significant amounts for 3G licences raised in some of the 3G auctions have triggered many of the problems faced by the mobile industry. In the wake of the heady sums raised by some European governments, other governments have structured their 3G licensing process so as to spread the 3G risk between themselves and the industry. In Hong Kong, for example, a fixed annual fee is payable for the first five years followed by the higher of an escalating fixed annual fee and 5% of network turnover i.e. revenue attributable to the provision of 3G services for the remaining years of the licence.

There has been no move generally to reduce licence fees to assist the 3G operators' predicament to kick start 3G development. France, however, which failed to license all of its available 3G spectrum, announced in November last year that it will be making a second attempt to do so but at a reduced annual licence fee of between 1% and 2% of 3G revenues. This fee will apply retroactively to the existing 3G operators. It has also extended the licence term from 15 years to 20. It is unlikely that other governments will follow suit but maybe 3G operators should be lobbying hard for this approach to be adopted elsewhere.

(b) Rollout requirements

Since 3G infrastructure requires approximately 4 to 5 times as many base stations and masts as 2G infrastructure, a substantial number of new base stations and masts will be required in order for 3G networks to be commercially operational and meet the roll-out requirements. Nevertheless, strict requirements governing 3G coverage further exacerbate the problems faced by operators. For example, in the UK the terms of the 3G licences require operators to provide 80% of the population with coverage by 2007. In Germany, all licensees are obliged to cover at least 25% of the German population by the end of 2003 and a minimum of 50% by the end of 2005, whilst in Hong Kong, 50% of the population must be covered by the end of 2006. These roll out timetables are almost certainly not those, which the operators would have chosen themselves. In addition, the financing arrangements, which they will have entered into, will almost definitely have similar 3G specific covenants, which will trigger financial consequences under the relevant financing documents if they are not met. These covenants will have been negotiated having regard to operators' regulatory requirements. Latest commentaries argue that GPRS will not become mass market until late this year or early next such that 3G will not become mass market until 2005 or 2006. With this prevailing opinion, the targets set in both licences and financing documents look hopelessly unrealistic. If regulators were to modify the targets, arguably the operators could focus on what is realistic.

(c) Other licence conditions

Operators may also be subject to other conditions under their licences so they cannot use the spectrum how and when they choose. A technology - neutral approach to licensing would enable operators to use their allocated spectrum for 2G, 2.5G and 3G services. This has happened in the GSM context with further spectrum at GSM1800 allocations being granted to the GSM900 operators. The GSM operators make no distinction between these allocations and customers certainly are not aware of the distinction. With greater flexibility in the use of the spectrum, operators will be able to focus on the technical and marketing issues associated with a new service rather than on regulatory constraints.

(d) Planning

There have been considerable aesthetic and health concerns resulting from the massive increase in the number of base stations and masts required for 3G networks. In response to these concerns, many governments have changed or are seeking to change existing planning rules to seek to allay public concerns. Throughout the EU, the commencement of the roll-out of 3G networks has prompted the introduction of stricter and increasingly regulated planning requirements. Such changes to planning rules have the potential to delay or block network roll-out which has obvious knock-on effects in terms of costs and revenue accrual. The importance attached to the potential problems envisaged by the stricter planning rules was reflected in the reaction of Hans Snook, former chief executive of Orange who recently accused the UK government of "creating a crisis in our industry", by changing the planning regulations governing the erection of masts since the auction of 3G licences.

(e) Health

Concerns have been growing for some time over possible adverse health effects caused by mobile phone base stations. The antennas located on base stations transmit and receive signals using electromagnetic emissions or "EMEs". There has been general public concern over reports that EMEs created by base stations may be responsible for various ailments experienced by people living in the vicinity of base stations.

In the EU, the Commission have published a recommendation that all base stations comply with the International Commission on Non-Ionising Radiation Protection (ICNIRP) guidelines on EMEs. In Germany (and soon in the UK) all base stations will need to be certified to comply with these guidelines prior to becoming operational. However, warning signs were signalled in a Spanish judgement in 2000 in which the judge ordered the removal of a mobile phone transmitter from a residential building on the basis of health concerns. It is inevitable that governments will come under pressure from some factions within the community to take a stronger stance on masts and this pressure may result in government measures that will complicate the mast roll-out and lead to increased costs for the operators.

In the USA, the mobile phone industry may face a wave of health-related lawsuits. The first of dozens of cases was filed on behalf of a former Motorola employee in Washington DC in November 2001. The move threatens to more than double the amount of health-related litigation being fought by US mobile phone operators and manufacturers and its outcome will undoubtedly have repercussions on the industry as a whole.

(f) Competition

As 3G network operation is limited by the licensing process of each jurisdiction to a relatively small number of operators, there are potential competition law problems. Issues such as merger control, infrastructure sharing (see section 3.2 below) and general collaboration (horizontal and vertical), preferred rights, roaming, exchange of confidential information, interconnection, abuse of dominant position and significant market power may be particularly important.

3. Future for 3G

3.1 Costs/debt control

Under the current climate, established funding routes such as bank lending and high yield bond issuance are difficult for many operators to pursue, at least on acceptable commercial terms. There are a number of possible methods of reducing the level of costs and debt (i.e. cost/debt reduction strategies). One of the more drastic is to sell-off non strategic assets. There has been a recent increase in the sale of assets. For example last year, France Telecom planned sell-offs totalling US$9 billion. BT aims to raise several billion pounds by selling European and Asian assets. In June 2001, Deutsche Telekom sold six German cable companies raising over US$4.5 billion. Another way of keeping debt levels in check is by holding back on investments in 3G (and ADSL), e.g. in 2000 France Telecom reduced its investment budget by 24%. Outsourcing has also become increasing popular, e.g. BT is raising some US$2.4 billion by sale and lease back of its properties. Some operators have chosen securitisation as a means of managing debt. Deutsche Telekom, France Telecom and Telecom Italia have all announced securitisation operations amounting to several billion dollars. Savings achieved are relatively low, however, and securitisation does not reduce debt levels as much as optimise management of balance sheets. It is perhaps network sharing (see section 3.2 below) that promises the most substantial savings potential. In Germany, five of the six 3G licenceholders are negotiating joint development schemes with approval from the German telecoms regulator (RegTP). Savings on network deployment costs could reach 40%. Other debt control alternatives include lay-offs (large and small telecoms industry players in Australia have made significant job cuts this year, with the majority of cuts made during October and November) and mergers or alliances (which allow operators to pool synergies and maximise economies of scale). However, these may have competition implications (see section 2.4(d) above). Despite these possible methods of controlling costs and reducing debt, the cost of 3G has already led to Sonera, a Finnish 3G operator, surrendering its 3G licence (August 2001). Sonera handed back its Norwegian licence and elected to write off its US$16 million investment.

3.2 Infrastructure sharing

The enormous cost of 3G licences together with the additional costs of building networks has led to operators placing pressure on governments to ease the regulatory environment governing network rollouts and thereby reduce the costs involved. In particular, operators are interested in pursuing various degrees of network or infrastructure sharing in order that costs can be split between competitors. Network sharing is an opportunity for operators to focus on their core competencies, increase efficiency and lower costs, while freeing up resources to develop more competitive service offerings. Network sharing would allow operators to improve coverage while reducing both capital and operational expenditure. However, regulatory bodies and geographical context impact on operator decisions. To date there have been conflicting signals from national regulators as to the extent that network sharing will be permitted.

There is a range of possible types of network sharing. The most integrated would be the full collocation and joint acquisition and build up of base stations and the sharing of masts and/or transmission equipment. Alternatively, operators could share sites while retaining ownership and operation of their own separate equipment on that site. Also, it is possible that operators may wish to divide a territory amongst themselves and act as MVNOs in the areas of a territory where they do not have their own infrastructure. There are clearly significant regulatory issues in each of these considerations. In the EU there is growing regulatory acceptance of infrastructure sharing and it is anticipated that some form of infrastructure sharing will become widespread amongst 3G operators.

Network sharing is more about cost avoidance than cost cutting. Savings of up to 35% of the total network costs can be achieved through network sharing. Network sharing can lead to economies of scale based around effective co-operation, faster rollout coverage and increased capacity at reduced costs. However, it is vital for the operators to ensure that the operational side of the partnership is managed effectively. Problems may arise if one partner fails with its business objectives, resources are not properly aligned, operational performance is poor or investment opportunities are not met. It can also present intercreditor issues for financiers of competing operations. Each syndicate will want to ensure through security sharing arrangements that the syndicates that financed the network will not be in a position to enforce security over the networks and hold the other syndicates to ransom.

It is worth noting that the benefits of network sharing may extend to equipment suppliers as well as the operators. Although suppliers will be anxious not to encourage a practice that results in falls in the sale of equipment, the stability that sharing will give to operators could potentially have a positive knock on effect on the uptake of 3G services and the resultant sale of 3G devices.

3.3 Vendor financing

Vendor financing (where equipment suppliers extend credit to buyers of their equipment or assume their credit risk) has recently been adopted as an alternative funding route for telecoms operators alongside traditional bank financing. It has also been used as a bargaining tool by operators to raise finance, knowing that the vendors do not want to lose valuable contracts for the manufacturer of equipment to other manufacturers.

Vendor financing has clear advantages for both operators and equipment suppliers. Operators are given access to much needed finance whilst the suppliers have the opportunity to increase sales, to increase market share, to open new markets where traditional bank/capital markets finance is unavailable and to increase buyer demand by stimulating the roll out of 3G services. Huge sums have been spent by the vendors on research and development for 3G infrastructure and handsets. The vendors have a finite market for these products and the only customers are the telecoms operators. The operators know very well that the vendors need to sell their 3G infrastructure equipment in order to recoup the investments made. As the only buyers, the operators have found themselves in a strong bargaining position. Intense competition between the manufacturers means that they are extremely keen themselves to secure contracts for 2.5G and 3G infrastructure. It can be seen, therefore, why manufacturers have until recently felt almost obliged to offer vendor financing.

The prime danger for suppliers is that they may over expose themselves to banking risk especially if they are lenders of last resort. For suppliers considering vendor financing, the key commercial issues to be aware of include:

(a) Credit exposure - if the supplier assumes the risk of the customer failing to pay, any such failure eradicates any commercial benefits that may have been obtained from the equipment supply. Suppliers need to enhance the underlying credit through parent guarantees, taking security, etc.

(b) Intercreditor issues - if the vendor financing is to sit alongside parallel bank financing, how does the supplier rank against the banks? At present the market, in terms of intercreditor issues, is still developing although it is not uncommon to see vendors sharing equally with the banks although there may be sell down restrictions on the vendors.

(c) Customer relationships - there is a substantial risk that the underlying customer relationship will be damaged or destroyed if the credit relationship is poorly managed.

The key issue for suppliers is whether they can offload the risks of vendor financing (i.e. by selling it down to banks or securitising it). Banks will want to be satisfied that there is adequate security and that the deal works from a regulatory and legal perspective. Key issues to consider will be the regulatory implications, credit exposure, legal due diligence and security. To date, vendor financing has not been highly publicised although the vendors of such financings, particularly in Asia have been significant. Many hard lessons have been learnt by suppliers in the spate of failed or restructured GSM networks, which are one of the major contributors to the current financial situation. At present, several suppliers are feeling the effects of a turbulent market. Both Lucent and Motorola have suffered at the hands of telecoms operators who have missed payments on vendor financing debts.

3.4 Other financing alternatives

One possible alternative is government funding. Government bodies may emerge as possible sources of funding. One2One recently announced that it had secured US$430 million of funding from the European Investment Bank ("EIB") to help in the construction of its UK GPRS network. This has fuelled suggestions that the EIB is prepared to provide finance to 3G licence holders to contribute towards the substantial costs of rolling out the 3G networks. Another financing alternative involves content providers, as operators are keen to obtain up-front funding from internet content providers for the 3G build-out.

3.5 Insolvency

The debt burden of 3G operators and suppliers is increasing the prospect of insolvency. To date there have not been any significant insolvencies in the 3G market. However, the telecoms market generally has experienced a wave of insolvency in 2000/2001. Particularly in the US, several companies pioneering the roll-out of fibre optic network have entered into chapter 11 protection proceedings (see section 4). Given the current debt of many of the 3G operators, there is a concern that this pattern of huge debt based investment leading to insolvency could be repeated in the 3G market.

If this situation were to occur, many of the same negative consequences that are currently being experienced in the fibre industry could be expected to be repeated in the 3G industry. In particular, the infrastructure suppliers would face a huge downturn in their business and additional losses in the form of defaults on vendor financing. Also, the business of infrastructure partners and MVNO partners would suffer directly from the insolvency of a 3G operator. The human costs would also be sizeable in terms of job losses and the delay or failure to bring 3G services to the market.

3.6 3G services

Even if operators are successful in reducing debts through some of the controls and initiatives mentioned in this paper, they will still have to address the underlying shift in the market with regard to the average revenue per subscriber numbers. From published data, these revenues have been declining leaving operators with the need to adopt a strategy, which will see those revenues rising again. The key will be in the types of application available such as financial services, banking, home shopping, gaming and music previews and the ability to make them of wide appeal. The difficulty will be assessing which applications will be successful, on what basis to model them for the purposes of raising finance and determining which of business services or consumer services will be most important.

3.7 Threats

There are a number of potential threats to 3G such as bluetooth, wireless LANs, 2.5G, MVNOs, fixed broadband wireless networks in addition to the inevitable emergence of 4G. In the short term, an extension of 2G is perhaps the most likely to threaten the success of 3G. Originally intended as a stepping-stone to 3G, GPRS delivers some of the potential benefits of 3G technology at a much lower cost. Wireless LANs (wireless local area networks) have recently gained popularity in a number of markets. They are a flexible data communications system that use radio frequency technology to transmit and receive data, minimising the need for wired connections. Reports estimate that there will be some 17 million Wireless-LAN users worldwide by 2006 and the technology is now being developed to compete with 3G.

MVNOs pose an additional threat to revenues of the network operators, since the MVNO operates in direct competition with the licensed 3G operators. The competitive advantage of MVNOs is that they can benefit from the sale of 3G services without suffering the financial burden imposed on the licensed operators through the costs of obtaining the licences and building-out networks. For the operators, the MVNO's provide a valuable source of revenue to fund expensive network roll-out and reduce growing debt.

4. Local issues

4.1 Europe

Infrastructure Sharing: Several infrastructure sharing deals have been announced in the EU since RegTP (the German regulator) gave the green light to limited infrastructure sharing on 5th June, 2001. The largest deal to date is between BT and Deutsche Telekom under which their subsidiaries will share infrastructure roll-out in the UK and Germany. BT and Deutsche Telekom expect to make joint savings of approximately US$3.5 billion through their collaboration.

4.2 USA

Insolvency: PSINet, the alternative US network provider is massively indebted to the tune of US$4.5 billion and has warned of possible bankruptcy threatening 6000 jobs worldwide; Winstar Communications, the US based telecoms operator filed for chapter 11 protection in April 2001 owing more than US$3.5 billion; Viatel, the US operator with substantial interests in Europe has recently missed payments on debts of more than US$2 billion; E.Spire Communications filed for chapter 11 protection in March 2001 having defaulted on bond payments in February. Papers filed with the bankruptcy court show assets of US$900 million against liabilities of US$1.5 billion.

4.3 Asia/Pacific

Restructurings in the telecoms industry: One.Tel, the Australian company was placed into insolvency administration by its directors in May 2001. The cause of the insolvency has still not been specified but debts are in excess of US$300 million.

Debt restructuring: A number of operators in the Asia-Pacific region have restructured their debts, or are in the process of doing so, through a combination of debt for equity swaps, principal and interest haircuts and longer tenors. Various factors have led to the consensual restructuring of debts owed to disparate groups of creditors, such as banks, bondholders and trade and vendor financiers rather than insolvency. The limited value of security taken over telecommunications equipment and other assets has generally meant that secured creditors do not have the same ability to "tough it out" when negotiating a debt restructuring with a troubled operator and its other creditors, compared to creditors with security from companies in other industries. A key factor is that full security can rarely be taken over an operator's main asset, its operating licence, and so security tends to be more defensive in nature, without giving secured creditors the ability to "step in" or sell an operator as a going concern. For creditors to operators in many jurisdictions in the region, uncertainty as to the effectiveness and fairness of the legal system has been a major factor in determining the outcome of, and the process for, debt restructurings.

5. Conclusion

3G operators are clearly experiencing a more difficult and indebted period than anticipated when commercial 3G activities and business plans were commenced. Despite this, the 3G operators hold rights to a finite resource (i.e. spectrum) and are therefore well placed to acquire revenues which will trickle back through the industry to the infrastructure and hardware suppliers and to banks in the form of debt repayment. Countering this optimism is the reality that viable alternatives to 3G exist and are subject to considerable developments and that these alternative technologies do not have such restrictive barriers to market entry as 3G. The net result may be a much more competitive industry than originally anticipated by the 3G operators. Such competition makes it imperative that 3G operators ensure effective management and utilisation of spectrum to retain their privileged status in the mobile market. In addition, governments and regulators may need to take a sympathetic approach with operators to ease the cost/debt burden, e.g. allowing network sharing, relaxing roll-out targets and resisting overly restrictive planning rules etc.

Shareholders in 3G operators have been hard hit by the loss of confidence and high debt in the markets. Suppliers have suffered too, largely as a result of turmoil in the vendor financing market. Over the past few months several manufacturers have turned to mergers and alliances to see them through the slump (e.g. Ericsson and Sony's joint venture to develop and distribute mobile phones). In addition, immediately following the 3G licence auctions in the UK, Germany and The Netherlands, European banking regulators began asking banks for detailed breakdowns of their loans to carriers. However, as yet, the banks do not appear to have suffered although they are not invulnerable to risk and many have been affected by the downturn in the telecoms sector. There is little doubt that they are already being increasingly cautious in their dealings with the telecoms sector. In reality, it will be the consumer who will suffer most by increased costs of use and a delayed service. But consumers also holds the key to 3G ultimate success. If the operators can capture the consumer attention and draw revenue from the application of the spectrum, there remains a massive potential for the success of operators and suppliers in the 3G market.

FIGURE 1

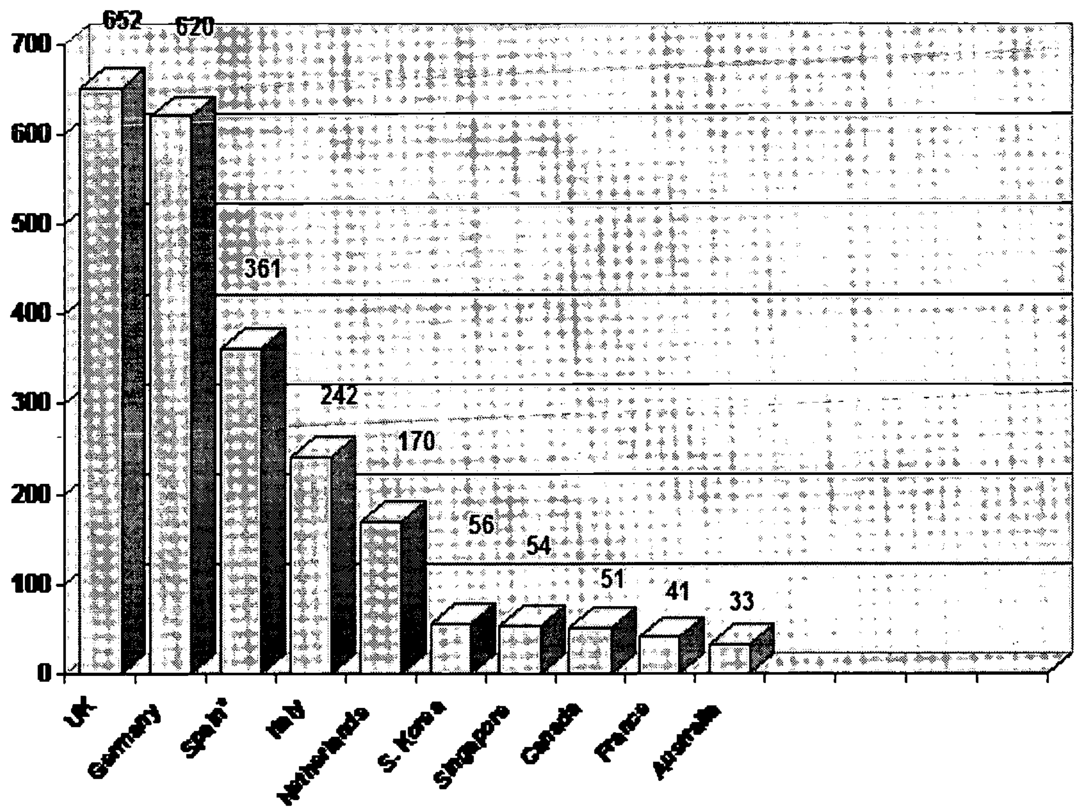
Country	**Licence Issued**	**Licensing Process**	**No. of Licences**	**Total Price US$**
Finland[i]	March 1999	Beauty Contest	4	$887 per 25KHz + admin fees
Spain	March 2000	Beauty Contest and payment	4	$461 m + annual tax + admin. Fees over 20 years of $12.5 bn
UK	April 2000	Auction	5	$34.13 bn
Netherlands	July 2000	Auction	5	$2.38 bn
Japan	July 2000	Beauty Contest	3	Annual fees

Germany	August 2000	Auction	6	$45.07 bn
Italy	October 2000	Auction	5	$13 bn
Portugal	November 2000	Beauty Contest	4	$355 m + admin fees
Austria	November 2000	Auction	6	$736 m
Sweden	December 2000	payment Beauty Contest	4	$41,000 + 0.15% annual fee
South Korea	December 2000	Beauty Contest	2 (+1 additional licence to be issued in 2001)	$2.22 bn
Australia	March 2001	Auction	6	$568.4 m
Belgium	March 2001	Auction	4	$399.4 m
Singapore	April 2001	Beauty Contest	3[ii]	$166.75 m
France	July 2001	Beauty Contest and payment	4 (only 2 out of 4) successfully issued at first attempt)[iii]	$8.7 bn + admin fees
Denmark	September 2001	Auction	4	$113.56 m
Hong Kong	September 2001	Pre-qualification screening + auction	4	$25.2 m for 1st 5 years
USA#	2003 (expected)[iv]	Auction	n/a	n/a
Canada #	January 2001	Auction (of PCS spectrum)	52	$1.42 bn
Thailand	Early 2000	Beauty Contest	2[v]	Free
Malaysia	2002 (expected)[vi]	Auction or tender process	n/a	n/a
Indonesia	2002 (expected)	Beauty Contest	Between 3 & 5	n/a
China	2002[vii]	Beauty Contest	Between 3 & 6	n/a
Chinese Taipei	2001 (expected)[viii]	Pre-qualification screening + auction	5 (expected) at least temporarily - this depends on the announcement to be made in the coming few days by MORET	n/a

The Philippines	Unknown[ix]	n/a	n/a	n/a
India	Late 2001/ early 2002	Auction	Between 3 & 5	n/a

FIGURE 2. THIRD-GENERATION LICENCES

Average price per person paid for a 3G licence (in euros)

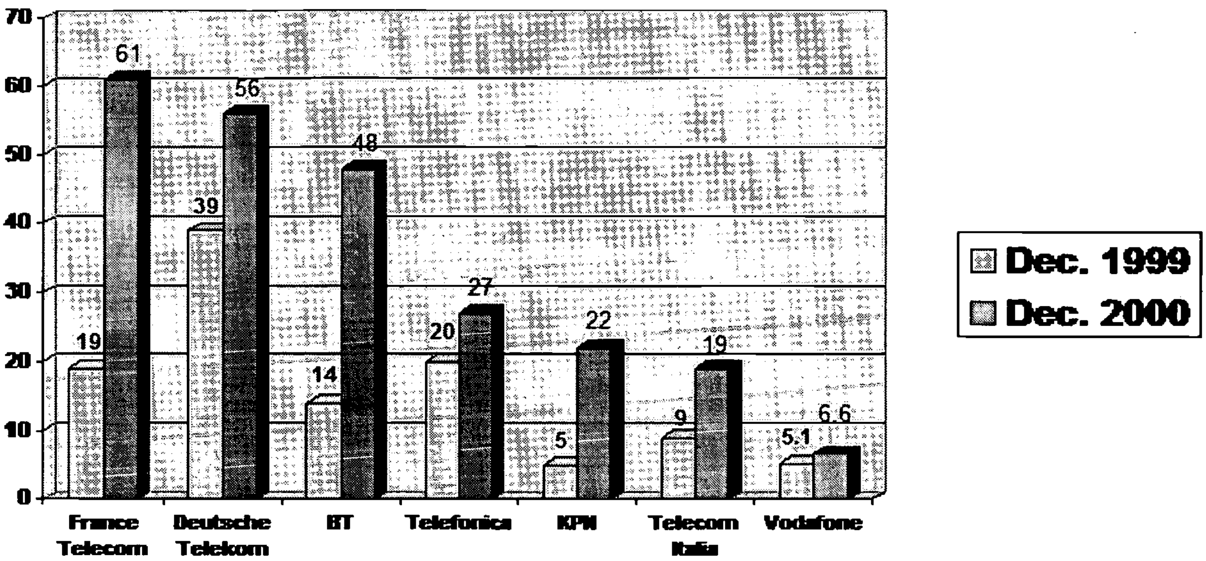


* A special tax means the average price per person has gone up from e13.3 to e361

** Price is staggered over 20 years and adjusted to inflation rate and to reflect reduced licence fee

Source: European Commission

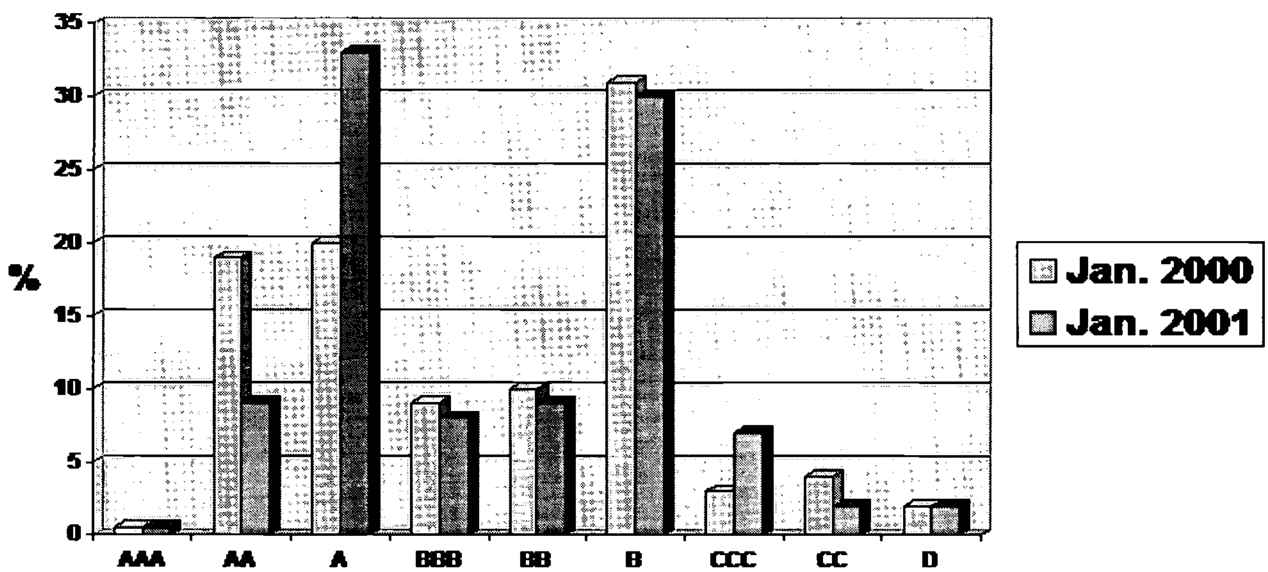
FIGURE 3. DEBT OF THE MAJOR EUROPEAN TELECOMS COMPANIES



Source: Standard & Poor's

FIGURE 4. RATING DISTRIBUTION FOR DEBT OF EUROPEAN TELECOMS OPERATORS

Share of total credits allocated to telecoms operators



Ratings are based on several factors, including companies' debt and their future outlook. The coveted triple A is increasingly rare, while all ratings below triple B are considered speculative.
Source: Standard & Poor's

Endnotes

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[i] First 3G licences issued

[ii] 4 licences were available but only the 3 existing 2G licensees bid.

[iii] Only 2 operators bid in the initial beauty contest. It is expected that France will only complete the sale of its four 3G mobile licences next autumn.
Spectrum policy in USA and Canada is not service specific.

[iv] Industry analysts believe the U.S. 3G auction won't happen in June 2002, as originally envisioned by the Clinton administration. But they do think the auction is likely to occur by 2003.

[v] Initially licences were issued to the Communications Authority of Thailand (CAT) and the Telecommunication Organisation of Thailand (TOT). These licences have since been merged into one licence of 2 x 7.5 MHz of spectrum. More licences may be awarded in the future.

[vi] Guidelines for awarding the licences, which may include an auction or tender process, will be completed late 2001 or early 2002.

[vii] It is expected that between 3 and 6 licences will be awarded via a beauty contest before the end of 2002. The Ministry of Information Industry has indicated that 2 licences will be made available to foreign companies.

[viii] The Chinese Taipei government had announced that it planned to commence the licensing process in September 2001.

[ix] The Philippines' National Telecommunications Commission (NTC) has postponed allocation of 3G frequency licences for at least 2 years.

back to index

Abstract

This paper considers the development of 3G services and the roll out of 3G networks in the light of the significant costs of 3G licences and 3G infrastructure. It reviews the ability of the players in the 3G market to launch 3G services notwithstanding their increased debt burden, the threatened competition from 2.5G and other technologies and the constraints of the regulatory environment.

back to index

Claire Wright

Claire is a partner in the corporate department of the Hong Kong office specialising in communications, media and technology. She advises on a wide range of communications related projects both in Hong Kong and internationally including communications regulation, acquisitions, joint ventures, strategic investments and contracts for the sale and purchase of telecommunication and technology systems, equipment and services and telecommunications network agreements. In 1994, she was seconded to the UK Office of Telecommunications for a year where she was closely involved in the development of UK telecommunications policies on interconnection and related issues including the drafting of significant modifications to BT's licence, Oftel policy statements and explanatory memoranda. She gives regulatory advice to a number of operators including Cable and Wireless.

Her telecommunications projects include advising the UK Government on the auction of third generation mobile spectrum, the Hong Kong Government on the third generation mobile project, the privatisation of SPT Telecom in the Czech Republic, advising Swisscom in connection with investments in India and Malaysia, the privatisation of Belgacom, advising Telkom SA in South Africa in connection with its restructuring, advising the Turkish Government on the proposed privatisation of Turk Telecom, and on telecommunications investments in Bulgaria, Estonia, Moldova, Morocco, Lithuania, Pakistan and Jordan. She has also been involved in a number of e-commerce, internet and broadcasting related projects including a joint venture for interactive TV and various internet portal related joint ventures. Her technology projects include the acquisition and supply of computer and communications systems, software development projects, systems integration projects, outsourcing transactions and the setting up of electronic cash systems and structures.

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back to index

Allocating and licensing process of 3G spectrum in Japan

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View Abstract

1. Introduction

This paper describes the processes for Radio licensing in Japan. Because assignment of Radio Frequencies and Licenses are related and inseparable, firstly, I describe the general law then how 3G spectrum is allocated and how operators are granted licenses. I hope this will show how spectrum is allocated in Japan in line with global cooperation, by aiming at the long-term prospective, how Japanese policy is involved when the license is authorized, to secure maximal fairness and transparency. Finally, I describe my opinion of differences between the Japanese allocation systems and the U.S. and European bidding systems in the last section.

2. Law systems in Japan

2.1 The Radio Law

The Law to grant radio licenses is based on "Radio Law" in Japan. Various radio license policies are implemented by complying with mainly the Radio Law, which is conducted under the administrative government agency of "Ministry of Public Management, Home affairs, and Post and Telecommunications" (MPHPT). Formerly Ministry of Post and Telecommunications (MPT). The Radio Law sets forth all the basic requirements to install and operate Radio stations, but when detailed procedures we follow subordinated "Government ordinances" or "Ministerial ordinances".

2.2 Disclosure of frequency assignment

One of key factor to obtain radio license is depending on spectrum actually needed for Radio station frequency is available or not. (In other words whether the frequency might not be used by the other licensees) and other factors such as nationalities to become a licensee.

You can access this publicly announced information "Frequency assignment plan" by listing the purposes of spectrum usage. (For purpose of broadcasting or telecommunications for private company use) it is also available from Web site*. In addition, you can view more detailed information from local agency of MPHPT, such as radio frequency allocated on individual radio station.

* http://www.tele.soumu.go.jp/e/frequency/plan.htm

2.3 Procedures of 3G spectrum allocation

When you look at "Frequency Assignment Plan", you might see easily how spectrum allocation is weighted on history, most case of allocations were implemented complying with ITU recommendation. See Figure 1.

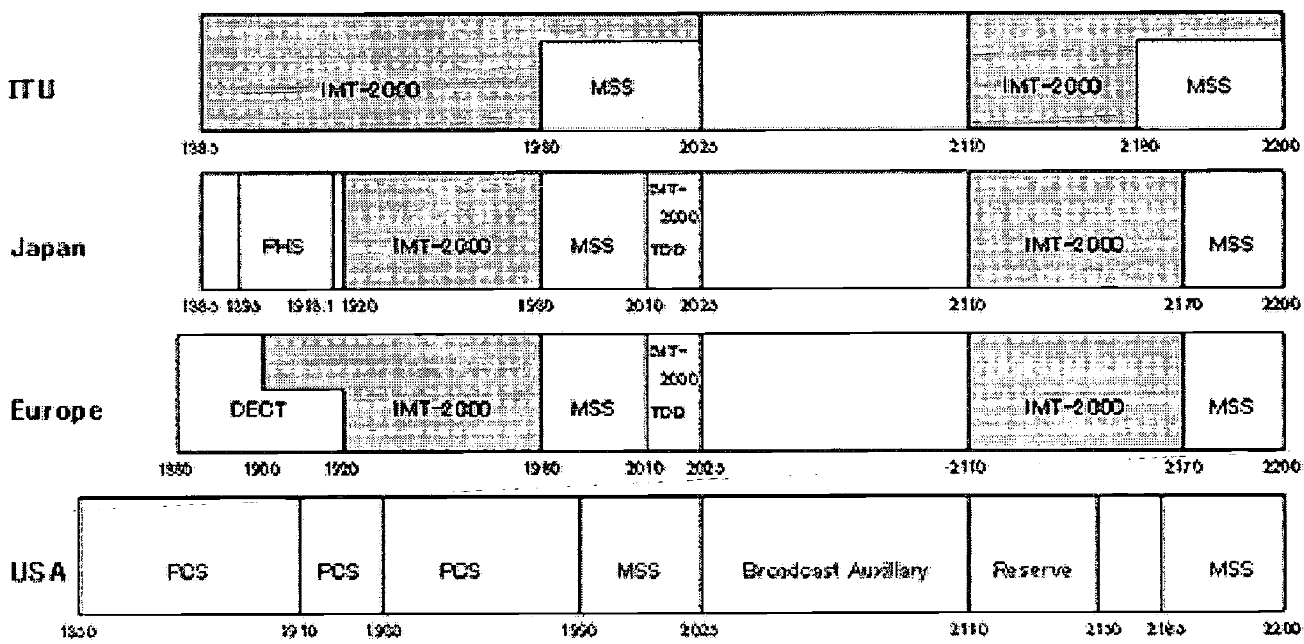

FIGURE 1. IMT-2000 FREQUENCY SCHEDULING

I will describe the procedure when new technology emerges and new spectrum allocation is required for 3G.

"Frequency Assignment Plan" is publicly announced in a form of the revision of the law authorized by the minister. Before implementing this law revision, the minister receives a proposal from "Telecommunications councils" in the form of advisory opinions or suggestions. The Telecommunications council structure is clearly described in the Radio Law.

Technical Field study and discussions are considered in "Telecommunications Technology Subcouncil" it varies on issues. The subcommittees may sometimes generate Adhoc committees. I will explain a little more about "Telecommunications Technology Subcouncil", that has ITU-R committee as a standing subcommittee underneath and below which there are workgroups to meet the needs of various kinds of work group of ITU-R to respond ITU-R issue in Japan. See Figure 2.

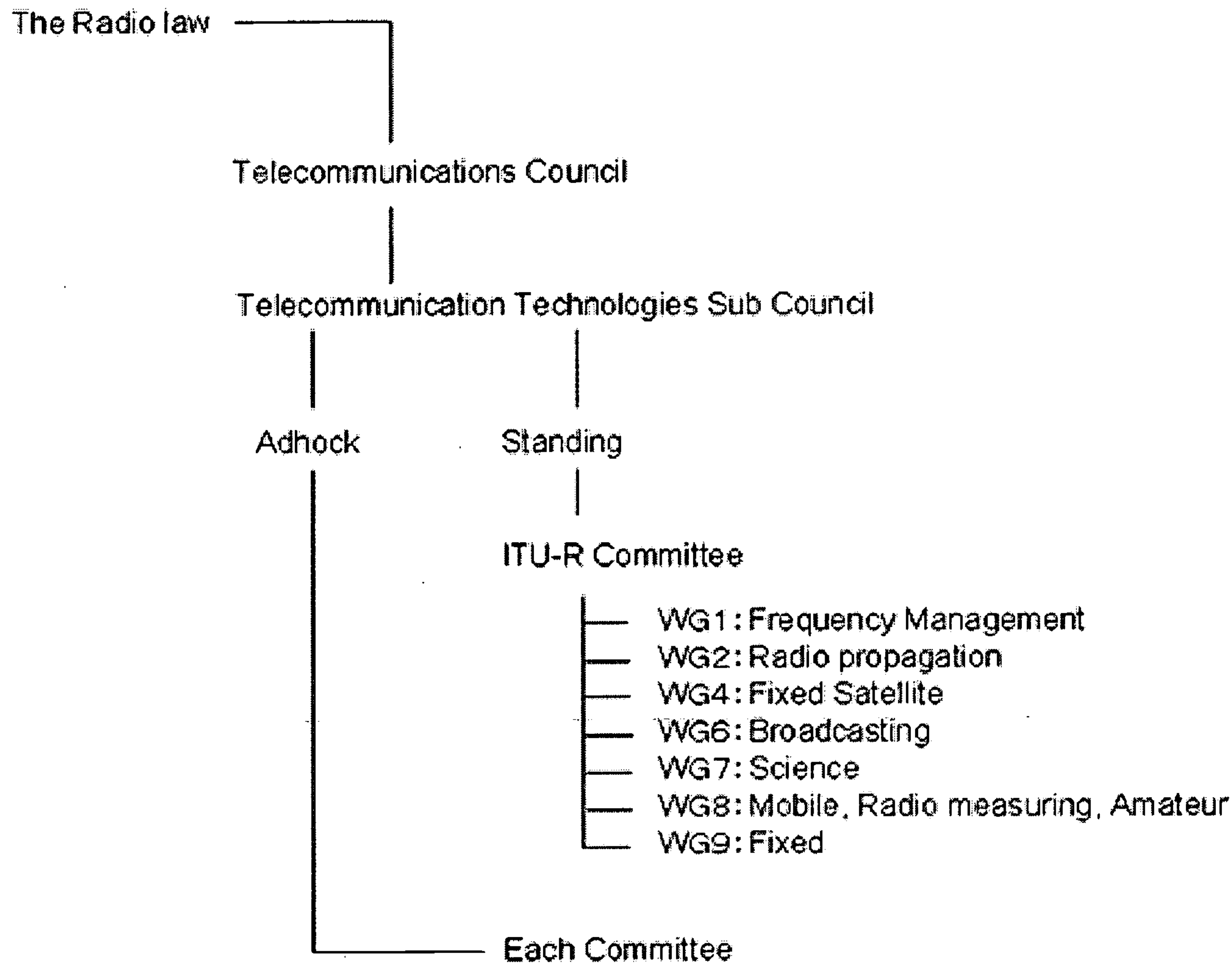

FIGURE 2. STRUCTURE OF TELECOMMUNICATION COUNCIL

MPHPT conducts many studies and discussions prior to going forward to the "Telecommunications technology subcouncil" by obtaining information on ITU trends. Private Study Groups (so called SG) led by MPHPT have played a key roll to consolidate and select critical items before coming substantial discussion items.

The subcouncils and Study Groups consist of experts such as professors, members of industries and members of operators. The chairman of subcouncils or the group leader is likely usually an academic.

2.4 Spectrum User Fee

Although the Spectrum User Fee is not directly related to the license, it was introduced when Radio Law was revised in 1993. The user fee is collected for increasing demands in future to control radio frequency that we consider contributing benefits from radio frequency usage is regarded as sharing global assets. The licensee of radio station usually pays the fees which are set at the price of approx. $5 per subscriber annually for wireless business operators. Mobile subscribers in Japan are over 60million, which amounts to over \36bil (Approx. ($300mil) annually for operators in Japan

3. Details to determine 3G spectrum in Japan

3.1 Formal assignment plan

There had been a debate in spectrum allocation for so - called FPLMTS new mobile global telecommunications system. In 1992, it was determined to allocate 2GHZ band at WRC 1992. Since Japan participated the WRC discussion from the start, I believe that 2GHZ band was determined to allocate for 3G by complying with ITU recommendation at the time when WRC1992 made its decision.

In fact, frequency assignment plan was officially revised later in 1998, though it is understandable from statement saying that existing fixed stations will move to the other spectrum by the end of November 2002.

3.2 Telecommunication technical subcouncil

Study in IMT-2000 Technical Standard has been progressed, and we identified high plausibility of the detailed radio usage plan (It was identified how many can be accommodated if bandwidth is specified). Technical study group for wireless telecommunications for next generation was established in ARIB in the middle of 1990s. (ARIB: Association of Radio Industries and Businesses)

There was a trend to converge with technical standard DS-CDMA (W-CDMA) and MC-CDMA (CDMA-2000), Study group was terminated after developing the assignment plan based on both standards. In 1997, to incorporate policy on 3G spectrum usage Telecommunications Technical Subcouncil established a subcommittee to deliberate the "Technical conditions for wireless Telecommunications for next generation".

In 1999 2GHZ band usage, was allocated 20MHZ on UL and DL respectively, that can be operated with sufficient capacity and extend the speed up to 2Mbps in future when technical standards takes in shape of DS-CDMA (W-CDMA) and MC-CDMA (CDMA-2000). It was founded that high possibility of three operators can offer 3G services in the 2GHZ band planned in 1998 as approved in Telecommunications Technical Subcouncil.

4. License

4.1 Before 2000

Resulting from technical and other reasons, a processes for allocating certain spectrum that is usable to specific purposes as described in section 3, is determined by considering many aspects from technical prospect, technical standard trends, and usage in existing radio stations and global community. The radio law before 2000 did not clearly stated which operator was allocated the radio frequency. As described in section 1 of the Radio Law, if spectrum can be allocated, the license will be given as well. However it did not state a procedure when technical standard and spectrum are newly allocated and operators compete to use the same bandwidth of the spectrum. For example, I would say there is a flaw on Legal systems, when applying 2G license, even if there had never been allocated more licenses than exceeded the official application from operators.

4.2 Revision of the Radio Law in 2000

2000 The Revision of Radio Law was established to cover the flaw mentioned above. I would say it is rather epoch-making in a way of exhibiting clear policy, when license will be granted, applicants compete. If 3G is introduced in an early phase by reflecting rapid growth in mobile business, we can anticipate there would be competition between applicants, law system is prepared to prevent this problem occurrence. The subject of this revision of the law was that the mobile operator was assumed to deploy nationwide not individual license issues, those who are granted considering in original characteristics of license, such as area range, business scale, deployment speed, effective technical adoption for spectrum usage. An additional item was included that if operation is not conducted as it was planned, the license shall be suspended.

4.3 "Beauty contest"

At the same time followed by the Revision of Radio Law, "Ministerial ordinance" set forth more concrete criteria, which is used to determine whether business is appropriate or not to meet demands, it is capable to conduct business as operating body, or in terms of economically cost efficient.

As it is described in section 3.2, followed by receiving advisory report of technical standards and concrete spectrum allocation, MPHPT announced assessment items to grant 3G license or license complying with regulations in Radio Law in April 2000. Applying 3 existing operating companies to this, there is a rumor, the other operators may enter, but it ended up 3 operators have granted license that is NTT DoCoMo, J-Phone, and KDDI (Brand name is known as au).

5. My personal view for beauty contest

5.1 Is beauty contest method not transparent?

When there are more competitors than limited spectrum resource, we have to place priorities by using some device, the spectrum you can say it is national assets to share with anyone that should be utilized as effective as possible. In Japan, in order to grant the license, which is applied to only limited to mobile business, it has a clear procedure, if there are competitors, the license will be granted by assessment based on released criteria complying with the Radio law and Ministerial Ordinance. In addition, there is a rule for punishment even if the operator passed the assessment examination when operator does not deploy as it planned, the license will be revoked.

5.2 Are auctions a good idea?

Some countries have adopted an auction policy, whereby license are auctioned to the highest bidding amount, The government grants license to use precious spectrum to the operators for a charge as the company gain profit. It is sure private companies may earn profits from spectrum, accordingly it is natural taking a money from private companies. However, is auction policy the only way to recover money from operators? For example, is it possible to collect income taxes from revenue earned by private companies so that part of revenue goes to the national coffer. In addition, there are spectrum user fee systems as described in section 2.4 in which the government collects revenue from radio frequencies.

The costs to obtain a license by auction will end up the cost accumulated to users in a form of usage costs, hence users will be forced to share the burden. As for operators' profit, user burden cost standards will converge with appropriate level measured by international benchmarking even it is a Japanese operator. Unfortunately, mobile price standard for monthly charge in Japan is slightly higher than that of global level.

5.3 Auction policy might disturb effective usage of radio wave.

There are some anxiety to obtain license (spectrum) by bidding in auction systems whether the spectrum will be effectively used or that can be disturbance in the future.

Japan has a short expiry date on license (If there is a legitimate reason, the license will be renewed), which allows to shift other spectrum in fixed radio stations in 2GHZ band allocated in 3G smoothly.

6. Conclusions

Expanding global economy and global human interaction, was resulted in high demand for handsets which can be used anywhere in the world. By consolidation of standards, services and handsets will be offered at lower prices. In Japan, in case of 2G specific standard PDC was adopted, which lead to an isolated network. Although there is still a long way to before we have global frequency allocations for mobile communications , 3G is a big first step towards "World Phone". Perhaps in 4G we can finally achieve this goal.

back to index

Abstract

This paper describes the processes for Radio licensing in Japan. Because assignment of Radio Frequencies and Licenses are related and inseparable, firstly, I describe the general law then how 3G spectrum is allocated and how operators are granted licenses. I hope this will show how spectrum is allocated in Japan in line with global cooperation, by aiming at the long-term prospective, how Japanese policy is involved when the license is authorized, to secure maximal fairness and transparency. Finally, I describe my opinion of differences between the Japanese allocation systems and the U.S. and European bidding systems in the last section.

back to index

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1944 born in Japan
1967 BE at Waseda Univ. Japan
1994 MD at Digital TU-KA Kyushu Co.Ltd (a local mobile opco)
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back to index

Pertti Johansson

BiographyMr. Pertti Johansson is a Motorola senior vice president and director of global account management in Motorola's Global Customer Solutions Group. Pertti joined Motorola in 1986 as the director of international cellular infrastructure operations.

Most recently Pertti built a new global account management organization for the top strategic telecom carrier customers in the Global telecom Solutions Group. Immediately prior to that Pertti was the assistant general manager of Motorola's Cellular Infrastructure Group (CIG), where his responsibilities included strategy, global marketing, public relations, wireless access business, and global accounts. Previously, he led Motorola's regional cellular infrastructure business divisions for Europe, Latin America, Japan, Asia Pacific, Middle East and Africa areas. He also led Motorola's Global Systems for Mobile (GSM) product development and marketing functions.

Pertti has been a member of Motorola's European and Asian Management Boards, and currently serves on the Latin American Management Board. He has been a member of the Senior Executive Program for the Emerging Markets as well as a sponsor of the company's Middle East and Africa initiative. He is serving his second term on the Board of Trustees of the Pacific Telecom Council. Pertti is also the Chairman of the Board of Directors for Strategic Account Management Association for 2001-2002. He is also serving on the Board of Directors for the Midwest Chapter of the Finnish American Chamber of Commerce and actively participates in the Executives' Club of Chicago as the Motorola representative. He has participated in Advance Management Programs at the European Institute of Business Administration (INSEAD) in France, Harvard University and Motorola University, actively participated in industry conferences, and lectured at the Motorola Global Institute for Managers.

Pertti started his career at Turku Telephone Company in Finland. After serving in the Finnish Army's Signal Corps, he entered Helsinki Institute of Technology and received his BSEE (Telecommunications) in 1972. Prior to joining Motorola, he worked for 14 years at ITT Corporation in technical and leadership positions in its world headquarters and subsidiaries in Norway, France, Finland, and the United States.

back to index

Policy / Regulatory

Wednesday, 16 January 2002
1600–1730
Coral II

W.3.5 Internet Governance

Chair:
LEN ST. AUBIN, Director, Business and Regulatory Analysis, Telecommunications Policy, Industry Canada, *Canada*

W.3.5.1 Governments and Country Names: Is ICANN Transforming into an Intergovernmental Regime? (View Abstract)

MILTON MUELLER, Syracuse University School of Information Studies, *USA*

W.3.5.2 The Internet: A True Paradise for Freedom of Speech? (View Abstract)

ULRIKE MARIS, Research-Assistant, Dept. of Communication Science and KEITH ROE, Professor of Communication & Dean, Faculty of Social Sciences, Catholic University of Leuven, *Belgium*

W.3.5.3 Uncomfortable Bedfellows: Privacy Protection and Laws to Protect Against Cybercrime and Terrorism (View Abstract)

JANE FORSTER, Partner, Clayton Utz, *Australia*

Presenter:
RUSSELL BERRY, Partner, Clayton Utz, *Australia*

Leonard St-Aubin

Leonard St-Aubin is the Senior Director, Business and Regulatory Analysis in the Telecommunications Policy Branch at Industry Canada. He heads up a team responsible for development of policy related to competition and convergence, new media, Internet content issues and the domain name system, and for monitoring CRTC regulatory proceedings. Len joined the Branch in 1993 to work on the passage of the Telecommunications Act. Previously he worked in broadcasting policy with the former Department of Communications as part of the team that developed the 1991 Broadcasting Act, and contributed to modernisation of copyright law. He represents Industry Canada on the Boards of Media Awareness Network and the Canadian Internet Registration Authority (CIRA) and is Vice Chair of the Governmental Advisory Committee to the Internet Corporation for Assigned Names and Numbers (ICANN).

back to index

Governments and Country Names: Is ICANN Transforming into an Intergovernmental Regime?

Milton Mueller
Syracuse University School of Information Studies
United States

View Abstract

1. Introduction

Nominally, the Internet Corporation for Assigned Names and Numbers (ICANN) is a private corporation. The founding document of ICANN, a U.S. Commerce Department White Paper, stated that "neither national governments acting as sovereigns nor intergovernmental organizations acting as representatives of governments should participate in management of Internet names and addresses."[1] Both the White Paper and the corporation's bylaws explicitly prohibit government officials from sitting on the Board.

Many observers, especially in Europe, have questioned the validity of the US-promoted private sector approach. Some believe that national governments and their treaty organizations should be involved in "governing the Internet" and view the leverage of Internet names and addresses as an appropriate tool for doing so. Another view may not particularly favor government intervention, but nevertheless holds that it is inevitable that governments will become more deeply involved in anything as important and politically sensitive as domain names and Internet addressing.

This paper suggests that, sadly, the latter view is correct. It describes the growing incursion of governments into ICANN's policymaking process, and the decline in ICANN's original status as a bottom-up method of forming a policy consensus among the Internet community. One of the key areas leading to governmental interest and influence is the issue of who has the right to register domain names that reflect the names of countries. Governments have used ICANN to assert sweeping new global rights to how their names are used in cyberspace – rights that have no basis in current treaties or international law. ICANN's management, due to the organization's weak legitimacy, is acceding to these claims.

2. Historical Background: Why ICANN became a private corporation

ICANN's private-sector status resulted from several years of struggle between the technologists organized around the Internet Society, the US government, a few key national governments, and international treaty organizations, notably the European Commission, the World Intellectual Property Organization (WIPO) and the International Telecommunication Union (ITU). The technologists were centered in the United States, but their community was international in scope and did not perceive itself as part of or in any way beholden to the US government (notwithstanding their receipt of federal subsidies for many years). These individuals wanted very badly to keep control of the Internet's name and address spaces in the hands of technologist groups and to shield it from external political influences. More specifically, they wanted to give formal, legal control of Internet governance to informal organizations like the Internet Assigned Numbers Authority (IANA) and the Internet Architecture Board (IAB) that they had created while the Internet was being built in the late 1980s and early 1990s. In early 1997, some of the leaders of these technical groups entered into a political alliance with WIPO, the ITU, and the International Trademark Association in an attempt to create a new, international domain name governance authority. These efforts took place without the approval or formal participation of the US government. The new authority was called the "generic top-level domain memorandum of understanding" (gTLD-MoU). The gTLD-MoU billed itself as "privatization" and "self-governance by the Internet community," but the strong presence of international treaty organizations, especially the ITU, belied that claim. Nor could it escape the notice of the US Government, which has a longstanding suspicion of the ITU. The US made it clear to the Internet technical community and the ITU that it would not agree to transfer control of the DNS root to the gTLD-MoU, and instead opened up a proceeding under the Department of Commerce National Telecommunication and Information Administration.[2]

The ultimate product of the US government proceeding was the Department of Commerce "White Paper" issued in June 1998.[3] The complete story of this process is told in detail in my forthcoming book Ruling the Root: Internet Governance and the Taming of Cyberspace (MIT Press, 2002). As noted before, the White Paper proposed to privatize Internet administration and tried to limit the role of governments, even the US government, in the new organization. Instead of creating a new corporation and defining the policies and rules it should follow, it asked the Internet community to come together around a new private sector organization, to which it would delegate control of the DNS and the Internet addressing system after a two-year trial period. ICANN was organized by Jon Postel (the veteran Internet guru who had managed names and addresses for DARPA since its inception) and his lawyer Joe Sims in response to this call. It was organized under the laws of the State of California as a non-profit public benefit corporation.

Ira Magaziner, the White House policy advisor who presided over the White Paper process, presented it to the public as an epochal change in the nature of international organization. Drawing on a distinction between "industrial society" and "information society" that was popular at the time, Magaziner suggested that the White Paper's methods were more appropriate to the information age. "We believe that the Internet as it develops needs to have a different type of coordination structure than has been typical for international institutions in the industrial age. Governmental processes and inter-governmental processes by definition work too slowly and somewhat too bureaucratically for the pace and flexibility of this new information age."[4] Not only was ICANN conceived as a private sector organization, but its purpose was allegedly confined to technical coordination rather than policy making or "Internet governance."

3. ICANN's Structure

Official policy making in ICANN's structure is supposed to follow a "bottom up" direction. (Figure 1)

Policymaking is supposed to start in one of three Supporting Organizations. One is devoted to protocols, another to addresses, and the third to domain names. As a matter of fact, domain name issues take up almost all of ICANN's time and account for 90 percent of its budget. According to the Corporation's bylaws, Supporting Organizations shall have "the primary responsibility for developing and recommending substantive policies regarding those matters falling within their specific responsibilities."[5] Any proposal for a "substantive policy" that is "not received from a Supporting Organization" is, according to the bylaws, supposed to be referred to the relevant Supporting Organization "for initial consideration and recommendation to the Board." Thus, all substantive domain name policies are supposed to originate in the Domain Name Supporting Organization (DNSO). The DNSO is a corporatist council composed of 7 constituencies representing different interest groups in domain names.[6] Thus, if a government proposed policies to ICANN concerning domain names, according to the procedure contemplated in ICANN's bylaws, those proposals should be forwarded to the DNSO for initial consideration and possible recommendation to the Board.

4. The Governmental Advisory Committee

In order to gain support and legitimacy for its plan to privatize the domain name system, the United States had to make concessions to foreign interests. Foreign governments were concerned about the US lead in Internet commerce and feared that privatization of the domain name system in the hands of a US-based private corporation would enhance US dominance. In response to demands from the European Commission and some national governments, the White Paper made it possible for governments to participate in ICANN in a "non-voting, advisory capacity."[7] That concession led to the recognition by ICANN of a Governmental Advisory Committee (GAC) as a permanent part of its structure. The GAC was constituted March 2, 1999, with Australia's Paul Twomey as its chair.[8] It should be noted that the GAC was not conceived as a Supporting Organization; it was intended to be only a point of communication between governments and ICANN.

The Americans who dominated ICANN's management and interim Board initially viewed GAC as a prophylactic that did as much to keep governments out of ICANN's affairs as it did to bring them in. The GAC, however, quickly became an important player in ICANN's policymaking processes. At this point it is functioning as a fourth Supporting Organization in all respects except for the election of Board members.

From its inception, the GAC has focused on country code top-level domains – the two-letter domains based on the ISO-3166-1 standard – and on other country names and codes in the Domain Name System.

In the US Government's final comment period on the ICANN proposal in October 1998, Australia's Senator and Communications Minister Richard Alston expressed concerns about "the authority of national governments to manage or establish policy for their own ccTLDs."[9] In her 20 October letter to the interim Board designees, Commerce Department official J. Beckwith Burr asked ICANN to provide assurances about their intentions regarding ccTLD management.[10] ICANN's response confirmed that governments would have such authority but cautioned that the "details of implementation ...may be complex" and implied that it would look to guidance from the GAC on that question.[11]

Henceforward GAC's leading participants mounted a persistent campaign to redefine the legal delegation procedure and practical relationship between ICANN, governments and country code top-level domain (ccTLD) administrators. Its mission was reinforced in the early stages of ICANN's formation when a U.S. Commerce Department official asked ICANN to consult with governments on this issue, and identified stable contractual arrangements with country code registries as one of the key issues needing to be resolved before it could transfer full authority to ICANN.

The changes in the relationship sought by GAC were designed to give national governments direct control over ccTLD delegation and re-delegation decisions. The GAC also fought to make name space references to countries exclusive and grounded in the existing political order. It demanded, for example, that ICANN abstain from assigning any top-level domain names that referred to countries, regions, languages and peoples without the approval of the relevant government or public authority. This would rule out, for example, top-level domains for internal nationalities such as .TIBET, .WALES, and .KASHMIR, and presumably for regions such as .ASIA.

A series of communiqués issued throughout 1999 affirmed the GAC's concerns about gaining control of country code delegations.[12] In February 2000, GAC released a detailed document describing what it hoped would become the model for institutionalizing the relationship between ICANN, ccTLD delegations, and the relevant national governments or public authorities.[13]

5. New TLDs and Rights to Names of Countries and Other Geopolitical Designators

As ICANN has matured, its management, which is basically controlled by the Jones, Day, Reavis and Pogue law firm, has become increasingly impatient with the bottom up supporting organization process proposed by Jon Postel (who died in October 1998, just as ICANN was getting off the ground). ICANN's management has done everything in its power to bypass the Domain Name Supporting Organization, or to marginalize it when it cannot be ignored completely.[14] It has also delayed and resisted the creation of a membership structure that would elect the At-Large Board members.

Governments and international organizations are eagerly stepping in to the policy and legitimacy vacuum created by ICANN management's resistance of public accountability. This began right after ICANN authorized new top-level domains in the fall of 2000. Shortly thereafter, the director-general of the European Commission, Robert Verrue, sent a letter to ICANN's President proposing to give governments the opportunity to register or assign in advance the two-letter and three-letter ISO country codes in the new TLDs.[15] In other words, in the new top-level domains such as .info, the government of France should be given the right to register fr.info and/or fra.info. In essence, governments were claiming property rights in hundreds of domain names.

The government of the Republic of South Africa has taken an even stronger stance. It has objected to the common practice of registering country names in the second-level domain space, when the registrants "have no association or tie with that country." It goes on to say that:

It is the position of the Republic of South Africa that second level domain names the same as Country Names are valuable national assets belonging to the respective sovereign nations. The country names in the gTLDs, particularly the dot-com TLD, have the potential to be of substantial political and economic value, particularly to developing nations.[16]

The rights claimed by the government of South Africa, however, have no basis in international law.

Shortly afterwards, the World Intellectual Property Organization (WIPO), at the request of several member states, initiated its second domain name policymaking process. As part of that proceeding, WIPO considered broadening ICANN's domain name dispute resolution policy to include geographic indicators – including not only country names but names of cities and other political subdivisions of states. It also proposed to exclude all two-letter country codes from the second level of all new generic TLDs.

But despite the aggressive assertion of property rights in names by governments, there was still a tacit understanding that any policy proposals they made still had to go through ICANN's own organic processes to become a part of the administration of the domain name system. That changed in September 2001.

6. The Montevideo GAC Resolution

At ICANN's Montevideo, Uruguay meeting in early September 2001, the Government Advisory Committee (GAC) voted to intervene directly into the process of introducing new generic top-level domains. GAC issued a request that "the names of countries and distinct economies...should be reserved by the .info Registry in Latin characters in their official language(s) and in English and assigned to the corresponding governments and public authorities, at their request, for use. These names in other [non-roman] character sets should be reserved in the same way as soon as they become available."

Surprisingly, ICANN did not brush aside this claim, as it might have done only two years ago. Instead, ICANN's Board passed a resolution one day after it received the request from GAC bowing in part to the GAC's wishes.[17] Specifically, the Board authorized Afilias to implement a freeze on any new registrations of ISO-3166-1 country codes under .info, and instructed Afilias to challenge any existing registrations made during the Sunrise period. These arrangements seem to have emerged from informal negotiations between GAC and Afilias. ICANN's President also agreed to come up with an action plan.

The implications of these actions upon the structure of ICANN's decision making and policy formation process should be clear. Fundamental policy decisions about who has the rights to names are being advanced at the 11th hour by an entity (the GAC) that under the original concept of ICANN simply does not have any policy making authority whatsoever. And yet, ICANN's management and its registry contractors have implemented its suggestions without any review by the DNSO or indeed even a public comment period that would allow the Internet community as a whole to react to the proposal. It would seem that GAC has stepped directly into the role of a policy making entity; not only is it acting as a Supporting Organization, but it seems to be "more equal" than other SOs, especially the DNSO.

The ICANN President's action plan made the situation even worse.[18] It proposed to retain the freeze on the 327 country codes under .info while a "discussion group" was formed to explore appropriate ways of dispensing the names. Incredibly, the proposed discussion group did not even include members of the Domain Name Supporting Organization, nominally ICANN's official body for formulating domain name policy. Instead, it included members of the ICANN Board, representatives of GAC, Afilias, and WIPO.

The DNSO was patted on the head and told to go off and ruminate on "possible approaches for longer-term arrangements concerning the use of geographic names within DNS."

It should be noted that under recognized international law, governments have no intellectual property rights in their country names. And in its second domain name process, the normally aggressive World Intellectual Property Organization (WIPO) pulled back from proposing to expand the domain name dispute resolution process to embrace rights to geographical indicators. The WIPO Final Report refers to "evidence of the widespread registration of the names of countries, places within countries and indigenous peoples as domain names by persons unassociated with the countries, places or peoples," but concluded that "these areas are not covered by existing international laws and a decision needs to be taken as to whether such laws ought to be developed."[19] WIPO's caution was prodded in part by business trademark holders concerned about the potential confusion, and possible erosion of their rights, that might be caused by proliferating claims to names by governments, regions, and administrative entities. The lack of a recognized claim in international law did not deter the GAC, however.

7. Conclusions: A Threat to Private Governance?

The GAC's power grab has serious implications. It calls into question ICANN's status as a bottom-up, private-sector organization and points toward its possible absorption by governments as an international regime under their direct control. ICANN is a policy making structure that can create and destroy rights and interests as they intersect with the domain name system of the Internet. Yet this policy making structure is not following the procedures for ensuring accountability to the Internet community set out in its own bylaws. One of the main rationales for creating a nongovernmental, consensus-based organization to administer the domain name system in the first place was that it was expected to be more accountable to and more closely reflecting the interests of the Internet's users, developers and suppliers.

If ICANN becomes a method by which governments can make policy outside of any formal treaty framework then it is possible that it represents the worst of both worlds. As a private sector organization, it lacks formal representation and accountability. But it also has a monopoly over an essential facility that no participant in the Internet can avoid – the DNS root. This monopoly control of an essential facility gives it legislative powers analogous to a governmental organization. While it claims to act entire on the basis of "contractual" authority, ICANN's contracts are, like municipal, state or federal franchises, the economic and political equivalent of legislation because there are no alternatives for those who would reject the contract.

ENDNOTES

[1] Department of Commerce, NTIA, "Management of Internet Names and Addresses," Statement of Policy,

Federal Register 63, No. 111 (June 10, 1998) 31741.

[2] US Department of Commerce, NTIA, "Request for Comments on the Registration and Administration of Internet Domain Names," July 1, 1997. http://www.ntia.doc.gov/ntiahome/domainname/dn5notic.htm

[3] White Paper, note 1 above.

[4] Ira Magaziner, introductory comments at the first International Forum on the White Paper Reston, Virginia meeting, July 1, 1998.

[5] ICANN bylaws, Article VI, Section 2b.

[6] The 7 constituencies are: Business and Commercial interests, Internet Service Providers, Trademark holders, Country code top-level domain registries, Noncommercial domain name holders, Registrars, and gTLD Registries. Many complaints have been voiced about the unrepresentative structure of the DNSO. Duplicate registration is deliberately given to certain business interests; e.g., a company such as AT&T is a major trademark holder, an Internet Service Provider, and a Business user. These three constituencies (Business, ISPs, and Trademark) generally act as a bloc and control nearly half the votes. Noncommercial interests, on the other hand, are stuffed into one broad constituency (with only 3 votes) that includes education and research networks, civil rights and civil liberties organizations, developing country networking organization, technical standards and computer bodies, etc.

[7] "...the Commission is seeking a clear role for the international organizations such as WIPO and ITU in international communications policy. The Internet is not an exception. We regard the statement in the White Paper as a minimum role, which should be implemented in the Bylaws of the new organization. I notice that the current draft Bylaws include a provision for Advisory Councils, and there may be a solution to be found in that context.' C. Wilkinson, European Commission 'Internet governance — implementation of the US white paper', Internet DNS Summit, Geneva, 24 July 1998.

[8] Leadership of the GAC came primarily from representatives of governments and intergovernmental organizations activated either by the gTLD-MoU or by the US Green Paper: Paul Twomey of Australia, Robert Shaw of the ITU, Christopher Wilkinson of the EC, and Francis Gurry of WIPO. The initial list of names inviting governments to send representatives to meetings was drawn from the ITU.

[9] Letter of Senator Richard Alston to William Daley, Secretary of Commerce, 8 October 1998.

[10] Letter of J. Beckwith Burr, U.S. Commerce Department NTIA to ICANN interim Board, October 20, 1998.

[11] Esther Dyson, ICANN Board Chair to Burr, 6 November 1998.

[12] At the Berlin meeting of ICANN in May 1999, the GAC communiqué asked ICANN to reassign "with the

utmost promptness" ccTLD delegations of "external and dependent territories" upon request of the "relevant public authority or government." (GAC Communiqué, 25 May, 1999) "The GAC also reaffirmed that the delegation of a ccTLD Registry is subject to the ultimate authority of the relevant public authority or government." (GAC communiqué 24 August, 1999)

[13] GAC, ICANN communicated document, PRINCIPLES FOR THE DELEGATION AND ADMINISTRATION OF COUNTRY CODE TOP LEVEL DOMAINS, 23 February, 2000. http://www.noie.gov.au/projects/international/DNS/gac/library/ccdocs/cctld.txt

[14] For example, it attempted to completely renegotiate its contracts with Verisign, the dominant operator of the .com, .net, and .org TLDs all the while insisting that these were contractual issues in which the DNSO had no role to play. It also unilaterally adopted a policy regarding alternate roots without even bothering to request the DNSO for a proceeding or an opinion. It ignored the DNSO's declaration that there was a lack of consensus on "sunrise" protection for trademarks in new TLDs, and required such protections in its contracts with new TLD registries. It created unilaterally a list of reserved names that it imposed on all registries. Until greeted with protests, ICANN management formed a secret committee on WHOIS policy, again bypassing the formal consultation or participation of the DNSO constituencies.

[15] Letter from Robert Verrue, European Commission, to Mike Roberts, President of ICANN, 1 December 2000.

[16] Submission by Republic of South Africa in Response to World Intellectual Property Organization's WIPO2 RFC-2 Process, March 1, 2001.

[17] ICANN Board Resolution #01.92, 10 September 2001. http://www.icann.org/minutes/prelim-report-10sep01.htm#01.92

[18] http://www.icann.org/montevideo/action-plan-country-names-09oct01.htm

[19] WIPO, Final Report of the Second Internet Domain Name Process, http://wipo2.wipo.int/process2/report/index.html

back to index

Abstract

This paper discusses the role of the Governmental Advisory Committee (GAC) within the Internet Corporation for Assigned Names and Numbers. It discusses the tensions between ICANN's original conception as a private-sector, technical coordination body and its status as an international policy making body in which governments seek to play an active role.

back to index

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back to index

The Internet: a true paradise for freedom of speech?

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(View Abstract)

1. Preface

The development of open information and communication networks - in particular the Internet - is accompanied by enormous opportunities for access to and distribution of all kinds of information on a global scale. This offers a great potential for social and economic development. Announcing the information highway, the (European) establishment says that this would result in unprecedented opportunities for expressing opinions. They point out that, thanks to the Internet, dissidents are able to ventilate criticism on dictatorial regimes, physicians can discuss patients world-wide, etc. This raises the question: "Is the Internet a true paradise for freedom of speech?". Some call it an unverifiable anarchy, because, like other communication media the Internet is used for a majority of legal, but also for a minority of reprehensible and even criminal activity: racist, pornographic and other 'indecent' data are spread world-wide. Those who point this out, desire a restricting legislation on sexually explicit material, material relating to minors or racism, etc. In the Caucasus, for example, Internet is completely forbidden and in North-Korea exists only an Intranet for scientists and government officials. In Saudi-Arabia the Internet is strictly governed: the whole Internet-traffic is filtered by the government. In Iran also the Internet is governed by severe restrictions and in Iraq there are even no private Internet-connections at all. In Lebanon the government takes action against web-sites with homosexual content. In Cuba, at last, strict legislation regulates all e-mails and Internet-sites which "affect the moral values" (although this is incompatible with the fact that Fidel Castro established the Ministry for Information, Communication and Technology in 2000, to transform Cuba in a 'State of Information').

Governments are challenged to strike the right balance between the desirability of economic growth based on emerging network technologies, the value of free expression and the free exchange of ideas for citizens, and the concerns for preventing or limiting the use of networks for purposes contrary to public order and security. Exacerbated by the inherently international nature of the network environment, the importance of the developing information society, and because of the diversity of cultural norms in this area, this issue is complex. This paper attempts to provide a foundation for general understanding about the nature and development of the Internet and its operation protocols, the ways that people can access and use the Internet, the ability to control at different points in the process of delivery or access, and the technological solutions for addressing content issues, represented through the international and European establishment. Therefore, we rely on a policy study on this matter and use recent policy documents of the European Commission: 'A multi-annual community action plan on promoting safer use of the Internet by combating illegal and harmful content on global networks' (European Commission, 1999) ; of Lawrence Lessig: Code and other Laws of Cyberspace (Lessig, 2000); of The Internet Content Rating Association (ICRA); a North American perspective: 'Canadian Strategy to Promote Safe, Wise and Responsible Internet Use' and 'ISP-based Internet filtering technologies'. It is all considerable work done on questions relating to freedom of speech and Internet content.

1. 1. The global nature of the Internet

The global nature of the Internet (we use it as a synonym for the 'Information Highway' and 'Cyberspace') implies that a possible adaptation of the legislation by country will not serve to catch the offender of criminal activity on the Net. The following reasons apply first of all, the problem is mainly situated on the enforcement of the regulation when it has to be applied to a border-crossing phenomenon as the Internet: international co-operation in this matter is a necessity. But, different countries use different norms and values. And, the Net is global, and so is the flow of Information. People who disseminate information through the Net that is illegal in one country can easily transfer their activities to a country with no similar prohibitions and effectively redeploy their operations within a matter of hours. When one does not want to violate a country's sovereignty, one needs to wait until the prohibitor returns to its own country in order to arrest him. Moreover, if one wants to exceed the national framework, one would surely be confronted with legal procedures taking so much time because they are not adapted to the speed with which everything is moving on the Information Highway. Second, the dissemination of illegal content on the Internet is mostly anonymous, for instance via 'anonymous remailers', or under a pseudonym, which makes it very difficult to detect the offender. Third, the data are immaterial, also difficult to trace. Solutions for this matter are not obvious. We will try to reach possible answers to tracing and prosecution procedures. But, first, it seems useful to pay attention to the different kinds of transmissions on the Internet. And, to structure this text, we will give a brief explanation of the traditional notion 'freedom of speech'.

2. The Internet: the different kinds of transmissions

The ever-evolving state of information technologies makes it difficult to definitively describe the applications available for accessing and distributing information on the Internet. However, generally there are six different kinds of transmissions possible: one-to-one transmissions (or one-to-several), such as electronic mail ('e-mail', that is private communication). Concerning public communication on the Internet, there are five subgroups: one-to-many transmissions, such as 'Listserv'; one-to-many or many-to-many transmissions via distributed message databases, such as 'Usenet newsgroups'; real time communications, such as 'Internet Relay Chat' ('IRC') or Internet telephony; real time remote computer operation, such as 'Telnet' and remote information retrieval, such as 'File Transfer Protocol' ('ftp'), 'Gopher', and the 'World Wide Web' (WWW). One of the difficulties according to the possible distinction of the public communication on the Internet, is that each of these applications (transmissions) require different answers of a potential legislator. Public communication via the Internet is able to enjoy the right of free expression. All in all, e-mail is seen as private communication, with the consequence that e-mail is protected through the right of confidentially of the mail. But, it is not always clear which e-mail is private communication and which e-mail can be received by a lot of people.

Furthermore, a distinction has to be made between illegal, harmful and controversial content. Generally, the concept of 'illegal' seems a relatively simple reference to content that is contrary to law. However, this becomes a particularly tricky issue in the international context, where what is illegal in some countries is not necessarily illegal in others. Furthermore, this question can be exacerbated in a discussion of civil and criminal law, where 'illegal' only refers to that which is a criminal offence, and 'harmful' might indicate that content which raises civil law issues because it 'harms' another party. For purposes of this paper, the term 'illegal' is used to indicate content that constitutes a criminal or civil offence under national law; 'harmful' will indicate content that is considered detrimental, particularly to children; and 'controversial' will be included to indicate the broader grey area where content might be considered illegal or harmful in one culture or community but not in another, raising issues of it own. This is an additional difficulty.
It may be clear that there is not only one issue concerning the Internet: the issues are fundamentally different and variable. This is an essential element that has to be taken into consideration when control-systems will be framed.

3. The principal 'freedom of speech'

3. 1. What does it mean?

Freedom of speech can be seen as the sum of three kinds of freedom: the freedom to have opinions or ideas, the freedom to pass these on and the freedom to accept them (Uyttendaele, 1996: 101-102). In the Internet-practice 'freedom of speech' allows everyone to publish or mail whatever he wants, without regard to the content. This implies everyone's obligation to fight racism, terrorism, fundamentalism and everything what one finds bad and ugly through the principle of 'Free Speech', verbal with all means (possibly - if applicable - through informing the involved authorities, the police, but also through making it ridiculous in public or boycotting it, not reacting on it) (Dirkzwager, 1997).

3. 2. The importance of 'Free Speech'

Freedom of speech is not a purpose on itself: it is a means to achieve the underlying aim, which - although this may evolve in time and place - is to reach an ideal democratic constitutional state.

4. Possible answers to tracing and prosecution procedures

4. 1. Self-regulation

Internet-users have to comply with a code of conduct. For example, within the framework of 'Netiquette', there exist some rules for the use of e-mail. The main rule is that if one send an e-mail, one may never forget the receiver is a human being ("Don't tell anything what you also not say in a non-virtual space, be careful with sending information about yourself", etc., ...) (WEYERMARS, 1995: 23-24). Hotlines (for example the Hotline of Child Pornography) should also be seen as an important element of self-regulation. In a recent survey commissioned by the federal government of computer-equipped Canadian parents, 'Canada's Children in a Wired World: the Parents' View', researchers found that the majority of those who wanted to complain did not do so because they did not know where to file their complaints (the Canadian Strategy to Promote Safe, Wise and Responsible Internet Use: 2001). To address this situation, some other countries have created Internet content hotlines: by which somebody is trying, through the Internet Community, to do something specific about the dissemination of illegal and harmful content on Internet public parts. Through self-regulation - in the meaning of hotlines - one is primarily counting on the user, who is expected to report, to the provider or directly to the authorities, all the compromising content he or she is facing on the Net. It is possible that someone is doing so by accident, although the most heavy stuff is sometimes well hidden behind innocent looking advertisements. Before a user is facing such a content, he or she has to search quite a lot, even intensively. But who is doing so? Not in the least moralists who want to prove themselves by informing juridical authorities about crazy things they have been seeing and of which they can not approve. This does not mean that we are evolving towards a society where everybody is betraying one another. So what is society supporting or not? An another very important aspect is the principle of privacy: who is authorised to check which persons are downloading racist sites on the Net? How far must the government protect us in this case? Intervening is contradictory to the philosophy of the Internet, usually recognised as a free-haven. But what is important about hotlines is that they must be seen as an action trying to get ahead of censorship on the Internet, instead of trying to censor. Because all the members are saying: "Restrictions on the Internet would just move the problems to another level".

To promote safer use on the Internet, it is important to make content easier to identify. This can be done through a rating system which describes the content in accordance with a generally recognised scheme (for instance, where items such as sex and violence are rated on a scale) and by filtering systems which empower the user to select the content he/she wishes to receive. Filtering software is software that compares some or all of the contents of a data file retrieved by a user against a pre-defined set of rules, and determines whether to permit the file to be retrieved and (or) displayed by the user's computer (Miller et. al., 1999: 32).

The Internet Content Rating Association (ICRA) is an international, independent organisation that empowers the public, especially parents, to make informed decisions about electronic media by means of the open and objective labelling of content. ICRA's labelling system is designed to be as objective as possible, and to cover a wide range of content types. The system gives users a great deal of flexibility in their choices of what should and should not be seen in their home or workplace. The broad topics covered are chat, the language used on the site, the nudity and sexual content of a site, the violence depicted on the site and others such as gambling, drugs and alcohol. ICRA's dual aims are to protect children from potentially harmful material and to protect free speech on the Internet. A key point is that ICRA does not rate Internet content - the content providers do that, using the ICRA system. ICRA makes no value judgement about sites. In global, ratings may be attached by the content provider or provided by a third-party rating service. Labelling or rating schemes for Internet content have been proposed and developed by groups such as the RSAG and SafeSurf. These schemes generally use either a simple age-based rating scale similar to that used for movies or a more sophisticated labelling system that rates material based on a number of dimensions (e.g. sex, violence, hate, language, etc.) (Miller et. al., 1999: 35). Content labels generated by ICRA conform to an Internet industry standard known as PICS - the 'Platform for Internet Content Selection'. It is a set of technical specifications for creating rating systems and filtering software for filtering content, that specifies how to create rating labels for Internet content. There are a number of possible filtering and rating systems. However, their level of sophistication is still low and none has yet reached the 'critical mass' where users can be sure that content in which they are interested and content which they wish to avoid will be rated appropriately and that perfectly innocent content will not be blocked. A labelling is not a purely technological approach to content filtering. These systems rely on either voluntary compliance (self-rating) by content creators, or rating and labelling by third parties. Labelling or rating by a large number of diverse groups and individuals would obviously result in inconsistency. Standards-based (or subjective) rating systems would result in the same item receiving different ratings from different groups or individuals (Miller et. al., 1999: 53-36). Blocking software (such services as 'Surf Watch', 'CyberPatrol', CYBERsitter, KinderGuard, Net Nanny and Parental Guidance) are becoming more sophisticated and more popular. Blocking software can solve the dilemma of explicit sexual material on the Net (WEINBERG, 1997: 226). 'Stand Alone Software' is another method for limiting access to certain kinds of content on the World Wide Web. In this case, the software company provides either a 'blacklist' of sites, which are blocked by the software, or a 'whitelist' of sites that are recommended for viewing based on certain criteria set forth by the software company. In some cases the software allows the user to select which kinds of content should be blocked. 'R3 Safety-Net Agreement and the Internet Watch Foundation' is an industry proposal for addressing the question of illegal material on the Internet, with particular reference to child pornography. It presents a package of measures developed by key players from the Internet Service Providers Association (ISPA), the London Internet Exchange (LINX) en The Internet Watch Foundation. ISP's have to implementate practical measures to prohibit the use of the Internet with illegal purposes and providing an answering mechanism in cases where illegal material or activities are established. The ISP's are not supposed to act as judges. Net-users are supposed to take their own responsibility when putting something on the Net.

Another way to empower users to avoid unwanted content would be to set up a 'TLD' ('Top-Level Domain'). That would indicate sites that are known to carry certain kinds of material. Such a TLD would make it easy for users to steer clear of or block sites, which have that domain name. Many parties seem to be in agreement with the need for careful, well calculated expansion of the name space and the need to keep a watchful eye on possible technical problems, since even short-term problems like name lookup failures or name collisions can have a highly detrimental effect on the welfare of users. This is not a complete list.

Technological solutions are widely recommended as the best available approach to harmful content issues today because they are readily, easy to use and effective. Generally, these technologies can accommodate a diversity of community values and educational needs, give positive guidance to children, and offer protections for free expression and the free flow of information. In this matter, we think of making perfect the blocking-, rating- en filter-systems for Internet-content, such as the PICS-platform and the labelling of sites. The technological development should also be situated in the European and international context. The ultimate aim has to be the possibility to apply the technological measures world-wide. The development of the PICS-platform shows that there is a need for this. International co-operation within the creation of such systems would create the space which is needed for the further refinements of these filter-and rating-possibilities, that they can be applied on a universal basis. The global nature of the Internet indicates a need to international co-operation in this field.

Self-monitoring through individual users can also be efficient up to a certain level and should be stimulated through the government with specific guidance programs. Awareness, education and knowledge are the foundations of all effective solution. It is fundamentally important that Internet-users be alerted to the potential pitfalls of the Internet, many of which are unique to this new medium. But it is equally essential to empower the users by raising awareness of the solutions that are available. The principle of self-monitoring has the advantage of enabling each user to make use of the Internet on an individual level, taking into consideration its own cultural background. Moreover, self-monitoring with the necessary software is rather easy to realise. One certain disadvantage of this method is that it is not providing a solution for the spread of illegal information through the Internet or adjacent networks.

4. 2. International co-operation concerning tracing and prosecution procedures

Self-regulation seems to be a solution in the matter of tracing and prosecution procedures, although this does not offer a total solution for the outlined problem. Self-regulation nowadays is organised on an national level. There is a need for international co-operation to tune the different initiatives and to strengthen them to come to a satisfactory solution. Self-regulatory systems, too, must address the international nature of Internet content. Industries increasingly need to coordinate their work and develop effective solutions that transcend national boundaries. In fact, the private sector is working internationally to develop a model self-regulatory code of conduct for Internet service providers (see further) around the world. The Canadian Association of Internet Providers (CAIP) has also entered into an agreement with the EuroISPA (European Internet Service Providers Association) to share information and collaborate on issues of common concern. Associations from around the world, including CAIP, are networking through an emerging ISP association forum. Collaboration with foreign law enforcement agencies and governments is also essential. Good examples are for instance: Canadian law enforcers participate with representatives of thirty other countries in the 'Interpol Specialist Group on Crimes Against Children'; and The Department of Foreign Affairs and International Trade, and Canadian criminal justice officials also actively participate in the Group of Eight (G8).

4. 3. A minimal harmonisation of standards for unacceptable content

As said, regulating the content of speech on the Net is still thought of as a national issue. Free speech absolutists and national legislators discuss these matters without considering the international dimension of the information infrastructure, which diminishes the significance of these national debates. But, only an international perspective can overcome the current short-sightedness of free speech absolutists and regulators alike. Speech restrictions on the Net must be elevated to the international level to be both subjectively acceptable to the world's nations and globally enforceable. An international legal instrument, which by definition embodies this global consensus and positively binds all nations, could provide a useful tool in drafting a possible solution: limiting regulation to specific, defined areas such as advocacy of genocide, slavery, torture, or apartheid, together with creative approaches to speech regulations for the nascent global information and communication networks that are both sensible and feasible.

4. 4. Clarifying liability and responsibility of the Internet-providers

It is of the utmost importance one should not impose a heavy responsibility to an Internet provider, because doing this smells like private censorship. Major question: "Who are those suppliers?" Before scanning the potential liability position of the providers, we first want to distinguish the existing kinds.

4. 4. 1. The liability of the Internet-providers

4. 4. 1. 1. The different kinds of providers

There are four kinds of providers: the 'Infrastructure' providers, 'Information' (or 'Content') providers, 'Presence' providers and 'Access' providers. The Infrastructure providers only offer the necessary telecommunication-infrastructure. So, they can never be responsible for the information which is transmitted through their infrastructure. Information providers determine the content of the information they offer. That's why they can be punished when the information is punishable. It is completely different for the Presence providers, because they help other companies on the Internet and have the responsibility to maintain their web-sites. They also do not seem to risk to be prosecuted ever. The last group, the Access providers offer their users access to the Internet. Van Eecke makes a distinction between, on the one hand these access providers who offer users access to the Internet and, on the other hand, these access providers who give the author of illegal content the opportunity to build a web-site on his or her own. Within the first group, users take the initiative to ask for information. But, because of the fact that the data are transmitted to the user via the server of an access provider, in some cases, the provider can assert a certain influence regarding the provided information. Within the second group of access providers, it is a different situation, because the public information is on the hard disk of the provider and can at all times be accessed by other users. (Van Eecke, 1997: 79-87). In this paper, we only take into account the first group of access providers, because of the following reasons: the access provider carries different possibilities to prohibit criminal behaviour on the Internet. This provider is in a contractual communication with the user in which he or she can submit him or her to certain conditions relating some kind of information. This kind of provider also has the possibility to shut down a web-site when after noticing harmful or 'indecent' content. So, when we talk about 'the liability of the provider' in this paper, we refer to the liability of this kind of access providers.

4. 4. 1. 2. The liability of the access-provider

Since ISP's provide the interface between users and the Internet, they can perform an important service in dealing with illegal and harmful content on the Internet. Some authors say that only when providers can be held responsible, one can really react against punishable expressions through the Internet. But, when providers constantly worry about the content of certain messages, newsgroups, etc., they are expected to react actively. They can choose: either they simply close down most of their services for the users or they check every message, every document or every picture spread through their system. They are supposed to act as a judge. Moreover, it is only theoretically possible to control everything. The information flow is so big that it is an endless task. On top of this, the existing technical possibilities to control all this can very easily be passed. Another remark is that shutting down those newsgroups does not offer a solution. Because, those who really want some information, can get this somewhere else. So, it is a lot more effective to oblige operators, suppliers or network-services and possibly system directors to warn the authorities when they are facing or observing illegal data-transmissions. Access-providers can only be held responsible when it has been proved they failed in holding up their responsibility. For instance, if the access provider was warned several times, that suspicious content passed through the system and failed to warn the authorities, the provider can accomplice to those deeds. Nobody is in fact objectively punishable. You are only punishable if you explicitly knew about it. On the other hand, providers are not authorised to hide behind the free speech-principle. A judge must find out whether he or she was involved in spreading indecencies through the Net. For service providers we maintain the same scenario.

5. Conclusions

Disposing or not of information in certain positions implicates power or absence of power. This means - to answer one of our previous questions - that the Internet is not a true paradise for freedom of speech. Nowadays, the Internet is still seen by many as a democratic wonderland, a place of unfettered freedom of speech, business competition and creativity. However, Lawrence Lessig does not view it quite that way. In writing "Code and other Laws of Cyberspace', he has demonstrated how "the basic Internet of the past is changing from a libertarian's utopia to a place that is controlled by commercial interests that could kill the innovative culture that fostered the Internet we see today" (Lessig, 1999). He has examined how the relationships of the technology (which he also refers to as 'architecture' or 'code') along with social norms, markets and laws regulate people's behaviour. Furthermore, the right on freedom of information can never be absolute. It has to take into consideration the coexistence of different social unites (companies, groups, individuals). They all have a certain right of self-determination. This simple statement explains why the widespread principle of the free information highway on all levels is always bouncing legitimate restrictions. On the individual level, the right of free expression and reception of one, ends with the right of privacy, security, identity, dignity (enjoying a good reputation) and personal material interest of the other. On state level, the right of full and free international information flow collides with the right of sovereignty (a kind of collective privacy), national security, public order, cultural identity and economic interest of all states. These contradictions are inevitable and one has to compare the pros and cons. At the present state of legislation this is rather difficult to do, especially on an international level, where the offices, busy with regulating the international information traffic, are put hard to work. The legal instruments are defective and partially out of date. Add to all this that the juridical discussion is not neutral, but tied to political and economical power. For national (and international) governments it is rather difficult to keep step with the developments of communication and information. Considering the digital revolution, however, a new reflection on adapting the present structures to the new surroundings is necessary. Everybody, authorities included, should realise that information and especially the extent to which information is transformed into knowledge will become one of the pillars of our Information Society. The tension between justice and reality must come to an end.

As a whole, the evolution in the Information Society provide us with lots of possibilities. Due to the integration of different kinds of services in one network (the telecom and broadcasting convergence) one is creating technological opportunities we could not dream off before. So, we come to the conclusion that public authorities should get used to this evolution, both in ameliorating society, as in developing the telecommunication sector. But, we also think the authorities should frame those developments. On the one hand to avoid that the Information Society would become a factor in (digitally) dividing society, on the other hand to protect citizens - more especially the weakest, such as children - against the aberrations technological progress can inflict. The authorities must, in other words, create conditions in which those modern technologies can be employed legally. The liberalisation - the throwing open of the telecom market for competition - is surely not reducing the role of the authorities, they have merely different changed. It's role as an economical agent is pushed back, but as regulating authority it is increasing. Not only on the national but also on the international level. Now the authorities are facing the difficult mission of finding a good balance between on the hand securing freedom of expression or opinion and, on the other hand banishing the worst excesses of the Net. Qualified people are necessary to track criminal content on the Net as well as in catching the criminals themselves. The speed with which all is moving on the Information Highway, requires fast and regular actions. But there is no miracle solution cure for all the problems at the same time.

Nevertheless, the information channels will continue to grow. Let us consider this to be an abundance. Emerging problems, we will not be able to solve them quickly. We will have to be more prudent in the first place and making choices: between correct and wrong, good and bad information, between relevant and irrelevant knowledge. To know our own bounds, will be the biggest challenge of all. Everybody, the educational establishments, the formation- and trainingsworld, the authorities, carries its own responsibility for a qualitative and social integration of the new information technologies in everybody's life. Only than, we can talk about a positive contribution of those new means to our democracy.

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back to index

Abstract

The Information Highway offers unprecedented opportunities for expressing opinions. This raises the question: "Is the Internet a true paradise for freedom of speech?". Governments are challenged to strike the right balance between the desirability of economic growth based on emerging technologies, the value of free expression and the free exchange of ideas for citizens, and the concerns for preventing or limiting the use of networks for purposes contrary to public order and security. This is a complex issue, due to the inherently international nature of the network environment, the importance of the developing information society, and the diversity of cultural norms in this area.

back to index

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back to index

UNCOMFORTABLE BEDFELLOWS: PRIVACY PROTECTION AND LAWS TO PROTECT AGAINST CYBERCRIME AND TERRORISM

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View Abstract

Some context

In considering the appropriate balance between laws protecting privacy and those providing protection against online terrorism and crime, it is interesting to note just how much has changed in as short a time as 20 years.

20 years ago, the legislative environment in Australia was a much simpler affair. But then, so was the business and commercial environment.

There was, at least as far as the public was concerned, one government owned carrier - Telecom. Two other government owned entities were responsible for international and satellite services, but, they had dealings with Telecom, not with the public. There were no carriage service providers (ie, no resellers) and there were certainly no internet service providers. Most households had a telephone, a television set and a radio.

On the legislation front, there was a Telecommunications Act 1975, the Wireless Telegraphy Act 1905 and the Broadcasting Act 1942. There was a Telecommunications (Interception) Act 1979 which prohibited not only the interception of communications passing over a telecommunications system, but, in addition, the unauthorised inspection of telegrams. In any event, it was quite a short little Act - 18 pages in all. There was no privacy legislation.

To the present. The Australian Communications Authority (ACA) expects to issue its 100th carrier licence in the current financial year. The number of carriage service providers including ISPs is not known with certainty as such entities are not required to be registered or licensed. However, carriage service providers and ISPs are required to be members of the Telecommunications Industry Ombudsman (TIO) Scheme. Currently, there are over 1000 members of the scheme. Many households have not only television, radio and telephone, but mobile phones and computers. If there is no access to the internet at home, it is generally available at school, at work or from internet cafes. Certainly, most businesses use the internet and rely increasingly on electronic communications.

Legislation which affects the operations of the internet and online activities, includes the following:

- the Telecommunications Act 1997 which governs the operations of carriage service providers, including ISPs;
- the Telecommunications (Consumer Protection and Service Standards) Act 1999 which also governs the operations of carriage service providers;
- Schedule 5 to the Broadcasting Services Act 1992, which regulates content provided over the internet;
- the Privacy Act 1988, which, since amendments came into force in late December 2001, imposes obligations on persons such as ISPs who collect or have access to personal information as a matter of course in the provision of services;
- the Crimes Act 1914, which creates a number of offences in relation to telecommunications;
- the Cybercrime Act 2001 which creates a number of offences in relation to electronic communications and computers;
- the Telecommunications (Interception) Act 1979, which makes it an offence to tap into and record certain communications;
- the Interactive Gambling Act 2001 which prohibits interactive gambling services from being provided to customers in Australia and prohibits Australian-based interactive gambling services from being provided to customers in designated countries.

These do not include other laws with which ISPs must also be familiar such as copyright and trademark laws, defamation laws, laws regulating electronic transactions and the various rules governing domain names and other forms of electronic addressing.
At the same time, ISPs are fighting cyber attacks including hacking, viruses and worms, use of their systems for the communication of offensive or illegal content, and the carrying out of "hate crimes" including defamation.

The needs of the average ISP

In considering an appropriate balance between the objectives of privacy, security and crime prevention, one place to start is to consider the needs of internet service providers.
What does the average, respectable, socially responsible ISP want or need to be able to do to promote use of the internet and the ISP's business?

An ISP probably has 4 basic needs:

1. Security. An ISP must provide a secure environment in which correspondence, data transfer and online commerce can take place so as to encourage the growth of the use of the internet and online commercial activities.
2. Customer confidence. An ISP must provide an environment in which customers can feel confident that their on-line activities and personal details are protected.
3. A reputation as a responsible member of the community. The responsible ISP would rather prevent

than facilitate illegal activities such as terrorism, drug offences, paedophile activities, theft and fraud and would prefer to be seen by the community as persons assisting in the prevention of such activities.

4. Clarity. The ISP needs to know what it can and cannot do, what it must and must not do. Further, ISPs would prefer to be able to do this in a lawyer free environment. The responsible ISP does not wish to engage in activities that will result in civil litigation or the imposition of penalties for criminal offences. In keeping with the rest of the community, an ISP would prefer not to hire lawyers.

The state of current legislation in Australia is such that an ISP has very little control over the above matters. The steps that an ISP can take to make the online environment more secure are limited. The extent to which ISPs can prevent illegal activities are also limited. Although an ISP can put in place certain processes to protect the privacy of its customers, guaranteeing that the privacy will be maintained is not so simple.

It is suggested that the problem is due, in part, to a failure on the part of the Government to address the need for balance between the rights of privacy, security and crime prevention. This lack of balance in Australian legislation is a reflection of a similar lack of balance in the development of policy at an international level. The result is confusion for ISPs about their rights in the legal environment in which they operate.

The privacy side of the equation - personal information and communications

The principles on which Australian privacy laws are based are contained in the Organisation for Economic Co-operation and Development (OECD) 1980 data protection principles, the Guidelines for the Protection of Privacy and Transborder Flows of Personal Data. Consideration of these guidelines commenced in the late 1970s when OECD member countries considered it necessary to develop guidelines "which would help to harmonise national privacy legislation and, while upholding such human rights, would at the same time prevent interruptions in international flows of data."

Australia first legislated in relation to privacy rights with the Privacy Act 1988. Obligations in relation to the protection of privacy under the Act were limited to government agencies. It was not until the passing of the Privacy Amendment (Private Sector) Act 2000 that obligations to protect privacy were extended to private sector organisations. These obligations commenced on 21 December 2001.

The Information Paper issued by the Federal Government to explain the extension of privacy principles into the private sector, describes the policy context thus:

In developing a system for the fair handling of personal information in the private sector, the Government's intention was to ensure that the scheme:

- acknowledges Australia's federated system of government...;
- is workable, nationally consistent (as far as possible) and cost effective;
- provides Australian businesses with a framework that will assist them to take a leading role in the global information economy; and
- is compatible with the European Union Directive on the Protection of Individuals with Regard to the

Processing of Personal Data and on the Free Movement of Such Data to remove any potential barriers to international trade.

Creating a workable scheme required consideration of many issues and interests. The Government was committed to achieving the right balance - a balance between the protection of individual privacy interests and competing social interest such as the free flow of information to the public through the media; a balance between the interests of consumers and those of business. The scheme also had to be consistent with other Government objectives, such as reducing the regulatory burden on the small business sector. The private sector legislation was developed in consultation with many sectors of the community. The Government is of the view that it does, as a result, strike the right balance.

No mention is made in the information paper, nor in the explanatory memorandum, of the need for a balance between the protection of privacy and the requirements of providing a secure environment free from cybercrime and terrorism.

However, with the commencement of the amendments to the Privacy Act 1988 (Privacy Act) in December 2001, in addition to protection of communications under Part 13 of the Telecommunications Act 1997 (Telecoms Act) and prohibitions against interception contained in the Telecommunications (Interception) Act 1979 (Interception Act) it would appear that Australia is well on the way to achieving a comprehensive framework for the protection of privacy in relation to electronic communications.

The amendments to the Privacy Act which came into force on 21 December 2001, establish a single comprehensive national scheme providing, through codes adopted by private sector organisations and the National Privacy Principles, for the appropriate collection, holding, use, correction, disclosure and transfer of personal information by private sector organisations. Personal information is defined as information or can opinion about an individual whose identity is apparent or an be determined from the information. The legislative scheme is based around 10 National Privacy Principles (NPPs) which dictate how organisations should handle personal information. The 10 NPPs relate to:

1. Collection. Personal information must be collected only as necessary, and must be fair, lawful and not intrusive. A person must be informed of a collecting organisation's name and the organisation's purpose in collecting the information.
2. Use and disclosure. Use of personal information which is collected is limited to the purpose for which it was collected except in limited circumstances which include specified public interest, law enforcement, authorisation under law, public safety or specified direct marketing purposes. Individuals must be able to opt out of some uses of their personal information.
3. Data quality. Personal information must be accurate, complete and up-to-date.
4. Data security. Personal information must be safe from misuse, loss or unauthorised access.
5. Openness. An organisation's information handling practices must be set out in a policy document and an organisation must, upon request, inform a person of its information handling practices.
6. Access and correction. Personal information must, with some exceptions, be made available on request and must be corrected if shown to be inaccurate.
7. Identifiers assigned by a Commonwealth government agency (eg, a tax file number) must not be

adopted or used by an organisation.

8. Anonymity should be available wherever it is lawful and practicable.
9. Transborder data flows are only allowed where the foreign recipient has appropriate protection.
10. Sensitive information (eg, information or opinion about a person's race, political opinions, religious beliefs, memberships of trade or professional associations, sexual practices, criminal record, health) must, with some limited exceptions, not be collected without consent.

An interference with privacy will occur if the relevant act or practice breaches an approved privacy code that binds the organisation or, if no code applies, the act or practice breaches a NPP.

If an approved code contains procedures for making and dealing with complaints, the procedures under the code will apply to any complaint. If there is no approved code or the code does not contain procedures for making and dealing with complaints, the Commissioner may investigate and determine complaints but only if the complainant has first complained to the respondent or the Commissioner decides complaining to the respondent is not appropriate. Determinations made by the Commissioner include that the respondent has interfered with privacy and must not repeat the relevant act, that the respondent should perform a reasonable act to address loss or damage, that the complainant is entitled to a specified amount as compensation for loss or damage.
A determination of the Commissioner or of an adjudicator under an approved privacy code is enforceable by way of an order of the Federal Court or the Federal Magistrates Court.

Disclosure or use of information by a carrier or carriage service provider as allowed under Part 13 of the Telecoms Act is not a breach of a privacy code or a NPP as it is taken to be authorised by law (see NPP 2 above).

Under Part 13 of the Telecoms Act, subject to a number of specified exceptions, carriers and carriage service providers (including internet service providers) are prohibited from disclosing or using any information or document which relates to the affairs or personal particulars of another person including any unlisted telephone number or any address of another person, the contents or substance of a communication being carried by a carrier or carriage service provider or carriage services supplied or intended to be supplied by a carrier or carriage service provider. The prohibitions only apply to information or documents that have come into the carrier's or carriage service provider's knowledge in connection with its business as a carrier or carriage service provider.

Disclosure or use is permitted in the following circumstances:

1. by or to an employee or a contractor as necessary for the performance of the employee's or contractor's duties;
2. when it is required or authorised by or under law;
3. when it is by a witness summoned to give evidence or to produce documents;
4. when reasonably necessary for the enforcement of the criminal law, the protection of the public revenue or the enforcement of a law imposing a pecuniary penalty;
5. if made to the Australian Security Intelligence Organisation;

6. if made to the ACA, the Australian Competition and Consumer Commission (ACCC) or the TIO to assist in carrying out the functions or powers of the ACA or ACCC or the consideration of a complaint by the TIO;
7. with the exception of unlisted telephone numbers, for purposes connected with the provision of directory assistance services or the publication or maintenance of a directory of public numbers where the directory does not enable a person who only knows a customer's number to readily identify the customer's name and/or address or for dealing with matters raised by a call to an emergency service number;
8. if made to an emergency service organisation or an emergency call person for purposes connected with dealing with the matter or matters raised by a call to an emergency service number;
9. if made by a person who believes, on reasonable rounds, that the disclosure or use is reasonably necessary to prevent or lessen a serious and imminent threat to the life or health of a person;
10. as may be reasonably necessary for the purpose of the preservation of human life at sea or otherwise in relation to the location of a vessel at sea and for maritime communications purposes;
11. in relation to information or a document which relates to the affairs or personal particulars of a person, if made with the person's consent or in circumstances where the person is reasonably likely to have been aware or made aware of the disclosure or use;
12. in relation to information or a document which relates to the contents or substance of a communication, if made in circumstances where it might reasonably be expected that the sender and recipient of the communication would have consented to the disclosure or use;
13. if made by a carrier or carriage service provider for the purposes of or in connection with the supply or proposed supply of carriage or content services to a customer by a different carrier or service provider.

People to whom information or a document is disclosed as a result of the operation of the exceptions outlined above are also prohibited from disclosing or using the information or documents except for the purposes for which it was disclosed.

Interception related prohibitions and obligations relevant to ISPs

The Interception Act makes it an offence to intercept a communication passing over a telecommunications system, including mobile telecommunications. Related offences include authorising, suffering or permitting or enabling an interception, dealing with intercepted information and obstructing or hindering a person acting under a warrant without reasonable excuse.

Interception is permitted if authorised under a valid warrant or if the interception is undertaken by the carrier, carriage service provider or ISP or their employee for the purposes of installation or operation or maintenance of a telecommunications system or, more importantly, for the purpose of identifying any person who has contravened or is suspected of having contravened certain provisions of the Crimes Act 1914 (Crimes Act), including:

- causing a communication to be wrongfully delivered;
- using a carriage service to menace or harass a person or in an offensive manner;

- interfering with carriage services or with carrier facilities; and
- connecting and/or using equipment connected to a telecommunications network for unlawful purposes.

In addition, under the Telecoms Act, ISPs are required:

- to give officers and law enforcement authorities reasonably necessary assistance in relation to the enforcement of the criminal law and laws safeguarding national security;
- to do their best to prevent their network and facilities being used in the commission of offences against the laws of the land; and
- to ensure that their networks or facilities are able to intercept a communication passing over it, in accordance with a warrant issued under the Interception Act.

Crime prevention in relation to electronic communications and computers

In Australia, the Cybercrime Act 2001 (Cybercrime Act) has recently amended the Criminal Code Act 1995 (Criminal Code) by inserting new computer offences. The new offences are based on the recommendations of the Model Criminal Code Officers Committee of the Standing Committee of Attorneys-General in their report Damage and Computer Offences dated January 2001. The new offences are consistent with the terms of the Council of Europe Convention on Cybercrime adopted by the Committee of Ministers in November 2001. The new offences do not commence operation until April 2002.

Similar provisions have been enacted or are intended to be enacted in the various States and Territories of Australia.

The explanatory memorandum to the Cybercrime Bill, states that the proposed offences are directed at conduct that impairs the security, integrity and reliability of computer data and electronic communications and that advances in computer technology and electronic communications have created new means and possibilities for committing cybercrime such as hacking, denial of service attacks and virus propagation. The offences are designed to address these new forms of cybercrime and to remedy deficiencies in the existing offences. The explanatory memorandum does not address competing issues such as privacy.

Despite the fact that the Convention on Cybercrime provides for the establishment, implementation and application of the powers under the Convention to be subject to conditions and safeguards for the adequate protection of human rights and liberties, the Cybercrime Bill did not originally make any allowance for such issues.

Before it was passed, the cybercrime legislation was considered by the Senate Legal and Constitutional Legislation Committee. The Committee's findings are contained in its report, Inquiry into the Provisions of the Cybercrime Bill 2001, dated August 2001.

The Senate Committee considered privacy issues. The Committee's report indicates that when asked what privacy protections are in place to protect material of persons who are unconnected to a suspected offence and which may be collected in the investigation process, the relevant law enforcement agencies referred to protection offered by "internal rules and guidelines". The report also refers to discussions between the Attorney-General's Department and the Office of the Federal Privacy Commissioner and the view that existing privacy guidelines would need to be revised.

On the Committee's recommendation, provisions were inserted in the Bill to provide for the destruction of personal information collected by law enforcement agencies which is not relevant to an investigation. There was, however, no detailed consideration of the interaction between the various issues of privacy, security and the prevention of cybercrime.

Under the Crimes Act and the Criminal Code (once it is amended by the Cybercrime Act which comes into force in April 2002), offences relating to telecommunications, electronic communications and computers will include:

- Causing a communication in the course of carriage to be received by a person or a carriage service other than the person or service to whom it is directed.
- Manipulating or tampering with any facility belonging to or operated by a carrier so as to hinder the normal operation of a carriage service.
- Connecting equipment to or using equipment connected to a telecommunications network in the commission of an offence if the equipment is unlabelled in breach of a labelling instrument or is not authorised by a connection permit or the connection rules, or, if labelled, is labelled as not complying with the applicable standards.
- Without authorisation, accessing, modifying or impairing data held in a computer or an electronic communication from or to a computer by means of a telecommunications service with the intent to commit a serious offence (a serious offence is one punishable by imprisonment for life or a period of 5 years or more).*
- Without authorisation, modifying data held in a computer so as to cause impairment to the data.*
- Without authorisation, impairing an electronic communication to or from a computer.*
- Without authorisation, accessing or modifying restricted data (data held in a computer access to which is restricted by an access control system associated with a function of the computer).*
- Possessing or controlling data with the intention of using it or its being used to commit an offence.*
- Producing, supplying or obtaining data with the intention of using it or its being used to commit an offence.*

* These sections do not commence until the Cybercrime Act commences operation, at the latest on 1 April 2002.

Confusion for ISPs

The laws outlined above provide a confusing matrix in which ISPs are required to operate. They certainly do not assist ISPs in meeting their basic needs.

The problem of creating a secure environment for online communications and commerce is a major difficulty. ISPs do not have any clear or definite charter to engage in the types of monitoring and reporting activities or self-help actions that would enable ISPs to manage many of the security issues themselves. Worse still, engaging in such activities could result in breaches of privacy obligations or offences under laws designed to protect privacy and limit interference with telecommunications and computers.

Access to the content of an internet communication in transit is an interception generally authorised only by warrant. Although the exceptions for ISPs include interceptions for maintenance purposes and for the purpose of identifying a person who has contravened or is suspected of having contravened certain provisions of the Crimes Act (see above), these provisions would not permit the ISP to undertake general or random monitoring activities for the purpose of identifying possible contraventions of the Crimes Act or breaches of security. The provisions do not provide carriers with positive rights of surveillance.

Accessing a communication once it has left the network (eg, and is stored on a computer) may not be an interception, but it could be an offence under the provisions of the new legislation which prevents unauthorised access to data stored in a computer.

Disclosure of information by a ISP could also be an offence under the provisions of the Telecoms Act designed to protect the privacy of communications. Disclosure in the absence of a certificate from a law enforcement agency would require the ISP to satisfy itself that the disclosure of the information was reasonably necessary for the enforcement of the criminal law, protection of the public revenue or of a law imposing a pecuniary penalty. Not too many ISPs would feel qualified to judge whether disclosure was necessary for such purposes nor would wish to take the risk. Penalties in relation to unauthorised access and disclosure are severe, and can include imprisonment.

Further legislative changes following the terrorist attacks of 11 September

In the wake of the events of 11 September 2001 and the flow of asylum seekers to Australia culminating in the Tampa Crisis, popular support for border protection and enhanced intelligence and enforcement powers in the interests of national security have lent legitimacy to new legislation (outlined below) which further erodes the protection of privacy and civil liberties.

Legislation Overview

Measures to Combat Serious and Organised Crime Act 2001 (assent date 1 October 2001) Immunities from criminal and civil liability for the purposes of law enforcement.

The Crimes Act has been amended so that law enforcement officers and persons authorised by a law enforcement officer are exempt from criminal liability for offences committed in the process of an operation for the purposes of obtaining evidence that may lead to the prosecution of a person for a serious Commonwealth offence. Law enforcement officers and authorised persons are also indemnified from civil liability. Serious Commonwealth offences include offences involving theft, illegal drugs, fraud, sex offences and threats to national security which are punishable on conviction by imprisonment for 3 years or more.

Controls apply, including that a law enforcement officer can only gain immunity for liability for committing an offence pursuant to an operation which has been authorised by a certificate issued by an authorised officer of the Australian Federal Police and National Crime Authority - an "authorised controlled operation".

Officers authorised under Part IAC of the Crimes Act to acquire evidence of, or use an assumed identity, are also immune from criminal and civil liability for offences which may be committed in the course of authorised activities. Offences have also been created deter the improper disclosure and misuse of assumed identities. The applicable penalties range from 12 months to 10 years imprisonment.

Intelligence Services Act 2001 (assent date 1 October 2001) Functions and powers of intelligence agencies.

The Act defines the functions and services of ASIS (Australian Secret Intelligence Service) and DSD (Defence Signals Directorate), both agencies having an external focus in advancing Australia's national security as well as foreign relations and national interest.
The functions of ASIS include:

- to obtain, in accordance with the Government's requirements, intelligence about the capabilities, intentions or activities of people or organisations outside Australia; and
- to communicate, in accordance with the Government's requirements, such intelligence.
  The functions of DSD include:
- to obtain intelligence about the capabilities, intentions or activities of people or organisations outside Australia in the form of electromagnetic energy, whether guided or unguided or both, or in the form of electrical, magnetic or acoustic energy, for the purposes of meeting the requirements of the Government, and in particular the requirements of the Defence Force, for such intelligence; and
- to communicate, in accordance with the Government's requirements, such intelligence; and
- to provide material, advice and other assistance to Commonwealth and State authorities on matters relating to the security and integrity of information that is processed, stored or communicated by electronic or similar means; and
- to provide assistance to Commonwealth or State authorities in relation to cryptography and communications technologies.

Controls apply in respect of intelligence activities. These include an extensive Ministerial authorisation regime associated with the proper conduct of the agencies' functions. Strict guidelines will apply where an agency's activities are specifically directed at collecting intelligence concerning an Australian overseas or if an agency's activities affect an Australian overseas.

Immunities from criminal and civil liability for the purposes of intelligence gathering.

The Act provides immunities from civil and criminal proceedings to the agencies, in respect of unintended consequences of Australian legislation, to enable the proper conduct of their functions both in and outside Australia. Immunities are not intended to extend beyond those necessary to enable the agencies to carry out their functions.

To ensure consistency with the rights of Australians to privacy, there is a statutory obligation on the agencies to respect these rights. The responsible Ministers for ASIS and DSD are required to make written rules to ensure that the activities of the agencies are carried out with due regard to those rights. The Attorney General must be consulted in the development of these rules.

Migration Legislation Amendment Act (No. 5) 2001 (assent date 27 September 2001) The Migration Act 1958 has been amended to authorise an airline operator, a shipping operator, a travel agent or a prescribed organisation, for the purposes of facilitating the administration and enforcement of the Migration Act or Regulations, to disclose to an officer information about any matter relating to travel by persons to or from the migration zone, even if the information is personal information (as defined in the Privacy Act).

Of particular concern are the immunities granted to law enforcement officers from criminal liability and indemnity from civil liability for breaches committed by them in the course of authorised activities. These provisions provide a significant escape from obligations of privacy in the course of investigations and enforcement of the criminal law.

Despite the Intelligence Services Act 2001 providing that immunities from criminal and civil liability granted to the officers of the agencies involved are not intended to permit any act in relation to premises, persons, computers, things, or telecommunications services in Australia that would otherwise only be authorised under warrant or in accordance with section 283 of the Telecoms Act, it is not at all clear what this means or the extent to which it limits the activities of the agencies.

Both the Measures to Combat Serious and Organised Crime Act 2001 and the Intelligence Services Act 2001 have the potential to detract significantly from the privacy-related protections contained in the Privacy Act and the Telecoms Act. Only minimal provision is made for the correction of invasions of privacy which ultimately are not justified, for example, for the destruction of records of personal information etc.

The US reaction

Legislative reaction in the United States to the 11 September attacks has been far more severe in its potential for invasions of privacy.

The United States Patriot Act 2001 contains significant expansions of the powers of government and law enforcement agencies to tap and monitor electronic communications and to compel access to customer and employee records without the knowledge of the persons concerned. Under the expanded powers, electronic communications relating not only to suspected terrorism but to suspected computer fraud can be intercepted, without a showing of probable cause. In addition, the government can compel the production of records from any business regarding any person including customers or employees, so long as it claims - to a secret court - that the information is sought for clandestine intelligence gathering or investigation of international terrorism.

New laws relevant to cable operators permit the operators to disclose personal details about a subscriber (other than records relating to a subscriber's selection of video content) to a law enforcement agency without the subscriber's consent or, as was previously required, without providing notice to the subscriber or showing that the information sought would be material evidence in suspected criminal activity.

Conclusion

Clearly the balance between the competing interests of privacy, security and prevention of crime needs to be addressed both at the international level and in terms of domestic law to a greater degree than has occurred to date. It is suggested that in addressing this balance, the events of 11 September should be taken into account - in a rational and considered way.

Separate forums which deal with issues of privacy, issues of security and issues of crime and at which the interests of the internet service providers are not represented will not come up with workable answers.

Basic principles have to be re-examined and their limits the context of the internet and electronic communications stated clearly.

In late 1994, the OECD organised a meeting of ad hoc experts on information infrastructures. The meeting brought together a multidisciplinary group of delegates from government, business and academia with expertise in information and communications technologies and the policy areas of security, protection of personal data and privacy, cryptography and protection of intellectual property. In the report of the meeting (Report of the Ad Hoc Meeting of Experts on Information Infrastructures, Issues related to security of Information Systems and Protection of Personal Data and Privacy, OECD, Paris 1996), the following conclusion was reported:

Discussions of privacy during this session placed it in a multifaceted context. It is easy to gain a false impression of the achievements and progress in a particular field when the only people present are those with some commitment to furthering it. Where parties represent a broad range of interests, as in this meeting, perhaps a more accurate idea is available of the tensions and of the obstacles and challenges that lie ahead.

This session did not only assess a new technological environment that may be privacy invasive. It also considered a whole new way of life and the means by which to ensure the presentation of fundamental human rights. It raises the broader issue: What sort of society do we want?

The immediate solution is a multidisciplinary approach to the regulation of electronic communications, so that the competing concerns - privacy, security and prevention of crime - can all be addressed in a comprehensive and consistent manner.

What the ultimate solution is depends on the answer to the question - what sort of society do we want.

Abstract

In Australia, as elsewhere, internet service providers are faced with a confusing array of laws that affect their operations. On the one hand, they are required to protect the personal details of their customers and are prohibited from intercepting communications that pass through their systems. On the other hand, they are required to provide interception capability, take steps to restrict access to offensive content and take steps to prevent use of their services by online gambling operators. In addition, in order to encourage use of online services, they must provide a secure environment which protects against online theft and fraud.

All this in an environment where acts of cyber-terrorism and online hate are on the increase.

Consistency in terms of the laws which affect the operation of the internet, although expressed as a concern in various policy documents, has never been a major agenda in the formulation of legislation. Achieving a three-way balance between the protection of privacy, the creation of a secure and socially acceptable online environment and the requirements of criminal law and national security remains a major headache. The importance of getting the balance right has been made more urgent by the events of 11 September. Legislation enacted in reaction to those events has only added to the confusion.

What is the correct balance between the rights of individuals to privacy and protection of users of the internet and online services from online terrorism and crime? How can this correct balance be determined? Perhaps these questions can be addressed (even if not answered) by focussing on what type of society such laws are trying to shape or protect.

back to index

Jane Forster

Jane advises a number of clients in the telecommunications and broadcasting industries. Most recently Jane has acted for Cable & Wireless plc in relation to the sale of the Cable & Wireless Optus businesses and for Virgin in relation to the establishment of Virgin Mobile in Australia. Jane has also acted for a variety of clients in litigation involving infringements of intellectual property, passing off and trade practices breaches and has documented large assignments of intellectual property, including in relation to Internet sites. Jane is the author of or has contributed to a number of significant and major publications in the communications area, including Halsbury's Laws of Australia (Title on Telecommunications), Butterworth's loose leaf service, "Communications Law and Policy in Australia", Prospect Publishing's "Telecommunications Regulation around the Pacific Rim" (edited by Jane) and the looseleaf service on international telecommunications regulation published by the Center for International Legal Studies.

As well as being a director of the Communications Law Centre (an influential research organisation affiliated with the University of New South Wales and the Victoria University of Technology), Jane is a committee member of the Communications and Media Law Association and a member of the Law Society of Australia Media and Communications Committee. Jane was also involved - as the Board's representative on the Steering Committee and the representative of a major sponsor - in the establishment of www.oznetlaw.net by the Communications Law Centre.

www.claytonutz.com

back to index

$ Economics & Financing

Wednesday, 16 January 2002
1400–1530
Tapa I

W.2.6 Bridging the Digital Divide

Chair:
MEHEROO JUSSAWALLA, Senior Fellow/Emerita, East-West Center, *USA*

W.2.6.1 Bridging the Digital Divide: Alternative Solution for the Impact of High Cost of Computer and Internet Access in Indonesia (View Abstract)

RAKHMAN IMANSYAH, Junior Engineer, Rural Communication Lab and SAMUDRA PRASETIO, PT Telekomunikasi Indonesia, *Indonesia*

W.2.6.2 Lessons of Investment in Technology Parks and Their Role in Bridging the Digital Divide (View Abstract)

MEHEROO JUSSAWALLA, Senior Fellow/ Emerita and SUNYEEN PAI, Project Assistant, East-West Center and RICHARD TAYLOR, Palmer Chair and Professor of Telecommunications Studies & Professor of Information Science and Technology & Co-Director, Institute for Information Policy, The Pennsylvania State University College of Communications, *USA*

Presenter:
SUNYEEN PAI, Project Assistant, East-West Center, *USA*

W.2.6.3 Overcoming Telecommunications and IP Challenges in Developing Countries (View Abstract)

RICHARD ELLIOT, Vice President, Global Trading Development & Co-Founder, Band-X, *USA*

W.2.6.4 Telecommunications Industry Rationalization: The Driving Forces for Change in the Asia Pacific (View Abstract)

PETER FALSHAW, Director, Consultancy, Ovum Pty Ltd., *Australia*

back to sessions

Meheroo Jussawalla

Dr. Meheroo Jussawalla is currently an Emerita Senior Fellow/Economist at the East West Center, Honolulu and Affiliate Faculty in the Departments of Economics and the School of Communications at the University of Hawaii. She is a leading scholar in the Economics of Telecommunications. She is extensively published and has 13 books to her credit. She contributes regularly to refereed journals such as Information Economics and Policy, Intermedia, Telecommunications Policy, Prometheus, the Asian Wall Street Journal and the Pacific Telecommunications Review. She has been a Visiting Scholar at the Institute of Social and Economic Research, University of Osaka in Japan and Randolph Macon College, Lynchburg, Virginia. She is on the International Advisory Board of the Information Economics and Policy Journal, the Board of Trustees of the Pacific Telecommunications Council, and on the US Chapter of the International Institute of Communications based in London. In 1995 she received an award from the Pacific Telecommunications Council for her contribution to Pacific Telecommunications Research. She was the founder president of the Research Committee of the Pacific Telecommunications Council. In 1998, a Fest Schrift was published in her honor edited by Professor Lamberton of the Australian National University entitled Communications and Trade: Essays in Honor of Meheroo Jussawalla (Hampton Press New York). She also won an award from Blue Cross Blue Shield of Hawaii in 1999 as an Ageless Hero of Hawaii in the category of Love of Learning. Since 2000 she has organized two international conferences on Asia's Involvement in E Commerce. She is currently researching the impact of IT Parks in Asia in collaboration with Dr. Richard Taylor, Palmer Professor of Telecommunications at Penn State University.

Sunyeen Pai

Sunyeen Pai is a research project assistant at the East West Center in Honolulu, Hawaii and is working on the research and communications aspects of the Information Technology Park study. She co-developed the project's web-site and worked on finalizing the study's survey instrument. She has taught systems analysis and design at the Department of Information Technology Management of the University of Hawaii.

She recently completed her Ph.D. in Communications and Information Sciences at the University of Hawaii, working under the guidance of Professor William Chismar. Her doctoral research used systems dynamics to examine the incentives and disincentives facing small business adoption of business-to-business electronic commerce, comparing and contrasting the adoption of traditional value added network-based services with Internet services.

She is continuing her studies in Library and Information Sciences and is also working on a library-sponsored digital imaging project. She is a member of the Hawaii Telecommunications Association, American Library Association, and Association for Computing Machinery.

http://www2.eastwestcenter.org/research/itparks

Bridging the Digital Divide: Alternative Solution for the Impact of High Cost of Computer & Internet Access in Indonesia

Rakhman Imansyah & Samudra Prasetio
RisTI Division of PT. Telekomunikasi Indonesia
Indonesia

View Abstract

1. Introduction

The Internet is becoming an increasingly vital tool in Indonesian information society. More and more "Indonesian" are going to conduct such day-to-day activities as education, business transactions, personal correspondence, researches and information gathering and job searches. Each year, being digitally connected becomes ever more critical to economic and educational advancement and community participation. Now that a "piece" number of Indonesian regularly use the Internet to conduct daily activities, people who lack access tools are at a growing disadvantage.

Yet even as the Internet races ambitiously toward critical mass, some social scientist and experts are beginning to examine carefully the policy implications of current demographic and geographic pattern of Internet access and usage in Indonesia. In the meantime the Indonesian Government may likely declare universal access for approximately 190 million people with country performance is becoming even more marginal - ironic!

2. Making the Solution

Before the rest country planned into digitized society, there are some points that should be kept in mind. The point that can be underlined is Indonesia becoming a poor country and the things related to information technology should be compensated for some money while they need for daily feed.

Simplified the case, the difficulties in conducting the Internet as reliable digital divide should be separated into 2 class as follows:

- Surely the information revolution has only just begun on a worldwide scale, and its networks are spreading wider every day, but no doubt that they are heavily concentrated in a very few countries. In Indonesia in 1996, there was less than 5 telephones for every 100 people.

  The dilemma of wide rural telecommunications like Indonesia is the promise offered by new, more capable, more efficient and evolving technologies, apparently precluded by the lack of possible resource assistance. In this case the provision of telecommunication facilities in rural, remote and un-served areas requires big investment and generally less profitable in terms of business. Consequently the development of new service and technology tends to be oriented to urban areas. Based on the said factors, an alternative telecommunication system, which accessible to rural, remote and un-served consumers is needed.

- Yet even if telecommunication systems are installed and accessible, without literacy and basic computer skills people will have little access to the Internet society. In 1990s junior/senior high school enrolments less than 60%-70%. Those data indicated that the expanding accesses beyond today's Internet users are heavily constrained. Even for the newest and most advanced technologies the most basic and long standing policy lies at the heart of the solution: INVESTMENT ON INTERNET (NETWORK & COMPUTER).

Based on these approaches term digital divide should be grouped into 2 types, SERVICE group and APPLICATION group. The service group, we have initialized DESA MAJU and for APPLICATION group we introduce VIPO.

3. DESA MAJU

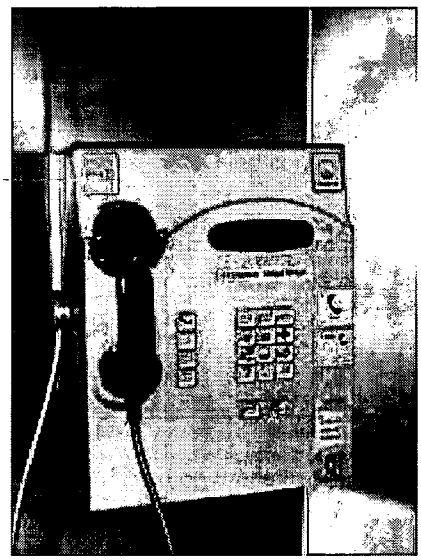

FIGURE 1. THE DESA MAJU'S TERMINAL

The Indonesian innovation "Voice Internet", called the Rural Voice-rich Information Community (RVIC) or DESA MAJU, could eventually bring the information age to developing country's often poor and scattered rural population. The innovation has combined existing technologies to create an interactive device that offers Internet features - including information retrieved, Web sites and homepages - through what is essentially a network of Voice Processing Server. The RIVC interfaces with the Internet through a software application developed to transform text into digital speech

Desa Maju is a system that provide such information based on voice and the content of information are all the things related to activity of economic, education, health etc of rural community. Next, the system converts text from the Internet into digital speech, this is transmitted to users through a device similar to a normal payphone. Instead of numbers, the keys have symbols that, when punched, provided data on everything from health problems to plant-cultivation tips to commodity prices. Users also can pose questions, which subsequently are answered by a team of local officials.

3.1. The Background Art

Market segment for telecommunication services recently still dominant in urban area. Hence, only the urban population can use the improvement in telecommunication field. In case there are no alternatives in order to conduct telecommunication facilities in rural will raise telecommunication-unbalanced distribution between urban and rural area.

The service has main object, which to optimize telecommunication facilities in order to develop an area and community of rural can have the use of information technology in a simple way.

3.2. Market Segmentation

Desa Maju service has three different kind of market segments or customers as follows:

- Type 1: community who has capability to be Telco's subscriber
- Type 2: community who does not have capability to be Telco's subscriber but needs information
- Type 3: community who does not have capability to be Telco's subscriber and understand obtaining information

3.3. Network Aspect

PSTN is main network used for delivery stream of information in this service. The access network for PSTN is limited into copper wire only, but some of them are radio even satellite (VSAT - Very Small Aperture Terminal).

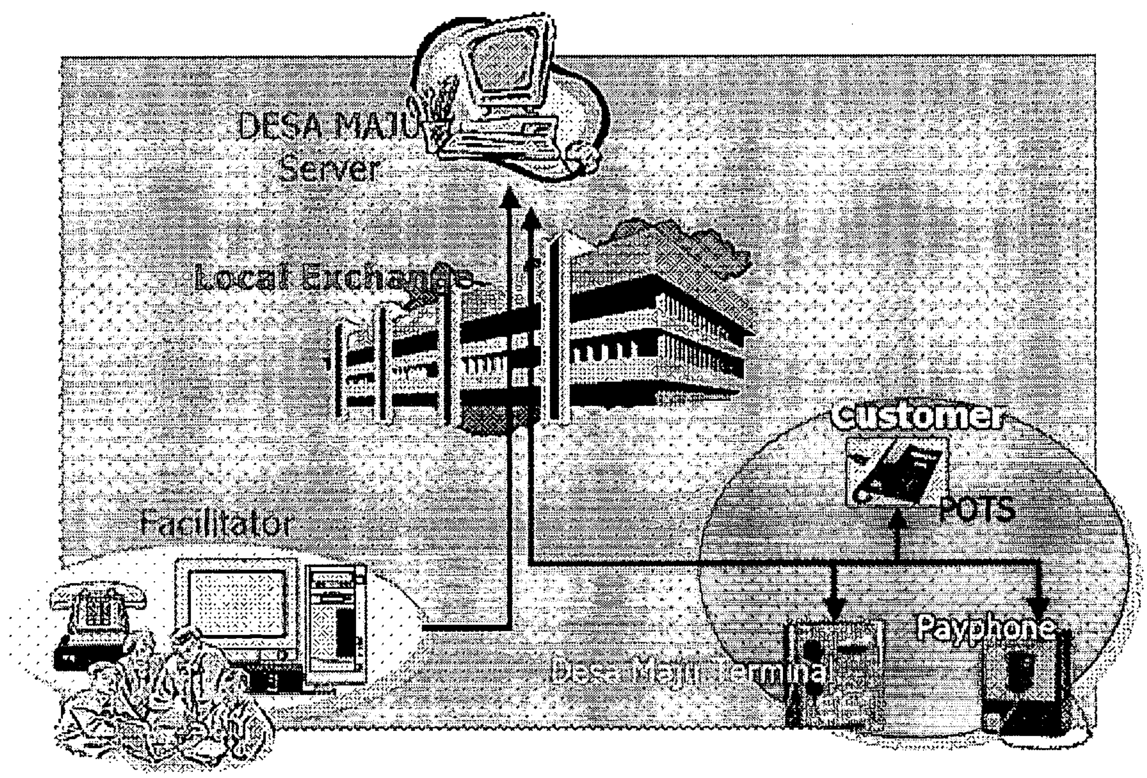

FIGURE 2. DESA MAJU ARCHITECTURE

The information stored in Server can be expanded whereas each server connected one to another as if hyperlink capability in the Internet Network.

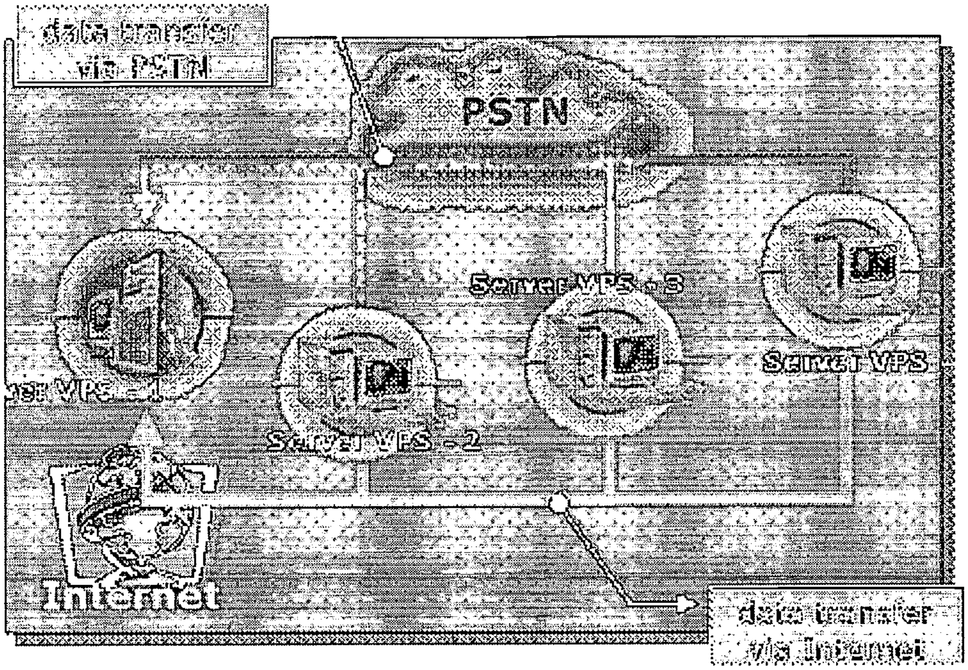

FIGURE 3. VOICE INTERNET AS EVOLUTION OF DESA MAJU

3.4. Service Application Aspect

Languages used in Desa Maju services consist of two different languages: Indonesia language and local language. Customer can select optional button in order to hear information in language desired. The service can be categorized as interactive service since customer has a chance to submit question that stored in Server and later will have notification from Facilitator that customer can retrieve answer from his question.

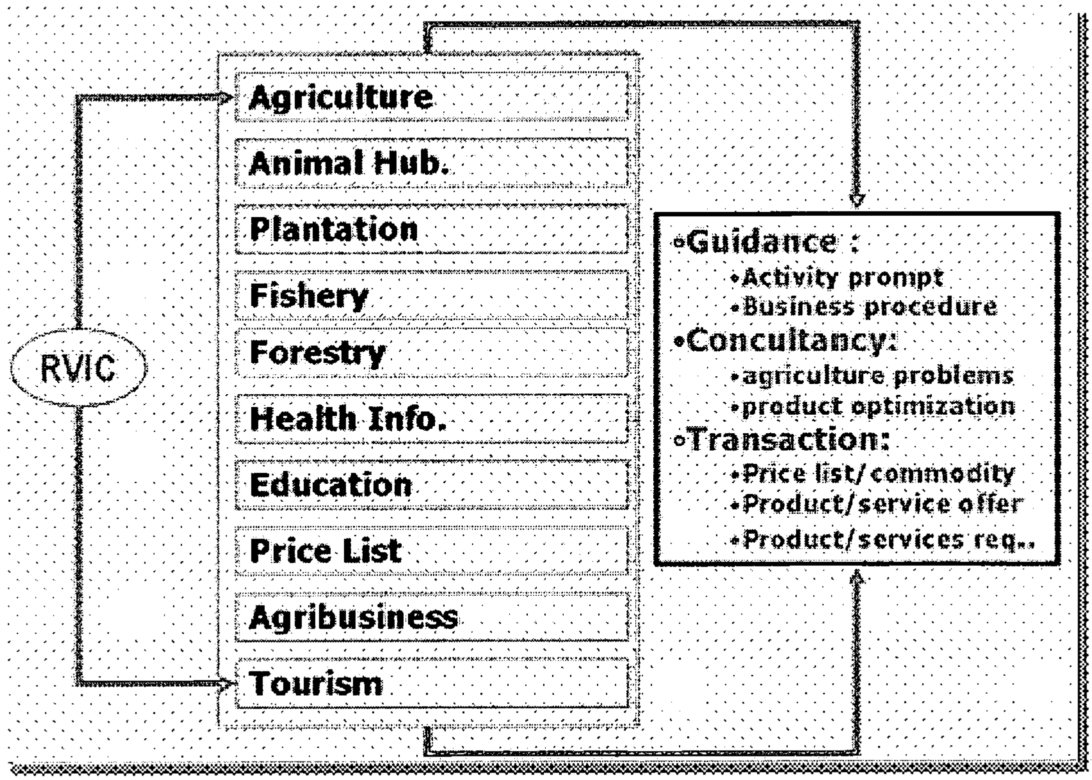

FIGURE 4. INFORMATION MENU

The information stored in Server is information related to economic activities so the information can stimulate rural community to increase economic growth such as agriculture, home industries, animal husbandry, plantation, health info etc. The information is not limited just guidance, but some of them are transaction, consultation and daily information about good prices.

Information and consultation are expected to stimulate economic activity in rural area efficiently. The readiness of information about product guidance and market is expected will make product higher, besides it will raise a chance to rural community trade their outcome optimally that encompass brokers, finally they can have good in low price.

Such information stored in Server will be a complement in real activity that is main task of technical departments (such as: department of agriculture, department of plantation etc).

4. VIPO

In the implementation of VIPO system, the low investment cost is achieved by optimizing the existing telecommunication equipment with addition of some other equipment. VIPO basically a unique system that powered by voice server (also knows as IVR - Interactive Voice Response) that has been widely operated for mailbox services. Then, The IVR is combined with base station (transmission equipment which was constructed gratis) in order to deliver message stored in IVR mailbox into specific terminal.

Among the unique characteristic of VIPO services are:

- VIPO uses signal-placing technique (e.g. SCA - Subsidiary Communication Authorization), where the additional signal from IVR is added to the base band signal of the existing radio broadcasting (private/government-owned). Those notion and idea would bring much-much benefit on both parties (operator and radio broadcasting company). Operator could downgrade the cost of building tower and other transmission equipment. It also would increase the income by optimizing the existing telecommunication network (especially in rural area which is recognized for its low traffic) this is because the caller who will send a message has to use the PSTN networks prior to being connected to the system. For radio broadcasting company, it is clear that the terms and conditions of interconnection dictate the nature of competition and play a central role in the evaluation of radio broadcasting market, because the radio listener has additional feature to collect specific information delivered to him from telephone lines.
- VIPO using specific terminal that is combination of ordinary FM/AM receiver radio set and equipped with DTMF detector and also recording message.
- The price of a VIPO terminal is equal to the price of a pocket radio (FM/AM pocket version), which enables the middle class and below to afford it.

Shortly, VIPO could be explained as a technology breakthrough that provides affordable and accessible communication infrastructure for the rural, remote and un-served consumers. Because they will be able to enjoy cheap communication as it has been predicted that the price of the terminal is relatively cheap. The next logical step for VIPO is a tremendous opportunity to become a competitor in the widespread revolutionary text-based paging business in the Asia Pacific Region, and becoming voice-based paging business.

4.1. VIPO Principles

The operation procedure of the above mentioned equipment configuration is as follows:

- The incoming call will be sent to a recording device (IVR server)
- The IVR server receives commands to record the message for a customer with certain ID
- Next, IVR server will send the notification (contain ID terminal + message) through FM/AM radio wave to the terminal to notify that there is a message for the user
- VIPO terminals have the capability to distinguish the information directed to it through ID code set in each terminal, Thus only the terminal with corresponding ID can access its message
- Another function of the terminal is that it can be used to receive FM/AM broadcast

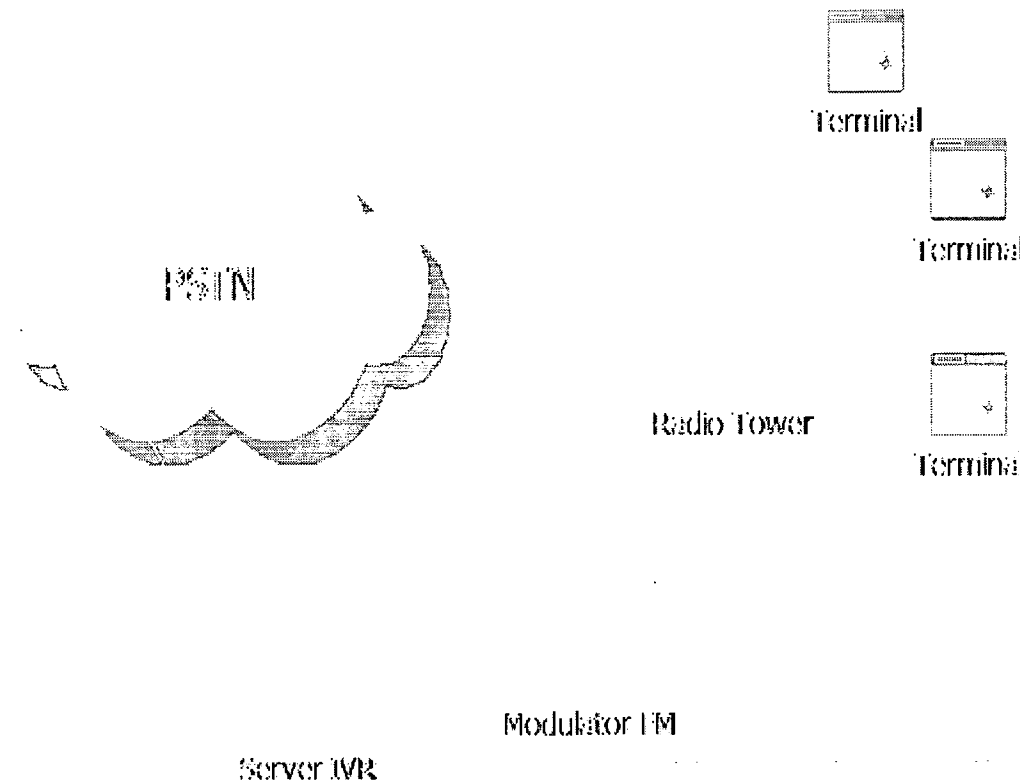

FIGURE 5. VIPO CONFIGURATION

IVR server

Infrastructure put in the recording device basically is an IVR server that operates voice-processing application. A lot of software programming and system designed are needed to make real VIPO system from the IVR technology. The software programs are required to make a recording message or information downloading from caller. Start from this device too, then the message was sent to transmission equipment's path through PSTN channel or direct connection.

Transmission equipment

The largest challenge for a developing country like Indonesia to provide information infrastructure which literally means telecommunication is mostly high cost investment - plus low population density which scattered individually/small group and economics activity tends to grow slowly - that makes the business is not a profit program. So in keeping the implementation of telecommunication infrastructure needs a special approach, and the decision of such problem above is using radio as access media. Serve as a basis for employ radio as access media is diminish time and effort needed to offer the service for potential user, besides radio access can reach area which is hard to reach (comparing to cable).

Furthermore, in Indonesia there are a lot of radio broadcasting company which has their owned transmission equipment and program, and practically their power can reach almost all corners of Indonesia. From the cost point of view they could be used to good advantage, hence VIPO uses signal placing technique (e.g. SCA - Subsidiary Communication Authorization), where the additional signal from IVR is added to the base band signal of the existing radio broadcasting (private/government-owned).

At this time, the infrastructure included in this device consists of 3 main component, they are FM/AM modulator, signal randomizer and transmitter amplifier (plus antenna). So those notion and plan could reduce the investment cost, which is the unique characteristic of this service.

Customer terminal

Talking about scope of culture for Indonesian people in joining the global information society makes the television and radio sets are not luxury appliance anymore that means it is not hard to have it. Even they live in rural, remote or un-served area, they got the effort to buy the things. And some of them even install parabolic antenna in order to watch television program. Inevitably radio has two factors that support gathering more marketplaces within wider coverage area rather than television and lower cost for equipment or infrastructures.

Certainly this is an ironic compare to their concerned to have telephone facility. Survey, which was conducted several times before, indicates that they will withdraw their plan for having telephone facility if they have to pay out additional money for installation/subscription fee (12.5 - 25 US$) and annual fee (1.25 - 2.5 US$, very cheap yea!). Besides economic issue that constrain the desire of rural community in having telephone facility, there is an interesting reality that should be underlined as they just use telephone as phone receiver set which means they could be easily connected by their relatives (usually they live at city/urban area). And when they want to phone their relative, they are going to use public payphones or access from locally metered devices from many attended telephone kiosks (in Indonesia it is called as 'wartel').

By this time, there are two key factors which could be combined would rise a technology breakthrough that provides affordable and accessible telecommunication for the customer. By the reason, the VIPO's terminal is identified as a radio receiver set device with additional feature to receive message from PSTN subscriber. In this matter, in short the VIPO's terminal has capability of dual mode.

In general VIPO user's terminal include three main components, they are:

- FM demodulator + Antenna, functioning as signal receiver sent by base station
- DTMF decoder, with this device the terminal is able to process and compare the ID code sent by base station with terminal ID. If the ID matches then status of the terminal becomes active and start to ring the alarm
- Message recorder, this feature has been added to anticipate the situation where the user is not ready to read the incoming message (such as in a meeting and the terminal should be switched off)

In a technology breakthrough like VIPO there is an underlining technology that is although the VIPO is targeted for rural, remote and undeserved community but the technology is also suitable for urban community. Therefore, like every other business product/service in economic perspective, the system could just grow if there is an acceptable business model that capture customer from different market by using product segmentation. The result is classified the VIPO terminal into 3 version as follow:

Mod. Technique	Mode	Note
AM	Single	Unable to receive FM/AM radio broadcasting
FM	Dual	Able to save the messages
FM	Dual Exclusive	Able to receive FM/AM radio broadcasting Able to save the messages

TABLE 1. VIPO TERMINAL SCENARIO

5. Conclusion

- Indonesia still may have some difficult constrain for introducing the Internet as reliable Digital Divide with the lack of telecommunication infrastructure and high portion of illiterate people.
- The presence of Desa Maju service can be recognized as an effort to train rural community, therefore they can have telecommunication skill and basic acknowledgement about information technology.
- VIPO is an innovative telecommunication access infrastructure that introduces a technology breakthrough that offers cheap and user friendly technological means, which is affordable for rural consumers. From the economic of view, the existence of VIPO product will have a tremendous opportunity to become a competitor in the widespread text-based paging business in Asia Pacific Region, that is due to its key factor, that is to offer affordable communication access for rural consumers, who densely dominate the Asia Pacific.

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back to index

Abstract

With this report, we move into a new concept of our digital divide version that can be separated into service group and access group. The service groups still can be recognize as DESA MAJU - which the society should not be isolated into information haves and information have-nots by using interactive voice response system - and the access group we introduce VIPO as an alternative for cheaper rural telecommunication access infrastructure.

back to index

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back to index

Lessons of Investment in Technology Parks And Their Role in Bridging the Digital Divide

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View Abstract

I. INTRODUCTION

What investments are Asia Pacific countries making in information technology parks as part of a national development strategy, and what lessons does this hold for reducing the Global Digital Divide? This paper explores and compares developments in five economies: China, India, Malaysia, Singapore and Chinese Taipei and looks at implications for Hawaii.

The GDD refers to the inequality, throughout the world, in access to information and communication technology and services. The Regional Digital Divide (RDD) refers to inequalities among nations within a region, for example between fast digitization in Singapore and slow access to information in Viet Nam. There is also disparity within nations. In developed countries the divide is marked by the minorities' lack of access to sophisticated telecommunications resources (Leahy and O'Brien *Intermedia, September 2000 Vol28/5*). In less developed countries differences in access often exist between urban and rural areas (Taylor and Jussawalla, 2001).

Addressing inequalities in access to information and communications technology (ICT) in an economy requires substantial investments in infrastructure and human resources. The cost of an economy's not making this investment could be the marginalization of that society in the global economy. The benefit of adopting ICT is that it supports a wide range of human activities and it offers a means of breaking barriers to knowledge, civic participation, and social and economic opportunity (UNDP Human Development Report, 2001).

Developing nations wish to increase economic and political viability through economic development

(Khondker, 1999). They are searching for strategies that will promote foreign direct investment (FDI), technology transfer, research and development (R & D), human resource development and employment, entry into the ICT export market, and overall economic growth. Investment in ICT offers the potential for developing countries to expand exports, create good jobs and diversify their economies. The ICT sector requires less initial investment in capital and infrastructure than do more traditional sectors, which may be why high-tech industries are growing faster than medium-tech industries in developing countries (UNDP Human Development Report, 2001).

However, as the Final Report of the Digital Opportunity Initiative points out, there is debate on the effectiveness of using ICT to help achieve development goals. Although ICT has the potential of assisting development efforts, its effectiveness depends on appropriate deployment. An explicit focus on using appropriate ICT for development goals may allow countries to achieve a wide diffusion of benefits and contribute to both broad-based economic growth and specific development goals. The success of national ICT strategies requires the coordination of all actors involved, from local to national to global levels (Digital Opportunity Initiative, 2001).

The Final Report states that nations can use ICT in two basic ways: ICT as a production sector and ICT as a socio-economic development enabler. If they invest in ICT as a production sector, the two most common approaches are to have an export market focus or to have a national capacity/domestic market focus. If they were to develop ICT as an enabler, the two approaches are a global positioning focus or a development goals focus. Technology parks can fall under both the export market focus and the global positioning focus, with parallel strengths and weaknesses.

An export market focused Technology Park strategy can produce economic growth, improve balance of payments and reduce dependence on traditional commodity exports. However it may have only a limited impact on the development of national infrastructure and capacity, and does not automatically translate into broader development gains. The global positioning focus is essential to the long-term economic success of developing countries in the global network economy, but may fail to meet specific development goals (Digital Opportunity Initiative, 2001).

Regardless of these issues, investment in the IT sector has proved a critical element in economic security for these countries. This strategy has been key in reviving the East Asian economies during the Asian financial crisis. Additionally, the development of domestic, in addition to foreign, demand for IT products and services will diversify their markets and provide further stability and growth (Jussawalla, 1999).

Information-based technology parks serve as a vehicle for leapfrogging an economy's technological capacities into the 21st century and bringing it up to par with those of more developed nations. Such a plan has a potentially major impact on both regional and global digital divides.

II. FIVE COUNTRIES / FIVE MODELS

A. CHINA

Once Mao liberated China from imperialism and foreign domination, Deng Xiaoping opened China's market economy to pave the way for prosperity. In the ICT arena, the telephone sector has grown at a rate of 41.6% annually since 1993. The government plans to increase teledensity to 8.5% in the first decade of the new millennium. However, this striking growth is confined to the cities and metropolitan areas along the eastern coast. During the Deng Xiaoping era, the state gave priority to telecommunications investments in the coastal regions and allowed industry to focus on major metropolitan areas. This increased the divide between the poorer and richer regions. China has wrought very little change in rural life, where 80% of its population resides, and this economic gap between the coastal areas and the hinterland is widening. The China Internet Network Information Center reports that only 2% of China's population has computers and Internet penetration remains at less than 1%. (Jussawalla, 2001b).

The drive in technology development continues and is evident in President Jiang Zemin's leadership. During the November 1996 Asia-Pacific Economic Cooperation (APEC) 4th Leader's Informal Conference, Jiang Zemin pointed out, "The most important pioneering work in our century on the industrialization of scientific and technologic achievements is to initiate and develop science and technology industry park. This kind of combination between industry development and science and technology activities, have solved the difficult problem of the separation of science and technology from economy, and made the discovery or invention of mankind transfer smoothly to the industry fields, to realize their economic and social benefit."

The Ministry of Science and Technology initiated and implemented the China Torch Program (CTP). The CTP is aimed at realizing the commercialization, industrialization and internationalization of scientific and technological achievements in China. It embodies China's strategy of "Nation Building through Technology and Education".

A key focus of the CTP is the development of high technology industry development zones. CTP began by building on an existing foundation of industry parks and continued to develop new parks. By 1997 the total number of the new high technology industry development zones at the state level reached 53, which spread over 29 provinces, autonomous regions and municipalities directly under the Central Government.

By the year 2005, the accumulative annual income of China's new high technology industry development zone from technology, industry, and trade is expected to be 1,750 billion yuan. The export earning in foreign exchange is projected to be 35 billion yuan. There may be 50 zones with annual total income over 10 billion yuan and 5 zones with annual income over 100 billion yuan. (//http://www.chinatorch.gov.cn/E-torch/index.htm, 2001)

B. INDIA

The development of India's information technology industries has been highly dependent on changing policy attitudes toward the balance between economic self-sufficiency and participation in the global economy. In 1991 India initiated a new fiscal policy encouraging foreign investment by liberalizing trade, devaluing the rupee, and easing foreign exchange transactions. The 1991 reforms and subsequent policies boosted economic growth. The World Bank reports that the economy grew at 7.5% a year in the mid-nineties. Unfortunately, this growth has had little impact on the overall poverty level, which dropped only one point from 35% to 34%. Higher numbers are reported in the rural areas, where most of the population resides. The economy is still heavily dependent on agriculture and industry, which comprise more than half of GDP output.

Much of the recent entrepreneurial energy in India has been directed toward the ICT sector. The growth of the ICT sector is due in large part to the large pool of highly educated, low-cost, English-speaking technology professionals. Indian universities are producing 125,000 engineers a year (Business Week, February 2001) and they are the foundation of software and hardware production in India.

There have been major developments in the areas of basic telecommunications, software engineering, business-support services, television, and space, resulting in an economic growth rate factor of 6% in the information technology sector, among the fastest rates in the world. India's investment in the development of technology parks has played a critical role in many of these areas. The Indian software industry grew from US$150 million in 1990-1992 to US$5.7 billion (including over US$4 billion worth of software exports in 1999-2000, an annual growth rate of over 50 percent. Teledensity has reached 3.5 percent of the population. The number of Internet accounts is around 1.5 million, growing at 50 percent per annum. The government hopes that the spread of IT will unify a nation divided by cultural, religious, and economic differences.

There are software technology parks and electronics hardware parks, each administered under policy "schemes". The Software Technology Park (STPI) Scheme (under The Ministry of Information Technology, Government of India) is a 100% export-oriented scheme for developing software for export via data communication links. There is also the export of consultancy services.

The Bangalore STP is located in Karnataka State. Karnataka has a state-of-the-art international technology park with 1.5 million sq ft of developed space, 6 new private technology parks with 6 million sq ft, STPs at Mysore, Hubli, Manipal, and Mangalore with high speed data communications, and the best telecommunications infrastructure in country. Karnakata leads India in software exports and the electronics industry, and was the first state in the country to have a software park. The Bangalore Software Park is the first to offer software services, information service provider (ISP) services, training and consultancy, videoconferencing, and is the first park with International Standards Organization (ISO) certification (Naidu, 1999). There is also substantial IT development underway in the area around the City of Hyderabad, which may even exceed that around Bangalore.

C. SINGAPORE

The Singapore government, from the inception of the state in 1965, realized that political viability and economic survival were two sides of the same coin. Aware of its small population and lack of natural resources, it looked to new economic activities and new markets to establish itself as a manufacturing base for multi-national corporations and as a service hub for the region. Consequently, Singapore made a key priority of capacity building in science and technology and always played a proactive role towards globalization.

The Government established Singapore Science Park in 1984. It is the cornerstone of Singapore's technology corridor, a 15-kilometer area stretching from the Park to Nanyang Technological University, enclosing the National University of Singapore and several high tech manufacturing facilities (Khondker, 1999).

The Singapore Science Park is the R & D base for many Fortune 500 companies in fields ranging from communications and information technologies to biotechnology. It occupies 300 acres and is being developed over three phases. Phase I is fully developed, with a gross floor area of 240,000 sq. m. and is wholly owned by Ascendas Land Pte Ltd. (formerly Arcasia Land Pte Ltd). Phase II is scheduled to be fully developed by 2001, and Phase III is in planning. The National Science and Technology Board, formed in

1991, is Ascendas' partner in phases II and III. In 1999 there were 123 tenants in Science Park I and 86 tenants in Science Park II, with a total of 7,000 employees. All tenants are required to be at least 50% R & D, and most of the companies are 100% R&D (Khondker, 1999).

In 1999, 51% and 52% of the companies in Phases I and II, respectively, were engaged in information technology and telecommunications activities (Wong 1999). Twelve percent of the employees have PhD, 16% have Masters, and 52% have Degree level education (Wong, 1999). About 50% of the companies are foreign-owned (Wong, 2001) and there are more than 307 multi-national corporations present. (http://www.sciencepark.com.sg/, 2001). The TeleTech Park is Southeast Asia's first R & D facility specially designed to meet the needs of telecommunications R&D companies. Completed in October 1996, it features cutting-edge infrastructure and test-bed (http://www.sciencepark.com.sg/, 2001).

D. MALAYSIA

The Malaysian government was one of the first to attempt to replicate the Silicon Valley model in a developing country. In its attempt to move to the technology sector to attract domestic and foreign private investment, the government invested in creating what was expected to be a world class physical and information infrastructure. This US$40 billion initiative, called the Multimedia Super Corridor (MSC), serves as the backbone for the country's information superhighway. The network is supported by a high-speed link (10Gb/s network) which connects the MSC to Japan, ASEAN, the US and Europe. The network is also capable of supporting extensive public, education, and business applications.

Malaysia provides generous tax incentives to attract multi-national corporations (MNCs). It has initiated efforts to raise relevant skill levels within the workforce and instituted policies that ease the entry of foreign knowledge workers. Malaysia has worked to create a strong ICT infrastructure in its major enterprise zones by improving business processes and providing incentives. Its development strategy has stimulated growth in investment and trade.

As a result of these efforts, in 1999 the gross national product (GNP) rose by 5.4%, an increase led by manufacturing and export of ICT-related electronics. The ICT sector's contribution to the GNP was approximately 36.5%, primarily from semiconductor and electronic equipment (Digital Opportunity Initiative, 2001).

However there are still problems. There remains an acute shortage of skilled labor and a lack of ability to generate sufficient numbers of knowledge workers. It is not clear that the goal of entering the knowledge society is best served by a capital intensive focus on multimedia applications, as opposed to a strategy focused on extending infrastructure, increasing ICT and general literacy, and focusing on small and medium enterprise and government usage of ICT. There is also an emerging gap between the information-rich and information-poor (Digital Opportunity Initiative, 2001).

The Multimedia Super Corridor is located in a site 15 km. wide and 50 km. long, between Kuala Lumpur city and Kuala Lumpur international airport. The MSC has 516 companies and 19 higher education institutions. Two of the world's first Smart Cities are being developed in the Corridor: Putrajaya, the new seat of government and administrative capital of Malaysia where electronic government will be introduced; and Cyberjaya, an intelligent city with multimedia industries, R & D centres, a multimedia university and operational headquarters for multinationals wishing to direct their worldwide manufacturing and trading activities using multimedia technology.

- The Multimedia Development Corporation envisions a 20-year time-frame for the full implementation and execution of the MSC, when Malaysia will have achieved leadership in the Information Age (http://www.mdc.com.my, 2001).

E. CHINESE TAIPEI

Chinese Taipei is a highly urbanized and industrialized society. With a US$101.6 billion foreign reserve that is second only to Japan, Taipei has had a growth rate of 5%. (Wang, 1999). Taipei's information industry went through several stages of development. Starting as an OEM in monitors and accessories, the industry moved into personal computers and semiconductors. By 1998 the value of Taipei's information products reached US$19.2 billion, ranking third after the US and Japan. Taipei's companies have 50% or more market share in seven different market product types (Wang, 1999).

There are two major parks in Taipei, Hsinchu Science-based Industrial Park (HSIP) in the north and Tainan in the south. The number of high-tech companies in the HSIP grew to 272 in 1998 with over 72,000 employees. Of the companies in the park, 222 were domestically owned and 50 were foreign-owned. HSIP companies are classified into six categories: integrated circuits, computers and peripherals, telecommunication, optoelectronics, precision machinery and materials and biotechnology. HSIP firms' combined sales were US$ 13.7 billion with a negative growth rate of 2.02%. Aggregate investment increased by 23.7% from 1997 to reach US$15.3 billion. Domestic sources accounted for 90.1% of HSIP investment capital, while foreign sources accounted for 9.9%.
In the area of new investment, 42 new firms entered the park in 1998, with new investments amounting to US$967.9 million. In 1998, 84 companies increased that amount to US$4,042 million. 39 companies of the integrated circuits sector alone raised a total of US$2,781.4 million in new capital.

The activities of the companies in the HSIP are increasingly geared to internationalization. Forty-seven companies have offices abroad, and many well known foreign manufacturers have already signed science and technology cooperation agreements with the park companies.

The Tainan Science-based Industrial Park is located in Tainan County. It covers an area of about 638 hectares and attracts companies producing semiconductors, wireless telecommunications, computer, micro electronic precision machinery, optoelectronics, and agricultural biotechnology products. Until the end of 1998, a total of 28 companies were approved to move into the Park, investing a total amount of US$4.6 billion. Nine companies have already started with the construction of factory buildings.

As the use of new land inside the HSIP has reached its limits, the fourth expansion plan of the HSIP is now under way in Chunan and Tungluo in Mioaoli County to provide a new area for high tech industries. The new area in Chunan covers 117 hectares and 365 hectares will be developed in Tungluo. It is planned that main companies of the biotechnology, optoelectronics, and telecommunication industries will move into the new Park area (http://www.sipa.gov.tw/seconde/index1.htm, 2001).

III. IMPLICATIONS FOR HAWAII

In recent history Hawaii has been disproportionately dependent upon the tourism sector for its economic growth and security. Due to its geographical isolation and ecological concerns, Hawaii is not strategically suited for a manufacturing economy. High technology development efforts have focused on the telecommunications and software sectors. Hawaii's unique location in the middle of the Pacific Basin, an English-speaking workforce, and a multi-cultural community have provided leverage in these sectors. The state has increased competition in the telecommunications sector and, often in partnership with the federal government, encouraged the development of a high technology sector. The private sector has spawned IT intensive projects and businesses.

One public sector initiative is the Maui High Performance Computing Center. Located on the island of Maui, this project of the Department of Defense houses one of the ten most powerful computers in the world (Bruce, 2001; MHPCC, http://www.mhpcc.edu/, 2001). The center encourages state and private sector organizations to participate in the utilization of its computing power. The contribution of this center to human resource development has already been realized through close cooperation with the state's University of Hawaii and a recently executed contract for the university to manage and maintain the center (Gomes, 2001; Ruel, 2001).

The Maui Research and Technology Center (MRTC) is a project of the High Technology Development Center (HTDC). HTDC is an agency of the State of Hawaii which promotes Hawaii as a site for high-technology applications and gives advice on policy and planning. HTDC assists start-up businesses in Hawaii and is a source of information on high technology activity in the state. The MRTC houses technology oriented start-up companies and is a source of economic diversification through job creation. The MRTC is also a home for the University of Hawaii's Office of Technology Transfer and Economic Development, and the Hawaii Small Business Development Center Network (MRTC, http://www.mrtc.org/MRTC/about.html, August 2001).

An example of a private sector initiative is that of the Estate of James Campbell. The estate developed the City of Kapolei, the Kapolei Business Park and the Kapolei Teleport on the island of Oahu. These projects share a high bandwidth high technology infrastructure linked to the continental US, Asia, and the MHPCC and designed to support both government and private business. The 11.5-acre teleport, located adjacent to the City of Kapolei, sits astride a number of the trans-Pacific fiber optic cables. The teleport's earth stations can simultaneously "see" Asian satellites that are invisible to the continental U.S. and North American satellites that are invisible to Asia. The teleport houses earth stations for Verizon and Loral Cyberstar, Sprint USA, Time Warner Communications, and Southern Cross, with other providers presently negotiating with Campbell Estate of locate their facilities there also. Together they have 14 satellite dishes that carry digital voice, data, video, and VSAT traffic to domestic and international destinations. The Teleport will continue expand to provide additional services that will make it an even more important international gateway. This includes interconnectivity between terrestrial and satellite networks, extension of Internet services into the Pacific and Asia, and earth segment connections to numerous new regional satellites needs (Bruce, 2001).

All these projects reflect the strategies of bringing in the latest in high technology, incubating entrepreneurship, and developing human resources.

IV. CONCLUSION

Investment in Technology Parks, using different models and different market niches, appears to have helped the nations surveyed to meet their immediate goals of increased FDI, technology transfer, increased exports, technology diffusion, increased employment, and human resource development. In so doing, it has contributed to the goals of overall economic growth, political stability and civic participation. It has supported infrastructure growth and penetration, and increasing access to the Internet. However, it is still subject to regional and global economic trends (e.g., the "dotcom" recession) and the more disruptive tendencies of globalization which can exacerbate gaps in access and affluence.

The contribution of investment in and operation of, technology parks, suggests that such investments can be a significant factor in driving infrastructure improvements, increasing penetration of information technologies, opening up international lines of communications, and increasing use of information technology in countries which have not historically been leaders in this area. They appear to help reduce national and regional digital divides. These concepts may also be of value in their application in other areas of the world, as a significant factor in the long-term effort to reduce the Global Digital Divide.

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back to index

Abstract

At PTC 2001, Jussawalla and Taylor reported on the commencement of a research project supported (by a grant from The Ford Foundation to the East West Center) on impacts of investment in technology parks in five Asian economies and one U.S. state economy: China, India, Singapore, Malaysia, Chinese Taipei, and Hawaii. The authors were co-principal investigators on the project. The study was intended to collect comparative baseline data, evaluate progress against initial goals, identify some "best practices," and attempt to extract from these examples lessons for the global digital divide (e.g., principles and practices that might be transferable to LDCs in Africa, Latin America). Later that year, an adjunct study was initiated for Hawaii.

During Spring 2001, secondary-source research was commenced, and a thirty-page data collection form was distributed to contacts in the target countries. In May and June 2001, senior researchers from The Pennsylvania State University, working on a sub-grant from the EWC, visited China, Singapore, India and Malaysia, and met with senior technology park officials and their staffs in each country. Local co-operating scholars collected data in Chinese Taipei and Hawaii. With the assistance of national academic experts and government officials, the relevant data was collected.

In July and August the data was reviewed, collated, and entered into a relational database to produce reports according to various selected characteristics. The authors then analyzed and interpreted the findings. The authors propose to present a summary of the project and its findings, with an emphasis on interesting factual comparisons and lessons learned. They further propose to suggest some ways in which these findings may be relevant to addressing the Global Digital Divide (GDD).

back to index

Meheroo Jussawalla

Dr. Meheroo Jussawalla is currently an Emerita Senior Fellow/Economist at the East West Center, Honolulu and Affiliate Faculty in the Departments of Economics and the School of Communications at the University of Hawaii. She is a leading scholar in the Economics of Telecommunications. She is extensively published and has 13 books to her credit. She contributes regularly to refereed journals such as Information Economics and Policy, Intermedia, Telecommunications Policy, Prometheus, the Asian Wall Street Journal and the Pacific Telecommunications Review. She has been a Visiting Scholar at the Institute of Social and Economic Research, University of Osaka in Japan and Randolph Macon College, Lynchburg, Virginia. She is on the International Advisory Board of the Information Economics and Policy Journal, the Board of Trustees of the Pacific Telecommunications Council, and on the US Chapter of the International Institute of Communications based in London. In 1995 she received an award from the Pacific Telecommunications Council for her contribution to Pacific Telecommunications Research. She was the founder president of the Research Committee of the Pacific Telecommunications Council. In 1998, a Fest Schrift was published in her honor edited by Professor Lamberton of the Australian National University entitled Communications and Trade: Essays in Honor of Meheroo Jussawalla (Hampton Press New York). She also won an award from Blue Cross Blue Shield of Hawaii in 1999 as an Ageless Hero of Hawaii in the category of Love of Learning. Since 2000 she has organized two international conferences on Asia's Involvement in E Commerce. She is currently researching the impact of IT Parks in Asia in collaboration with Dr. Richard Taylor, Palmer Professor of Telecommunications at Penn State University.

Sunyeen Pai

Sunyeen Pai is a research project assistant at the East West Center in Honolulu, Hawaii and is working on the research and communications aspects of the Information Technology Park study. She co-developed the project's web-site and worked on finalizing the study's survey instrument. She has taught systems analysis and design at the Department of Information Technology Management of the University of Hawaii.

She recently completed her Ph.D. in Communications and Information Sciences at the University of Hawaii, working under the guidance of Professor William Chismar. Her doctoral research used systems dynamics to examine the incentives and disincentives facing small business adoption of business-to-business electronic commerce, comparing and contrasting the adoption of traditional value added network-based services with Internet services.

She is continuing her studies in Library and Information Sciences and is also working on a library-sponsored digital imaging project. She is a member of the Hawaii Telecommunications Association, American Library Association, and Association for Computing Machinery.

http://www2.eastwestcenter.org/research/itparks

back to index

Overcoming Telecommunications And IP Challenges In Developing Countries

Richard Elliot
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View Abstract

Introduction

Although more than 400 million people access the Internet on a daily basis, there are still areas throughout the world that face significant challenges to readily access the Web.

Up until recently, penetration of the Internet was linked directly with the economic prosperity of a country -- Sweden, Canada and the United States leading the charge with the greatest percent of their populations online. For these countries, resources were readily available to develop an infrastructure that enabled Internet accessibility to the masses.

However, there are billions of people in emerging countries where Internet usage is not as prevalent, and access to the Internet is a very significant problem. Although on opposite ends of the globe, developing countries of the world in Asia and South America find that they have many similarities when it comes to the obstacles they must face for telecommunications development. Many countries in these regions have large populations, cover vast geographic areas, and experience high levels of rural poverty and income disparity. Deregulation also has played a significant role in the advancement of telecommunications and Internet growth in developing countries.

As wholesale telecom providers and businesses eye the promising Internet potential in many developing countries, they also face serious social, economic and communications infrastructure hurdles that must first be overcome. The implementation of a cost effective, reliable, quality Internet in many developing countries will have an immediate impact on some of these issues.

This paper will look at the telecommunications challenges in developing countries, and the solutions available to help them overcome these obstacles, and establish reliable, cost effective Internet access in their countries.

The Market Perspective of Developing Countries

The irony of the Internet boom is that while it offers us a global network stretching across many continents, the vast majority of the world's population is found in developing countries that have limited, costly, or no access to it.

For example, India, with a population of more than one billion people and home to some of the best software engineers in the world, reports the majority of its population is not online. In fact, according to Internet research firm eMarketer, India has roughly 2.8 million active Internet users, representing only .28% of its population. To make matters more complicated, since the country's income distribution is highly unequal, only a small fraction of the population can be considered a target for potential Internet use. This portion of the population is well-educated, cosmopolitan, media-savvy and early adopters of new electronic devices and technology.

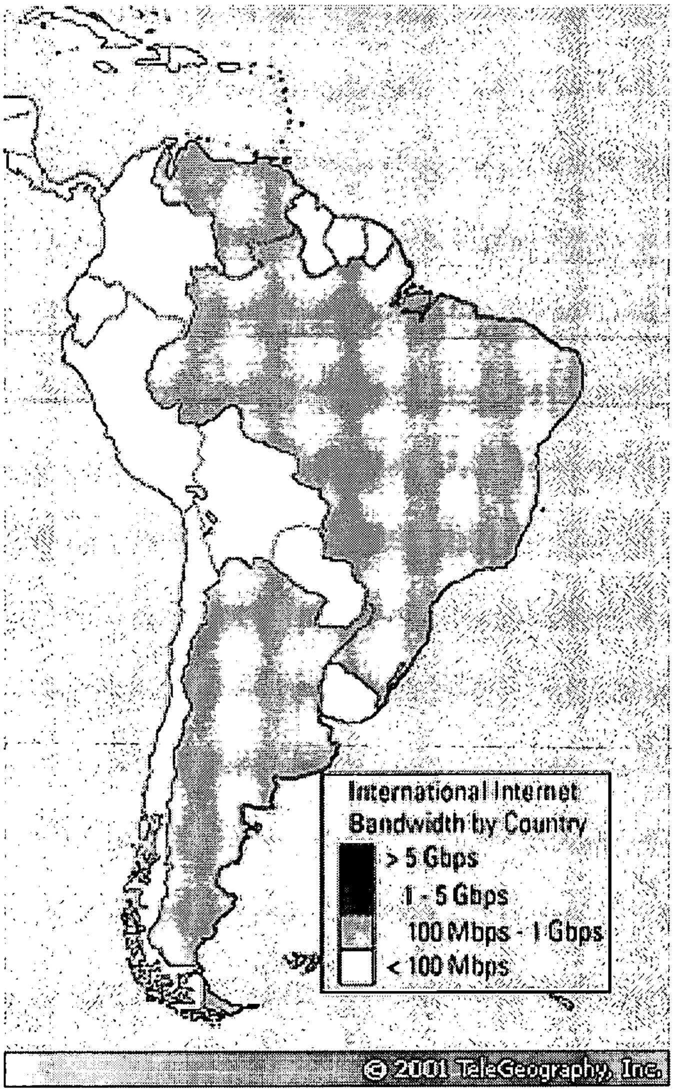
For the remaining population, widespread poverty is the main culprit. With 35% of the country's population living below the poverty line, and extremely low personal computer ownership, Internet development is faced with an uphill climb. In addition, India's electricity supply is often erratic with some communities receiving electricity for no more than six to eight hours a day.

However, a South American country like Brazil, with a smaller population than India, has more than twice the Internet users at an estimated 6.1 million. Unfortunately, that number is still considerably lower than that of most developed nations.

What is stopping Internet usage from surging exponentially in South America is the disparity in socio-economic classes. In San Paulo, for example, the majority of the city's residents can barely afford housing or public transportation, so appliances such as PCs and telephones are considered luxuries. Access costs also are a significant barrier for most users. Since the costs are high, only the wealthy can afford to spend significant amounts of time on the Internet. Most users ration their online time, with an even larger portion of the population unable to afford connecting at all. Also, with the Internet overwhelmingly filled with English (3/4 of web pages worldwide), increased local content is essential to widen Internet use.

However, there is hope. Brazil's telecommunications regulator, Anatel, recently announced it might introduce a flat rate for Internet usage by the end of 2001. The organization is studying two different methods of payment that would allow Internet users to stay online for an unlimited time without inflating their phone bills. Where this may not be good news for carriers' bottom lines on the face of it, it would certainly help increase Internet usage and give carriers the scope to develop new services.

Another promising note for the future of the Internet in developing countries is that interest levels among rural populations remain high. Many people associate computers and the Internet with education, and better career opportunities. In fact, in India, industry pundits are predicting that the number of Internet users will rise by 15 or 20 times in the next few years alone. It is apparent that the incumbent telecommunication carriers will play an integral role in supplying the resources for this growth.

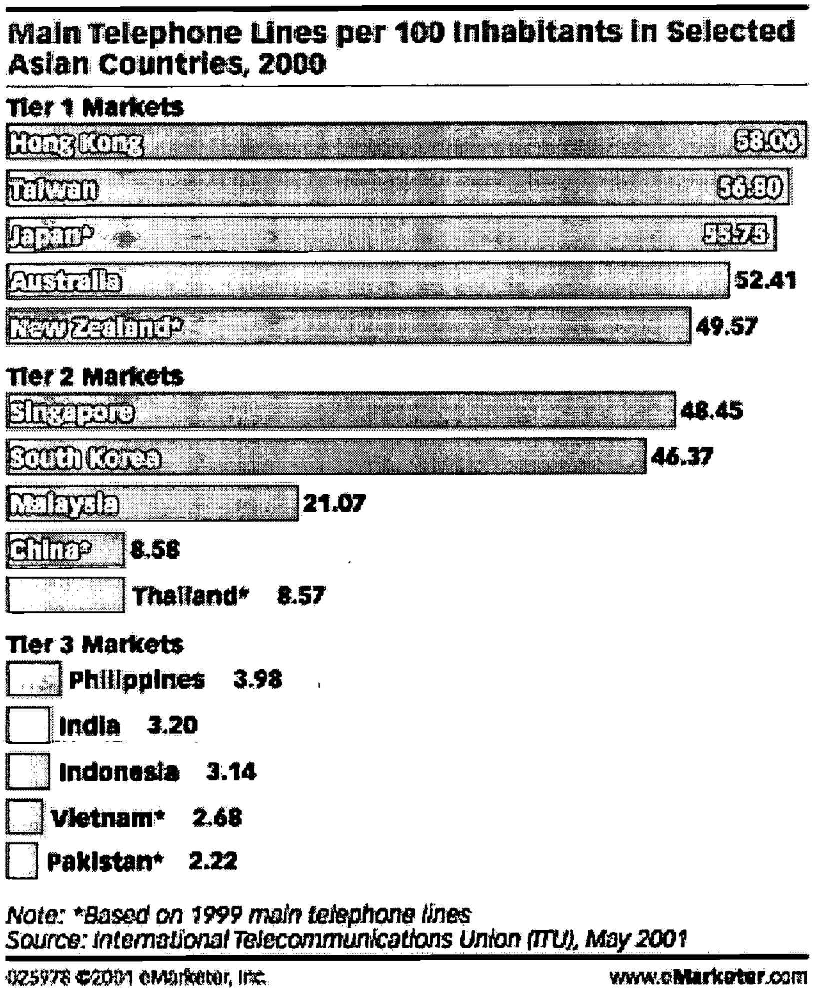


The Telecom Situation

There is no question that one of the main deterrents for Internet businesses looking to penetrate the markets of developing countries is the poor telecom infrastructure that exists in many of these nations.

eMarketer forecasts that Internet usage in Asia will be more closely tied to PC ownership and penetration rates. The presence of quality telephone lines, the most common link between the computer and the web, is likely to remain the key to the success of the market. Of course, the mere presence of telephone lines does not guarantee that people will dial up to the Internet, but a low quantity of working lines will naturally reduce the possibility.

An example of the importance of a good telecom infrastructure can be found in the disparity of the telecom situation in Asia. According to the latest data made available by the International Telecommunications Union (ITU), the three largest countries in the Asian region -- China, India, and Indonesia -- all have fixed-line telephone penetration rates of less than 10%, whereas Hong Kong SAR, Chinese Taipei and Japan, all much smaller, boast penetration rates approaching 60%.



Even though India began liberalizing its state-owned economy in 1991, according to the ITU, telephone penetration remains extremely low at only 3.2 main lines per 100 citizens. That's well below the world average of more than 14. The country is hoping to increase the density to seven by 2005, which while it would triple the present number, is still only half of the world average. To add to this, the lines that do exist are of low quality, and are not suitable to deliver the speed demanded of the Internet.

Similarly, eMarketer reports there are only 11 telephones per 100 people in Brazil. However, these landlines are extremely unreliable, causing carriers to scrap their existing infrastructure and start developing more reliable fiber optic networks.

In comparison, Mexico is bracing for growth, having recently announced plans to add new area codes to long distance and cellular telephone numbers across the country. In 1996, Mexican telecommunications regulator Cofetel realized that several cities and regions were set to run out of numbers. The company laid out a plan that included the new area codes (approximately 401) to ensure the country had enough capacity to last for 40 years.

However, in many developing nations, the telecom solution can't be as easily remedied by adding more telephone lines or area codes. Recently, large Indian-based companies have started planning for broadband services. Firms like Reliance Industries, Tata Electric Companies and Bharti Enterprises are wiring the country with fiber optic networks, which should boost bandwidth capacity. That should be good news for the many Internet users in India today who say speed is still the biggest constraint for increased use of the Internet.

Ready, Set, Deregulation

Deregulation also has played a major part in Internet adoption for many developing nations. The Brazilian market is just now experiencing the deregulation that United States experienced decades ago, so increased competition is forcing the incumbents to re-think the way they do business. Companies that want to take full advantage of this new opportunity created by deregulation are transitioning themselves for the Internet economy. For example, Embratel, Brazilian's long-distance operator, is currently implementing changes to its network to make it IP compatible. Embratel's strategy to modify its network from the old Telebras system is a testament to what is expected to happen in the region after deregulation occurs.

In India, telecommunications is synonymous with state-run Videsh Sanchar Nigam Ltd. (VSNL). Even though the government ended VSNL's monopoly of the industry in 1999, few telecom companies have been able to make any significant inroads in to the market. The breakup is a bright spot for the over 200 ISPs (Internet service providers) looking to offer their services in India; however, the bulk of the traffic runs through the top five providers. While the increase in the number of ISPs in the country is encouraging (there were only three ISPs in India in 1999, and approximately 43 in 2000, according to the CIA World Fact Book) almost all still buy their bandwidth from VSNL, which maintains its firm grip on the industry.

According to Total Telecom Asia, the privatization, billed as India's biggest in a decade of economic reforms, has been repeatedly delayed because of a lack of rules for the entry of private firms into the telecom industry. However, in November 2001, the Indian government accepted entry rules proposed by the TRAI (Telecom Regulatory Authority of India) for allowing private companies into international telephony in April of 2002.

There are many difficulties ahead, however, things are promising for many carriers in developing countries, especially those prepared to be innovative and flexible. According to the ITU, research shows that emerging economies that have introduced a degree of national competition are now experiencing higher rates of growth in international traffic per subscriber line than those which have remained firmly stuck in a "monopolistic" operating environment.

Generally, governments are now finding that deregulation can help them achieve their development objectives quickly. Private sector participation helps channel some of the income from telecommunications away from the existing operator and into the pocket of the new carriers. An added advantage is the introduction of foreign capital, technology and skills. As a result, deregulation helps develop other sectors of the economy that are highly dependent on telecommunications, such as travel and tourism, information technology, transport, and banking and financial services.

Solutions

With so many social and economic factors contributing to the slowing Internet progress in many developing countries, what will bring the Internet to them and make it a truly global network?

The procurement of quality IP transit and access to the Internet is a significant barrier to the development of the Internet in many emerging markets. Naturally, developed nations that were first to establish the Internet benefited the most. Today, emerging markets are forced to play catch-up with harsher and more restrictive rules as the Internet gets more commercial and competitive. However, on the plus side, these developing nations are able to see and learn from the mistakes of the more developed nations before them.

Emerging markets have few options for acquiring IP transit. Some are already in place, but very costly, while other more promising solutions are still months or years away.

In many developing countries, carriers buy transit from international backbone providers and route domestic Internet traffic via New York. This can be very costly (it is the equivalent of taking a direct flight from Mumbai to Delhi via London). Also, in addition to cost, this process greatly affects network performance and end-user experience (not only would it take a long time to do, but you also would not enjoy taking a direct flight from Mumbai to Delhi via London). The challenge telecommunications companies are faced with is finding ways to conquer this obstacle in the most cost effective and timely manner.

Part of the solution is the development of a public peering point. This allows for efficient interconnection between a country's ISPs by providing them with a local exchange for their Internet traffic, in essence, keeping local traffic "at home". The most significant and immediate benefit to these ISPs will be that they can eliminate unnecessary transit costs, which are extremely high, and reduce latency thus immediately impacting performance. In turn, they can exchange traffic more efficiently, and be able to provide a better, more cost effective and more advanced Internet services to their customers -- an impossibility without a public peering point.

Today, international IP transit is the greatest operating expense for many ISPs in developing countries, and the major factor prohibiting a competitive marketplace. A public peering point will reduce the amount spent on buying transit by eliminating the need to send all traffic, even if its destination is local, via international routes.

By allowing ISPs to exchange Internet capacity directly with each other and stop relying on interconnection points outside their own country, developing nations will see reductions in costs for end-users, both consumer and corporate. Service providers will look at these emerging markets as a good opportunity for them to offer adequate service while increasing profit margins. These providers may then use the increased revenue from these markets to drive product development.

Once a country has established a public peering point, the emergence of a healthy and competitive IP transit market will be the key to the success of the Internet industry for that country. It is the wealth of the IP market in countries like the United Kingdom, United States, and Hong Kong that has driven the Internet industry there.

While a public peering point can manage some of the local traffic, telecommunications carriers in developing nations will still need to long-line IP transit out of the country. Currently, Internet traffic in developing countries is long-lined via satellite providers to the U.S. where most of the Internet content resides. This leaves many telecommunications carriers locked into IP purchasing contracts with these providers, with no choice regarding the quality of the IP they are buying.

However, an alternative for carriers is to long-line IP transit back to a neutral provider, which not only offers cost savings, but several other benefits as well.

One solution Band-X offers companies looking to gain a competitive edge is the ability to buy and sell Internet transit via a neutral trading platform. This can help alleviate the obstacles associated with buying and selling IP, such as contract negotiation and lock in, price fluctuation, and quality of the IP to varying destinations. These are choices that satellite providers can't offer telecommunications carriers. Even though the carriers still need to use the satellite providers to long-line the transit, because the IP platform is neutral, they now can choose how they want to access the Internet.

For companies looking to enter into developing markets, a neutral IP trading platform can provide a clear view of all the IP transit suppliers, including their network's performance and quality status. And, in Band-X's case, the buyer contracts directly with Band-X, giving them the freedom to change suppliers once a month without financial or technical penalty. Because the suppliers set the price, buyers are always paying the current market price, automatically.

What Lies Ahead?

Although it is not anticipated that an increase in Internet accessibility will be the saving grace for communications in all developing countries, it can help alleviate some of the social and economic issues they currently face. In fact, John Chambers, CEO of Cisco Systems has said, "India is poised for an economic leap if it could develop a solid Internet infrastructure to match its army of software engineers."

With the expected lowered cost of Internet use in developing nations and improved service, companies are more likely to take full advantage of the Internet, thus providing a significant boost to the development of e-commerce. For example, a public peering point in India will enable more companies to host their websites (currently 88% of Indian content Web sites are hosted in the U.S., which makes upkeep and management expensive).

As more companies go online, domestic employment opportunities will grow dramatically in these developing nations as well.

Finding The Best Way To Get There

When evaluating the telecommunications states of many developing nations we find that these countries share a common goal: the need for cost effective, reliable, and quality Internet services. However, each developing nation faces very similar and very unique roadblocks to overcome. These countries will see that the Internet can play a major role in impacting their current social and economic conditions. And, wholesale telecom providers and enterprises that can offer these developing nations the most strategic and cost effective solutions will find that their potential reward is an increased market share --and increasing stability in a volatile marketplace.

back to index

Abstract

With Internet usage growing at a tremendous rate, including in developing countries of the world in Asia and South America, the incumbent telecommunication carriers have struggled to keep up and provide the adequate resources to accommodate this growth. There are some differences between what is available locally in these areas, and what is available in other, more developed and deregulated markets such as Europe or North America.

So what is standing in the way of the development of the Internet industry in these countries?

There are several factors, which may contribute to the slowing Internet development in some developing countries, such as, the social and economic situation, lack of sufficient infrastructure, a quality supply of IP, or standardized regulations. The challenge is for companies to find ways to get over these hurdles in the most cost effective and timely manner. The rewards will be seen not only by the telecommunications providers, but by the millions of Internet users within these countries.

With so many factors contributing to the slowing Internet progress in many developing countries, what will bring the Internet to them and make it a truly global network?

The emergence of a healthy and competitive IP transit market is not only the key to the success of the Internet industry as a whole, but essential for the success of the Internet market in all developing countries. It is the wealth of the IP market in countries like the UK, USA, Hong Kong, France and the Netherlands that has driven the Internet industry there.

This presentation will look at the telecommunications challenges in developing countries, and the solutions available to help them overcome these obstacles, and establish reliable, cost effective Internet access in their countries.

back to index

Richard Elliott

Executive Vice President, Global Trading Development and co-founder

As an expert in the trading environment, as well as telecommunications markets, Richard drives the development of Band-X's Networks trading floor - the world's busiest market for telecoms infrastructure. As a former director of Kleinwort Benson's equities division he was closely involved in the trading function of the investment bank and has had wide experience of markets. Richard left Kleinwort Benson Securities after eleven years to co-found Band-X in July 1997.

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back to index

Telecommunications industry rationalisation: The driving forces for change in the Asia Pacific.

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View Abstract

Introduction

For the past ten years or more telecoms markets in the Asia Pacific have been characterised by an ever increasing number of new market entrants, attracted by pro-competitive regulation, a seemingly insatiable market demand for new services and easy access to investment funds. The first two of these drivers of market development still exist in large measure, but investors have become increasingly impatient within the last 12 months or so with telco business plans that fail to deliver positive cash flow. Investment funds have virtually dried up for start-up telcos and even some of the once most powerful incumbent players are facing difficulties obtaining funding for new investments from an increasingly risk averse and sceptical market.

The downturn in business prospects for new telcos started well before the current global economic downturn but has now become much worse. A range of disruptive forces have come together to change the telecoms business landscape:

- **Market demand**
  Saturation in demand for fixed PSTN and 2G mobiles networks has occurred concurrently with market convergence and price erosion, making it increasingly difficult to market new services to discerning end-users. Customers remain sceptical about the benefits of new services, and 'more-for-less' customer expectations make it difficult to migrate customers to higher value generating services.
- **Technology**
  The legacy PDH and circuit switching technologies of PSTN and 2G mobile networks are becoming irrelevant as all networks move towards common next generation architectures based on IP, MPLS, DWDM, softswitches, GPRS and 3G. Maintaining technological innovation is critical but also costly, and the demand for next-generation services is still uncertain.
- **Macro economics**
  A synchronised global slowdown in the telecommunications, media and technology sectors has resulted in a decline in stock prices and an 'investment strike' as financial institutions have turned away from the industry to market sectors with lower risk profiles. More recently, a general turndown in macro economic performance of the broader global economy has exacerbated the situation through a decline in end-user spending.

The key questions now for telecoms firms in the Asia Pacific are when will telecoms markets recover, how can we stimulate demand, and how can we conserve capital and survive in the meantime? For a select number of financially strong telcos, the downturn presents an opportunity to take competitors out of the market cheaply and to remove excess capacity. This in turn may produce a more efficient industry but will it be in the long-term interest of competition and end users?

The changes taking place in the telecoms competitive landscape pose a threat to governments and regulators as the sustainability of competition comes into question, and the capacity of private sector firms to invest in needed national infrastructure is diminished.

In the remainder of this paper we will consider the global dynamics of how industry rationalisation is taking place in both fixed and mobile networks, and the opportunities and threats that these forces present to players in the Asia Pacific.

The pivotal role of government in creating the current industry structure

An important thing to remember about the structure of the global telecommunications industry as it exists today is that it has been brought about primarily through the actions of government and the application of government regulation.

Telecommunications markets are still in transition from state owned monopolies to various flavours of what passes for open competition. The word flavour is used advisedly because competition is not to everyone's taste and there are divergent interpretations of what constitutes open competition. Moreover, governments have many agendas to consider in ensuring that the competitive framework addresses the changing interests of a wide variety of stakeholders.

The transformation of markets from conditions of monopoly to open competition does not occur naturally - in fact the whole process of implementing a competitive framework for telecoms is the very antithesis of the way in which markets operate when left to themselves. Most markets tend to evolve over time into oligopolistic structures where a small number of large firms become dominant and are able to exert considerable influence over the basis of competition for the industry as a whole, particularly in regard to the level of market prices.

Not surprisingly, therefore, the process of transition to open competition in telecoms has not been smooth. Regulators, at the urging of new entrants, consumers and governments, have faced a constant battle to sustain a pro-competitive environment. Although regulators have often espoused the virtues of light handed regulation and, for that matter, a diminishing role for regulation over time, the need for timely and effective market interventions by regulators to protect competition and the interests of customers has never been greater.

In the Asia Pacific there are particular problems for governments in managing the transition to a new industry model. Competitive telecoms markets in the Asia Pacific are still immature and there remains a strong focus on building national infrastructure. Moreover, incumbent operators, for the most part, remain majority owned by governments and there are restrictions on foreign ownership. The great risk is that governments and regulators in the Asia Pacific will continue with regulatory frameworks and licence obligations which perpetuate the status quo while ignoring, or not understanding, the fact that the dynamics of the industry have changed. In doing so, important considerations for the promotion of sustainable competition in the future, such as the development of wholesale markets and infrastructure sharing, will be missed.

Evolution of the telco business model

At the start of telecoms competition the dominant business model was that of the vertically integrated full-service incumbent telco. Scale economies, particularly in the access network, were seen to be fundamental to achieving a sustainable competitive position. Indeed, the actions of governments and regulators reinforced the view that new entrants should also emulate this model. The primary concern of governments was to ensure broadly based infrastructure competition and to prevent 'cream skimming' whereby new entrants simply addressed the highly profitable segments of the market. New entrants were required, therefore, to meet specific network rollout obligations as part of their licence conditions.

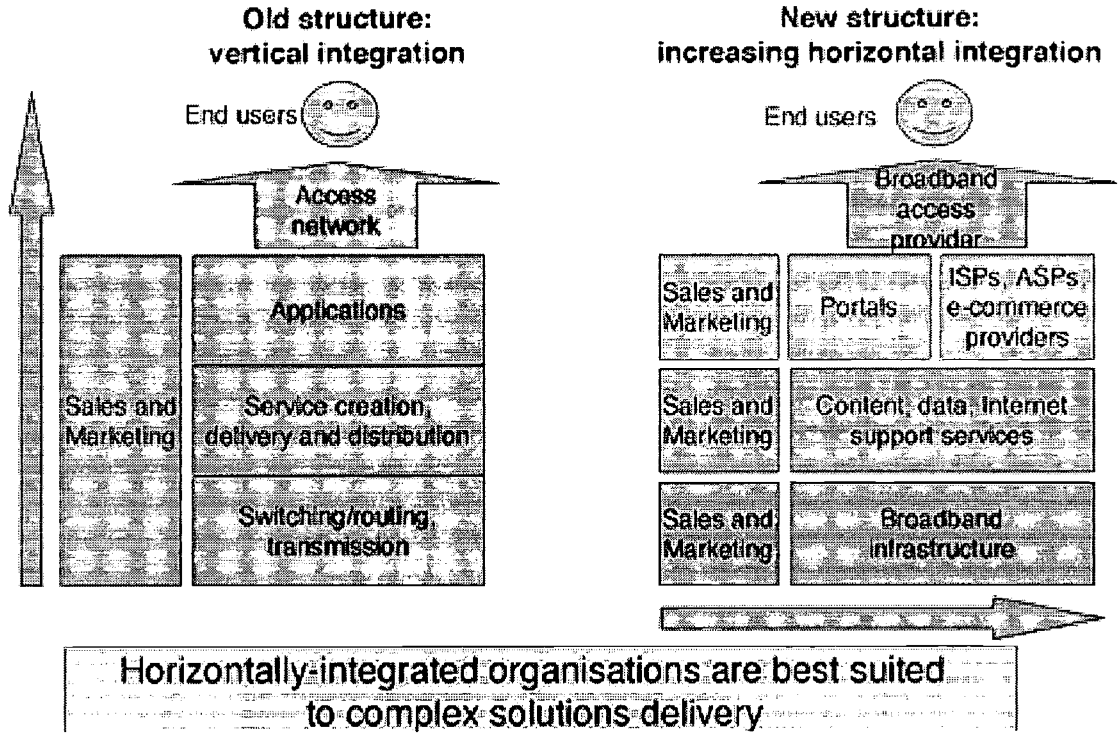
The net result of these government policies, the preference of new entrants to have control over their own infrastructure, and the ready availability of investment funds has been to stimulate substantial investment in new telecoms infrastructure over the past 10 years. So much so that there is now a glut of capacity in many market sectors and severe price competition.

Unfortunately for many recent industry participants, technology and market conditions have changed so much within the last few years that business models which appeared to be viable as little as two years ago are no longer viable. Many incumbent telcos now face the need to radically restructure their businesses and re-invest in next generation network infrastructure in order to survive in the new environment.

In the early days of competition, in both fixed and mobile network services, there was substantial primary demand, driven by increasing service penetration and usage rates for voice services. By now this primary growth phase in most developed markets has dissipated and we are now in an uncertain transition period where the growth in demand from new value added broadband and data services is insufficient to offset the slackening of demand from traditional voice services.

The future engine for telecoms market growth will undoubtedly be the provision of value added broadband and data services on both fixed and mobile networks. However, the delivery of these services requires an entirely different business models to those that were successful in the past, as well as new forms of investment in management and support systems. Figure A illustrates how, in future, horizontally integrated rather than vertically integrated telcos will be best suited to complex solutions delivery.

FIGURE A: FROM HORIZONTAL TO VERTICAL INTEGRATION



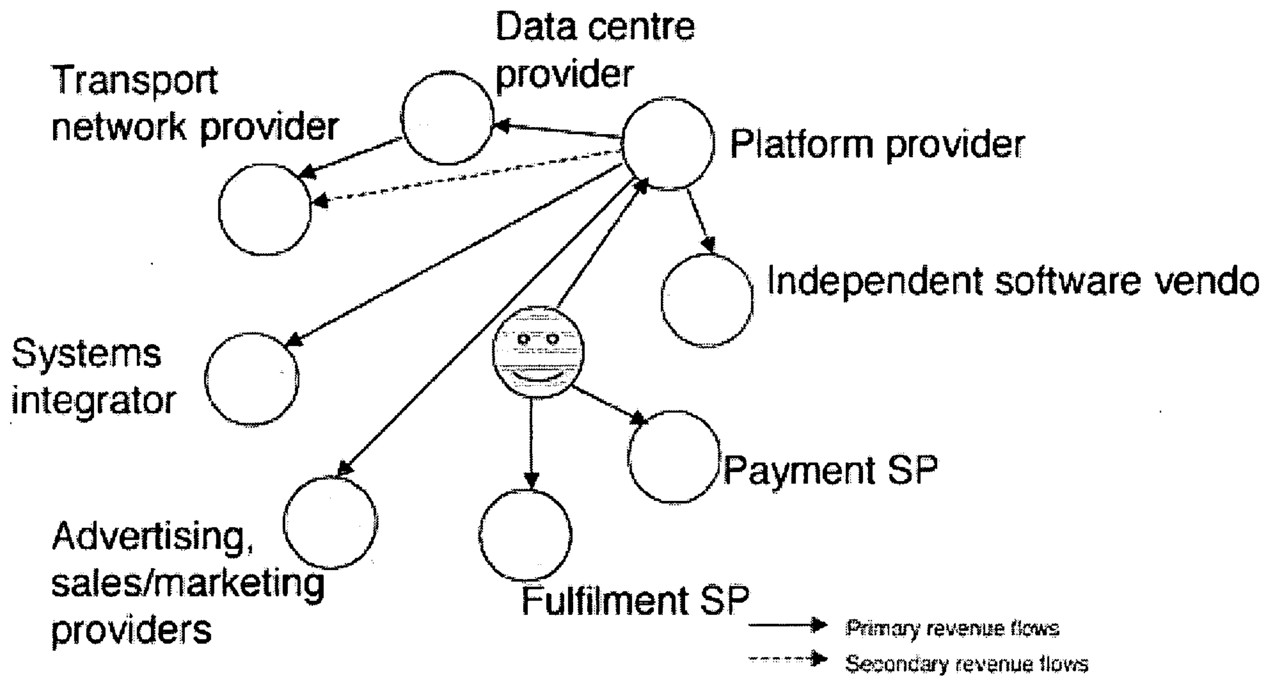
In the new market environment it will be difficult, if not impossible, for individual telcos to be good at everything themselves. Increasingly the network elements (broadband backbone infrastructure) of a telecoms business will be separate from the service elements (content, data transmission and support services) and the end-user interface (formed by portals, ISPs ASPs, and e-commerce providers etc).

In the future, a telco focusing on the provision of services within a network or service layer will need to form partnerships with other telcos specialising in other service layers to acquire services that complement and add value to their core competencies. These partnerships will increasingly take the form of wholesale relationships where telcos do not necessarily provide services directly to end users but instead sell their services to an intermediary who in turn adds value before providing an enhanced service to end-users. In this environment partner selection and channel management are critical, as is the ability to develop suitable service packages that optimise value adding opportunities throughout the value chain.

At this stage there are few examples to illustrate a successful track record in developing sustainable partnership arrangements. It is likely that there will be a high level of experimentation and failure before successful role models emerge. Nevertheless the general model appears clear. Figure B shows, in conceptual terms, how a telco platform provider might create partnering arrangements to deliver customer focused solutions.

The core network platform provider can outsource a range of functions such as service fulfilment, payment and sales and marketing to specialist service providers thereby achieving operational efficiencies that could not be achieved within a vertically integrated structure. Similarly, it may use alternative market channels such as data service centre operators, software vendors and system integrators to reach customer segments and capture additional value that it could not achieve when operating a 'one-stop-shop' model. In essence, many of the individual elements of the new model are not new in themselves - it's the increased business reach and opportunities for value enhancement that are new.

FIGURE B: A VALUE MAP FOR CUSTOMER FOCUSED SOLUTIONS DELIVERY



The new rules of competition

The new rules of the competitive telecoms landscape in terms of the required management focus are summarised in Figure C:

FIGURE C: THE NEW RULES OF TELECOMS COMPETITION

Old world order:	New world order:
Revenue growth, cash flow	Profitability sustained, cash
Capex	Opex
Scale	Scope
Integrated	Specialised
Technology	Solutions
Long cycles	Short Cycles
Rigid	Flexible
In-source	Out-source
Customer ownership	Partnerships

In the future the telecoms market will increasingly be split into infrastructure (networks) and services, and into wholesale and retail. Effective market consolidation, therefore, is likely to occur in horizontal layers through the achievement of efficiencies in service scope and scale efficiencies in networks or markets. Vertical integration, on the other hand, is unlikely to achieve either scope or scale efficiencies and mergers or acquisitions that follow the old model are likely to fail.

The future model for a successful telco will comprise one or more business units competing independently in homogenous markets. To this end, the more enlightened incumbent operators are now splitting up their businesses into stand-alone business units reflecting the discrete needs of:

- wholesale versus retail
- network versus services
- fixed versus mobile versus ISP

At the same time they are also spinning off business units performing activities that are no longer considered to be core.

Winners and losers

The winners and losers in the new market environment are still to emerge in Asia Pacific markets. However, the key differentiators between the two groups are clear.

Losers

The losers in the new market environment will be:

- **do-it-all large incumbents** who continue to follow the old world model
- **small incumbents** who are unable to achieve sufficient scale economies
- **operators of legacy networks** who will not be able to match the flexibility and functionality of next generation network services
- **operators with a poor customer services and business focus** who are unable to maintain a service quality and customer solutions focus.

Winners

The winners in the new market environment will be:

- **horizontally focused service providers** who can achieve economies of scope in providing niche services and solutions
- **low cost network only operators** who can achieve scale economies and hence offer low prices
- **operators with strong brand recognition in consumer markets** who can sustain a strong consumer franchise and differentiate themselves in what are otherwise commodity markets
- **operators with a strong service and solutions focus in corporate markets** who can integrate solutions and add value beyond that available from technology focused operators
- **operators able to expand addressable markets through strategic partnerships** who are thereby able to leverage there core competencies with those of other operators.

Above all else, the effectiveness of business plan execution will be the key determinant of success or failure. Incumbency will not afford protection from market forces if traditional vertically integrated 'one stop shop' strategies are persisted with. Equally, new market entrants who persist with a 'build and they will come' approach to infrastructure investment will fail in the absence of appropriate partnership arrangements, including the purchase of wholesale services from other operators.

Fixed network competition

The core business of traditional incumbent operators has been the fixed wireline business. These businesses are increasingly under threat from:

- **alternative infrastructure operators** who either build their own network infrastructure or rent infrastructure from the incumbent operator, subject to regulatory supervision (eg unbundled local loops (ULL) used to provide xDSL services). These rivals generate their competitive advantage by working in a more focused way than the incumbent. They gear their operations to the needs of particular classes of customers and the products they wish to provide in particular locations. They have been particularly successful in addressing the lucrative and rapidly growing data service market and are not burdened with the complex management and efficiency problems of the incumbent who typically has an obligation to serve all customers.
- **resellers** who resell end-to-end services supplied on a wholesale basis by the incumbent, as well as providing long distance services using indirect access from the incumbent. Resellers reduce the end-user revenues available to the incumbent but potentially offer a lower cost distribution channel to the incumbents own sales and marketing resources.
- **mobile operators** who have taken the majority of growth in narrowband voice traffic. The volume of fixed network telephone calls (excluding calls to mobiles, freefone and dial-up internet access calls) is now declining in many Asia Pacific countries. This trend is irreversible as, despite higher average call charges, mobile networks offer more personalised services and mobility which is highly valued by most customer segments.

Threats from competitors are, however, only part of the problem for incumbent fixed network operators. Fixed network services have been the main target of telecoms regulations which were created to open monopoly markets. Typically they are subject to a range of constraints including: price control, universal service obligations, the need to maintain geographically averaged prices and limitations on the bundling of monopoly and competitive products.

All of the above factors have lead to a decline in profitability of incumbent fixed network operators. In terms of EBITDA (Earnings Before Interest, Taxation, Depreciation and Amortisation) margins, the following levels typically apply in Asia Pacific markets:

- in a relatively weakly regulated monopoly a reasonably efficient incumbent might expect to make EBITDA of 40% to 60%
- in an oligopoly sector, an incumbent might expect to make an EBITDA of 25% to 40%
- in a sector with full competition, an incumbent might expect to make an EBITDA of 15% to 25%.

However, all in the access network is not bad for incumbent operators. The move to broadband service creates major opportunities to increase revenues per customer in fixed access networks as the bulk of broadband applications will use wireline rather than mobile networks. But the support of these new services will require substantial new investments.

Incumbent fixed network operators typically run a core circuit switched network together with a series of specialist data networks and IP networks for internet traffic. These are increasingly inefficient to operate and substantial investment funds are required to upgrade them to a single IP multi-service network. There are also opportunities for incumbent operators to further reduce the costs of their next generation networks by operating a single backbone for both fixed and mobile traffic.

The net result of this is that the original pre-competition model of core access networks being natural monopolies, requiring common ownership, still has resonance. Indeed, it may be that fixed broadband access networks in the Asia Pacific will move towards multi-carrier wholesale networks. This would address the concerns of governments to ensure the widespread availability of broadband access throughout the community, as well as ensure an equitable basis of competition.

Mobile network competition

The transition of mobile networks from second-generation (2G) to third generation (3G) technology and service in a number of European countries such as the UK and Germany has been an unmitigated disaster. Governments have effectively taxed away the potential profits out of the new networks prior to service implementation via auctioning the available radio spectrum to the highest bidder(s). As a result, a number of carriers have become so capital constrained that their ability to implement their 3G business plans has been severely constrained. Of course the participants in the auctions were also culpable in making bids for the spectrum that could not be justified by any rational business model. Fortunately, for most Asia Pacific countries, the lessons of the European experience have been learned and 3G spectrum has been made available in Asia Pacific markets at much lower prices.

In the early days of mobile networks competition the general view of governments and regulators was that there was little need for regulatory intervention, except to define network rollout obligations as part of the licence conditions. Free market forces were achieving appropriate outcomes without the need for intrusive or 'heavy handed' regulation.

In many markets there was an essentially 'level playing field' where the fixed network incumbent had no particular advantage. As a consequence, a large number of new entrants were attracted into Asia Pacific mobile markets. The net result was a high level of network infrastructure investment with up to six or more networks serving the same geographic area and customer base.

In the early days of competition it was not difficult for a mobile operator to sustain a profitable business plan as primary growth was strong, average revenue was increasing and profit margins were high. With the move towards 2.5G and 3G networks and the provision of data as well as voice service the circumstances have changed. Primary growth has peaked and increased price competition has caused Average Revenue Per User (ARPU) to decline. The demand for new broadband data services is still uncertain and substantial investments are required to acquire spectrum and to rollout new network infrastructure.

The changed economics have given pause to many operators and there is now active consideration of various levels of network infrastructure sharing. These include the implementation of mobile virtual network operator (MVNO) business models, where the operator relies entirely on wholesale access to the complete network of another operator and, alternatively, the sharing of the radio access network or specific items of infrastructure such as transmitter towers.

The regulatory model in a number of Asia Pacific countries has failed to catch up with the new network economics and infrastructure sharing is not allowed. Most regulators have typically set coverage limits that operators must achieve in rolling out 3G networks. As a consequence, regulation forces the rollout of infrastructure faster than may be required by business models and restricts the opportunities for wholesale revenues. Moreover, the nature of 3G technology is that investment is more concentrated in the early years which increases the business risk to the operator because the early years are the period in which revenues are most uncertain. This contrasts with 2G networks which follow a more 'pay as you grow' path.

It appears inevitable that in most Asia Pacific markets there will be a need for substantial industry rationalisation. The investment required on behalf of individual operators in 3G technology are so large that individual country markets can only sustain a small number of infrastructure based players.

Conclusions

The key conclusions from our research into telecommunications industry rationalisation in Asia Pacific markets are:

- a high level of industry rationalisation in both mobile and fixed networks is inevitable in order to sustain effective competition
- the new competitive model with require a high level of partnering arrangements between otherwise competing operators as it becomes increasingly difficult for individual operators to maintain a vertically integrated 'one-stop-shop' business model
- government and regulatory policies will need to adapt to the new competitive framework. This will require a greater emphasis on promoting wholesale competition and less emphasis on infrastructure based competition.

Ovum report references

The following Ovum report provide further information on the forces causing the rationalisation of fixed and mobile network markets:

1. Releasing Shareholder Value: The Telco's Home Wireline Business – Tony Lavender and David Lewin, 2001 Ovum Ltd
2. 3G Survival Strategies: Build, Buy or Share – Eirwen Nichols, Carrie Pawsey, Ines Respini, Virtyt Koshi, Ajay Gambhir and Martin Garner, 2001 Ovum Ltd
3. Recession in Telecoms: The birth of a New World Order – Sue Uglow, 2001 Ovum Ltd.

back to index

Abstract

2001 has been a year of economic slowing in most economies both globally and in the Asia Pacific. Many telecommunications operators have over-extended themselves and incurred higher levels of debt. Capital for industry development has been at a premium, as the capital markets have taken a more sceptical view of industry business cases. Governments have, at the same time, attempted to extract new rents through the sale or auction of spectrum, particularly in new technology areas such as 3G. The result has been an upsurge in industry rationalisation, both nationally and regionally. In this paper we will examine the forces operating and those sectors of the industry that will be most prone to rationalisation in 2002. We will also examine barriers to industry rationalisation, and the overall effects that these may have on the efficiency of the industry and its future development in the Asia Pacific.

back to index

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back to index

Economics & Financing

Wednesday, 16 January 2002
1600–1730
Honolulu Suite

W.3.6 Pricing and Forecasting Issues

Chair:
ROBERT AAMOTH, Attorney, Kelley Drye & Warren, *USA*

W.3.6.1 Comparative Approaches in the Economics of Broadband Satellite Services (View Abstract)

MARK DANKBERG, President & CEO, ViaSat, Inc. and JOHN PUETZ, President, MasterWorks Communications, *USA*

W.3.6.2 The Benefits of Taking the Long View-Assessing the Effect of Life Cycle Costing and Risk Management on the Business Plan of Next Generation Ventures. A Case Study in the Submarine Networks Environment. (View Abstract)

MURRAY ELDRIDGE, Director, Customer Services and JAN STRINGER, Senior Manager, Global Marine Systems Limited, *United Kingdom*

W.3.6.3 Meeting the Business Plan Milestones for New Submarine Cable Systems - The Interdependence and Phasing of Key System Planning Processes (View Abstract)

GRAHAM EVANS, Director, International Business Development, C&C-EGS Subsea Geosciences, *Singapore*

Comparative Approaches in the Economics of Broadband Satellite Services

Mark Dankberg, President & CEO, ViaSat, Inc.
and John Puetz, President, MasterWorks Communications
USA

View Abstract

1. Introduction

Historically satellites have been most successful in distributing information over very large geographical areas using a single transmission. With services such as television broadcasting, data broadcasting, digital messaging, enterprise virtual private networks (VPNs) and point-to-point telecom-datacom services, traditional "bent-pipe" satellites have played a significant role in our daily lives. A new generation of application needs, higher throughput requirements, and communication demands are changing the way satellite systems are designed, implemented and operated. New architectures and system networking concepts are being implemented to make satellite systems capable of addressing these new market demands. The progressive idea of making satellite systems that are optimized for highly in demand services (e.g., Internet access, VPNs, personal access) opens entire new market opportunities that go far beyond the traditional viewpoint of selling services only into markets that where satellite services excel (e.g., broadcasting, multicasting and content delivery).

While technology is an important and very necessary ingredient to success, equally important, if not more so, is the need for a viable business model that can withstand the rigors of the marketplace and provide earnings within a reasonable time frame. To that end, all aspects of a new broadband service must be carefully considered; market demands researched, user needs profiled, implementation and operational costs analyzed, service uptake rates accurately estimated and service revenues and margins realistically forecasted.

From a user's perspective, consumers have different service requirements than do corporations and small to medium enterprises (SME). Service speed, throughput capacity and connectivity are very different—and much more demanding in an enterprise environment. The mobile broadband market adds yet another dimension to system capability and design.

To illustrate the wide variety of market needs and user expectations we've formulated a service and market requirements matrix as presented in Table 1. As can be seen, there is a very wide range of service capability, performance expectations and pricing. Thus the concept that one system can address the diverse needs of the consumer, business and mobile marketplace is just not realistic.

TABLE 1 - SERVICE / MARKET REQUIREMENTS MATRIX

	Consumer Access	Business Access	Business VPN	Mobile Platform	Mobile Personal
Terrestrial	Cable	ADSL	Frame Relay	InFlight	2.5G/3G
Equivalent	ADSL	SDSL VDSL T1	ATM VPN T1	Online Hotel DSL	GPRS
Service Cost	$50/mo	$200/mo	$1,000/mo	$/hour	$/min
Topology	hub/spoke	hub/spoke	mesh	hub/spoke	hub/spoke
Service type	all you can eat	by the Mbyte	by the Mbyte	by the Mbyte	by the Mbyte
Connectivity	asymmetric	asymmetric/ symmetric	mostly symmetric	asymmetric	asymmetric
Service Quality	best efforts	may have SLAs	SLAs (latency, availability throughput, responsiveness)	best efforts	best efforts
Capacity	Limited peak speeds (< 1 Mbps)	higher peak speeds (<2 Mbps)	even higher peak speeds (2 to 45 Mbps)	Limited peak speeds (<1 Mbps)	lowest peak speeds (<256 Kbps)
Traffic Volume (Downstream)	100 to 1,000 Mbyte/mo	200 Mbyte to 2 Gbyte/mo	300 Mbyte to 3 Gbyte/mo	1 to 5 Mbyte/hr	0.1 to 0.5 Mbyte/hr
Traffic Volume (Upstream)	25 to 250 Mbyte/mo	50 to 500 Mbyte/mo	75 to 1,000 Mbyte/mo	100 to 500 Kbyte/hr	10 to 50 Kbyte/hr
Satellite System	Starband [1] WildBlue [2]	SkyBridge	Astrolink SpaceWay	Connexion	Inmarsat ICO
System Implementation	Ku-FSS [1] Ka-Spotbeam [2]	Ku-FSS	Ka-on board processing	Ku-FSS	L-band MSS

To be successful in any particular market segment (or even any two adjacent segments) the system must be customized to meet the particular segment demands. For example, to provide upstream data rates of 1 to 4 Mbps the satellite terminal needs to have a much larger antenna, significantly more transmit power or the satellite must have a high G/T factor (e.g., spotbeam operation) than that for a consumer Internet access service capable of 64 to 256 Kbps. Another example is that a $300 to $400 terminal price is incompatible with a 4 Mbps upstream transmit speed. Direct peer-to-peer connections needed for enterprise networking applications (and potentially future consumer applications) require mesh connectivity, not hub-spoke as in other systems. Small dish, high-speed mesh connectivity is currently only achievable using specialized on-board satellite processing techniques in conjunction with Ka-band spot beams.

From the service operator's (and investors') perspective, the business' return on investment (ROI) must be attractive and compelling-service revenues need to be maximized and the operational costs minimized. Take for example the first generation of satellite broadband service (e.g., StarBand) that operates with upstream rates of 30 to 60 Kbps and much larger downstream capacity (150 to 500 Kbps per user, 30 Mbps total capacity) to the user terminals that number 10,000 to 20,000 per transponder. However, system operational limits keep the number of concurrent online users to below 8,000 per transponder. Yet the ROI economics for the service provider require many more subscribers per transponder-and the end users demand much higher data capacity as interactive broadband applications and services become more widespread.

2. What Does Broadband Satellite Really Mean?

Broadband satellite systems both receive and transmit rich-media content to and among network end-users whether at home or in the office-these systems are not intended to supply huge amounts of bandwidth for backbone infrastructure purposes. The market need is great for two-way broadband network access across large geographical areas where infrastructure has not been built out, or would be too costly to implement. In short, satellite will become the broadband "local-loop" in such communities.

Forecasted broadband satellite service revenues are projected in Figure 1 over the next eight years, growing from $2.2B this year to over $40B and contribute 30 percent of broadband service revenues worldwide. Thus, there is considerable economic motivation for today's heavy investment in next-generation broadband satellite systems by a number of players.

3. Satellite System Approaches

There are four basic technology categories that form the basis for the various satellite broadband service offerings: Ku-band FSS, bent pipe Ka-band, on-board processing Ka-band and L-band MSS. These approaches and representative service offerings are summarized in Table 2. The first generation services that are now in place use existing Ku-band fixed satellite service (FSS) satellites for two-way connections. Using FSS, a large geographical area (e.g., the United States or all of North America) is covered by a single broadcast beam.

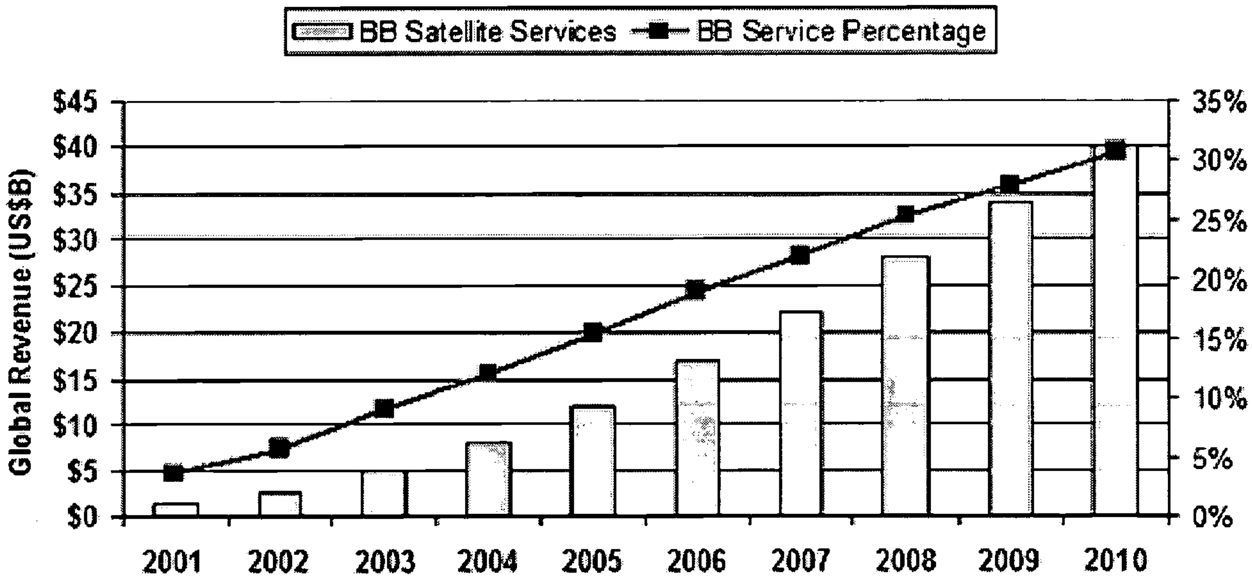


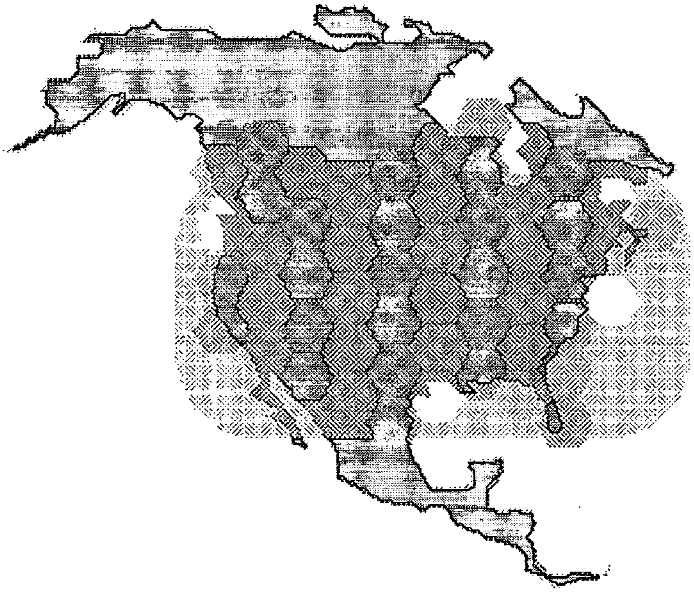
FIGURE 1 - GLOBAL BROADBAND SATELLITE SERVICE REVENUE GROWTH

Source: IEC Study (Dr. J.N.Pelton)

TABLE 2 - 2-WAY BROADBAND SATELLITE TECHNOLOGIES

Satellite Broadband Technology Category	Representative Offerings	Capacity (per system)
Ku-band (FSS)	DirecPC/DirecWay, StarBand, SkyBridge	500 Mbps
Ka-band (bent pipe)	WildBlue, Astra-Net, iPStar	30 Gbps
Ka-band (on-board processing)	Astrolink, SpaceWay, Teledesic	30 Gbps
Mobile (3G MSS) (L-band) Airplane (Ku-FSS)	Inmarsat's B-GAN, New ICO Connexion	100 Mbps 500 Mbps

The new Ka-band systems use more focused beams that cover a much smaller area (hundreds of miles across, rather than thousands of miles with FSS) that form coverage cells like the illustration below. Adjacent cells use different frequency ranges but a given frequency range can be reused many times over a wide geographical area. In this way there is a large increase in overall capacity because of frequency reuse; the spot beam frequency gain is analogous to the difference between a direct-to-home broadcast signal and cellular phone coverage. From a practical standpoint, Ka spot beams provide 30 to 60 times the system capacity of the FSS approach. The increase system capacity to 30 Gbps plays a very significant role in helping to make satellite broadband services a long-term, economically viable business opportunity, as end-users' bandwidth requirements will only increase over the next five to ten years.



The Ka-band systems under development are being designed with two basic constructs: bent pipe and on-board processing. Bent-pipe satellites are essentially repeaters in the sky-they simply receive and retransmit signals without performing any additional functions like multiplexing, switching or routing. All waveform processing intelligence, like rain fade mitigation or data rate adjustment, is performed by the ground station terminal equipment. This bent-pipe approach is much less complex, less costly, and is less susceptible to obsolescence than the on-board processing approach.

Having said this, onboard processing has a number of benefits over bent-pipe technology and it will be deployed on three of the four forthcoming Ka-band systems as indicated in Table 3.

TABLE 3 - GLOBAL BROADBAND SERVICE OFFERINGS

Services	SkyBridge	SpaceWay	Astrolink	Teledesic
Data uplink (Kbps/Mbps)	16K- 2M	384K- 6M	384K- 2M	16K- 2M
Data downlink (Kbps/Mbps)	16K - 20M	384K- 20M	384K - 155M	16K - 64M
System capacity	~200 Gbps	~20 Gbps	~30 Gbps	~25 Gbps
Mesh connectivity	Yes		Yes	
Terminal cost (US$)	700	<1000	<300	<1000
Access fee (US$/mo)	30-40			
Service rates (US$) - Consumer - Business		$.05-$.50/Mbyte $1,000-$8,000/mo		$0.04/Mbyte

Number of Satellites	80	8	9 (in 5 orbital slots)	288
Frequency Band	Ku	Ka	Ka	Ka
Onboard processing	No	Yes	Yes	Yes
Inter-satellite links	No	Yes	Yes	Yes
Orbit	LEO	GEO	GEO	LEO
Satellite lifetime (years)		15		10
Expected cost (US$)	6.7B	3.6B	3.6B	9B
Operation scheduled	2002/2003 (full coverage)	2003	2003	2004/5

On-board processing payloads act as intelligent signal routers and switches, directing traffic from one spot beam to another within the same satellite or to another sibling satellite to provide large regional or global single-hop connectivity. On-board processing enables very efficient full-mesh broadband connections that can adapt quickly to changing data throughput and system loading demands—all key attributes for enterprise networking and the increasing importance of supporting peer-to-peer networking applications.

The new Ka-band systems under development will be deployed in two varieties—regional and global. Four major global offerings are planned as shown in Table 3, with most scheduled to launch services in the 2003-2004 time period. Common to each of these systems are high-bandwidth transmit/receive capability and hefty system implementation price tags ($4B to $9B).

The regional broadband offerings, summarized in Table 4, will provide the first indications of business plan success for the satellite broadband markets as several have launched this year (e.g., StarBand and Astra-Net) and the remaining will be in service in 2002. These systems are much less complicated than their global counterparts and have greatly reduced system price tags ($500 to $900M). The regional systems appear much more likely to succeed because of less technical complexity, but more importantly they appear to have far fewer business risks-significantly lower infrastructure costs, less regulatory concerns, and fewer distribution and service channel issues.

TABLE 4 - REGIONAL BROADBAND SYSTEMS

Services	**StarBand**	**WildBlue**	**iPSTAR**	**Astra-BBI**
Data uplink (Kbps/Mbps)	38-153K	384K- 6M	2M	2M
Data downlink (Kbps/Mbps)	40M	384K- 20M	10M	38M
Coverage Area	US	Americas	Asia	Europe

Market	Consumer	Business/SME	Consumer & Business	Business
Connectivity	Star		Star	Star
System Capacity		7 Gbps	35 Gbps (2-way)	
Terminal cost (US$)	< $350	< $1000	< $1000	~ $1800 < $450 (2001)
Access fee/mo (US$)	$60	$45		
Number of Satellites	1 - Telstar 7	2	1 @ 120E	1 - Astra 1H Astra 1K (2001)
Antenna Size (M)	1.2	0.8 - 1.2	0.8 - 1.2	0.5
Frequency Band	Ku	Ka	Ku & Ka	Ku/Ka
Orbit	GEO	GEO	GEO	GEO
Satellite lifetime (years)		15	12	10
Expected Cost ($US)		$700M	$500M	
Operation scheduled	Nov 2000	Mid 2002	Late 2002	Late 2000

4. The Economics

Broadband means bandwidth, and in any media more bandwidth means higher transmission costs. Until now satellites shining glory has been delivering content (TV, movies or real-time data) to large numbers of content consumers using a single transmission. The economic gain for this point-to-multipoint distribution in terms of cost per user/receiver is phenomenal and easily surpasses any other media—fiber, cable/coax, copper or wireless local loop.

However, for two-way interactive connections, satellites require a return channel from the user location, which significantly impacts the economic equation. Equipment costs are much higher than for their receive-only DBS cousins and perhaps more importantly, satellite bandwidth costs quickly dominate. Additionally, for non-spot beam systems, throughput capacity can quickly become a bottle-neck and served subscriber density drops significantly. The following tables and figures illustrate the economic differences between Ku- and Ka-band systems given the stated assumptions.

TABLE 5 - KU-BAND ECONOMICS

Assumptions	**Ku-band**

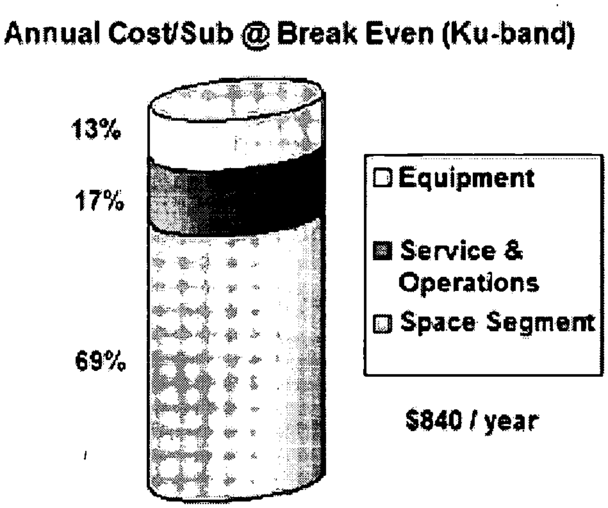
Cost/transponder/year (Avg 40 Mbps)	$1,800,000
Return-link service speed (Mbps)	0.128
Subs/transponder	12,000
Subscriber Rev per Month	$70
ISP and Customer Service cost/mo/sub	$12
Subscriber Acquisition Cost	$450
Customer life (avg) in years	4
Analysis (per subscriber) per year	
Annual Revenues	$840
Space segment costs	$150
ISP & customer service costs	$144
Annual Gross Margin	$546
Subscriber Acq Cost	$113
Cash Flow/Yr	$434
Subs/Transponder Necessary for Break Even	3,085
Cost/Mbps/Mo (all services included)	**$3,894**

As shown in Figure 2, the primary cost categories in offering service are space segment, service and operational expenses, and end-user equipment. As subscriber volume increases, equipment costs will fall to within $300 to $350, which will enable subscribers to purchase equipment without subsidies from service operators. Current Ku-band service providers subsidize the terminal cost to their customers, as the true terminal cost is in the $800 to $1,150 range.

TABLE 6 - KA-BAND (BENT-PIPE) ECONOMICS

Assumptions	**Ka-band Bent Pipe**
System Cost ($M)	$700
Satellite Life (Yrs)	15
Satellite Capacity (Gbps)	7
Return-link service speed (Mbps)	1.5

Subscriber Rev per Month	$50
ISP and Customer Service cost/mo/sub	$12
Subscriber Acquisition Cost	$450
Customer life (avg) in years	4
Analysis (per subscriber) per year	
Annual Revenues	$600
ISP & customer service costs	$144
Annual Gross Margin	$456
Subscriber Acq Cost	$113
Cash Flow/Yr	$344
Subs Necessary for Break Even	2,037,846
Cost/Mbps/Mo (all services included)	**$739**



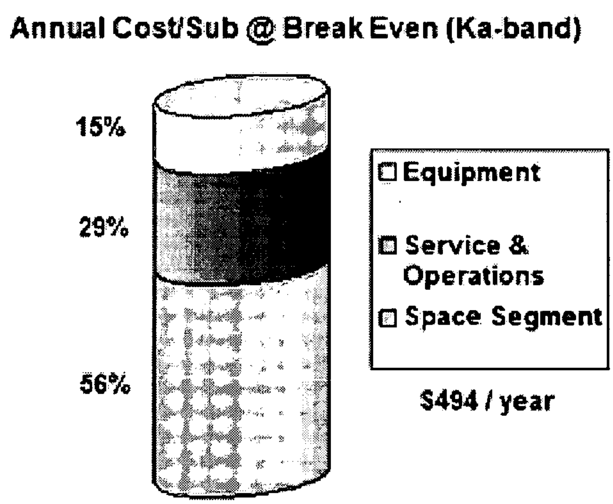


FIGURE 2 - SERVICE COSTS PER SUBSCRIBER BY SYSTEM TYPE

Key to reaching the $300 equipment cost level, is a strategy that uses key components that are already used in high-volume set-top consumer units, such as the DVB-S technology used for digital satellite TV or the DOCSIS technology used in the very large cable modem market.

The most notable economic difference between these two systems is the bandwidth per user cost basis (Mbps/subscriber/month). The bent-pipe Ka-band system approach enjoys a huge 82 percent savings over the Ku-band system. All of this savings can be attributed to the greatly reduced cost of air-time (space segment) for the Ka-band system. Thus broadcast (FSS) satellites are much more expensive than Ka-band spot beams for providing 2-way bandwidth intensive service.

Within the general telecom industry, studies show that a one percent decrease in costs results in a three percent increase in demand. Applying a similar model to two-way satellite broadband, the significant reduction in air-time costs with Ka-band systems could stimulate a two to four-fold increase in service demand. This greater demand yields increasing service revenues which in turn significantly increases the likelihood of business success.

The key to a successful service offering is attracting and keeping a satisfied subscriber base that is in excess of the breakeven points presented. The primary restriction with a Ku-band offering is the limited system capacity, which inherently limits the number of subscribers and therefore makes economic success more risky.

Both types of systems can further increase service revenues by augmenting basic Internet access with premium services, such as specialized content delivery and media-casting/streaming. Furthermore, it's likely that higher bandwidth service levels for power-users will be offered along with quality-of-service (QoS) guarantees.

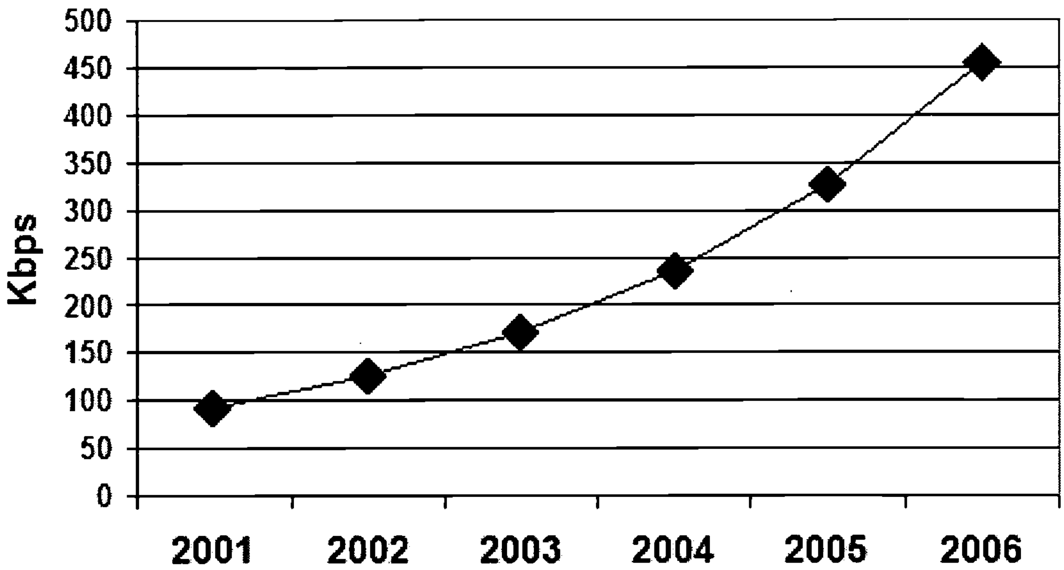
5. Performance & Trade-offs

Internet access and networking services will have an increasing dependence on high-bandwidth capacity. And, as shown in Figure 3, the expected bandwidth capacity need will increase three to four fold over the next few years. This demand for continual performance increase requires that service providers plan accordingly and carefully evaluate their overall implementation approach so that their businesses have longer term viability.

The commercial success of a satellite broadband service offerings will be closely linked with three key factors:

1. deploying a system with sufficient subscriber capability, service capacity and scalability
    - a high number of system users
    - a consistent quality of service (minimal click-response delays, perceived throughputs comparable to Figure 3, reliable/dependable connections, and various application support)
    - the ability to handle peak system loads well
2. maximizing the ROI of space segment (e.g., high utilization-subscriber/Mbps)
3. supporting essential business functions and practices in an efficient manner: service activation/management, customer care, billing, remediation, etc.

All of the above factors are significantly influenced by the overall system design and implementation. The first is closely inter-related as illustrated by a hypothetical system loading curve illustrated in Figure 4. System throughput and user demand vary significantly as a function of time of day and the types of applications used by the end-users. The application type affects the amount of data to be transferred, the timeliness of information and the number of concurrent applications to be supported across the network or a geographical area (e.g., within a particular spot beam).



Source: NorthernSky Research

FIGURE 3 - AVERAGE BANDWIDTH DEMAND FOR BROADBAND SUBSCRIBERS

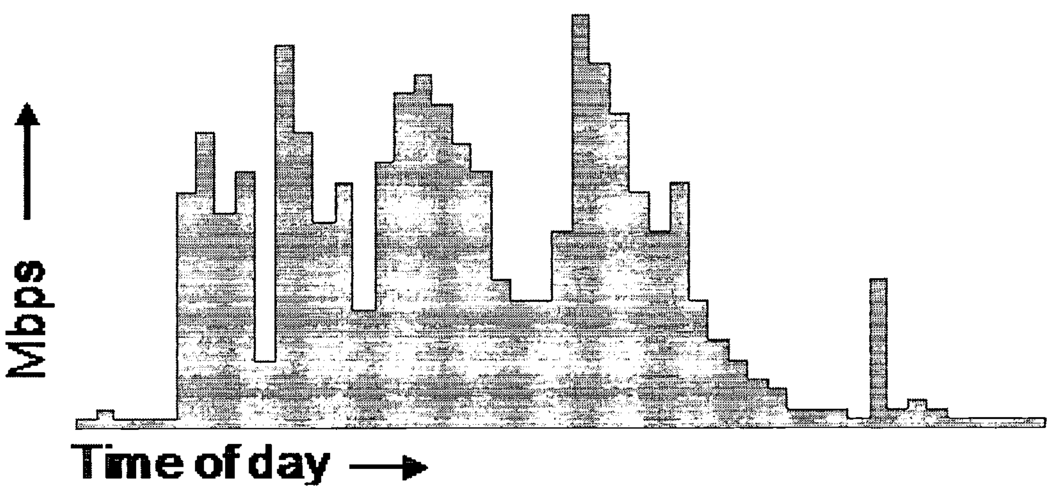


FIGURE 4 - SYSTEM LOADING & USAGE

By implementing a system that supports dynamic resource allocation in a controlled, easy to administrate fashion, a large number of users can be supported with a consistent quality-of-service experience. This approach relies on the basic premise that most subscribers don't use peak capacity all the time. In fact, dedicating a fixed amount of system bandwidth by data rate to each subscriber (or subscriber type) to address the quality-of-service need, is not only an inefficient use of overall system bandwidth, but it severely limits the number of end-users that the system can support. Furthermore, simple "peak-to-average" allocations are not sufficient to address the high demand for broadband access.

New advanced bandwidth-on-demand techniques allow for:

- flexible bandwidth allocation-e.g., high bandwidth applications get more system resource attention than web surfing
- prioritized bandwidth allocation-e.g., real-time applications over low-priority file down-loads
- "bandwidth pools" shared by many subscribers ensure large user population usage
- quality-of-service flexibility: priority based and connection based
- tiered service offerings:
    - enterprise customers: "metered" usage, by-the-minute or Mbyte
    - residential: flat rate usage, "all you can eat"

Many of these challenges are being addressed in the terrestrial broadband marketplace, especially by the hybrid fiber-cable system operators and equipment manufacturers. Within the United States the development of products based on Data over Cable Service Interface Specification (DOCSIS) 1.1, cable networks is moving from the best-effort service defined in DOCSIS 1.0 to the delivery of guaranteed service level agreements (SLA) for critical business applications. By implementing end-to-end Quality of Service (QoS) controls, cable system operators are:

- expanding their customer base by offering a wide variety of business and residential services
- building increased customer loyalty by offering bundled services supporting voice, data, audio, and video traffic
- creating multiple revenue streams from their HFC network

The second key factor in network design is addressing the largest cost in implementing broadband services, space segment. A partial remedy lies in implementing the latest in transmission channel modulation (e.g., 8-PSK) and coding techniques (e.g., turbo product codes) to maximize the bits-per-hertz signal density. These techniques produce considerable improvements. Even the DVB-S standard is in the process of adopting 8-PSK and turbo product codes. To further maximize system throughput and service availability, especially when dealing with Ka-band systems, many of the transmission channel parameters (e.g., coding rates, data rates, link power) need to be adaptive and adjusted in an intelligent manner on a dynamic basis. This capability is being built into the subscriber terminals and the associated network control system.

The third key factor in deploying a success broadband business is the most often overlooked within the satellite industry-provisioning the operating business functions. Figure 5 illustrates the system hierarchy for any broadband service offering, whether satellite or facilities based. Table 7 provides a brief explanation of each level.

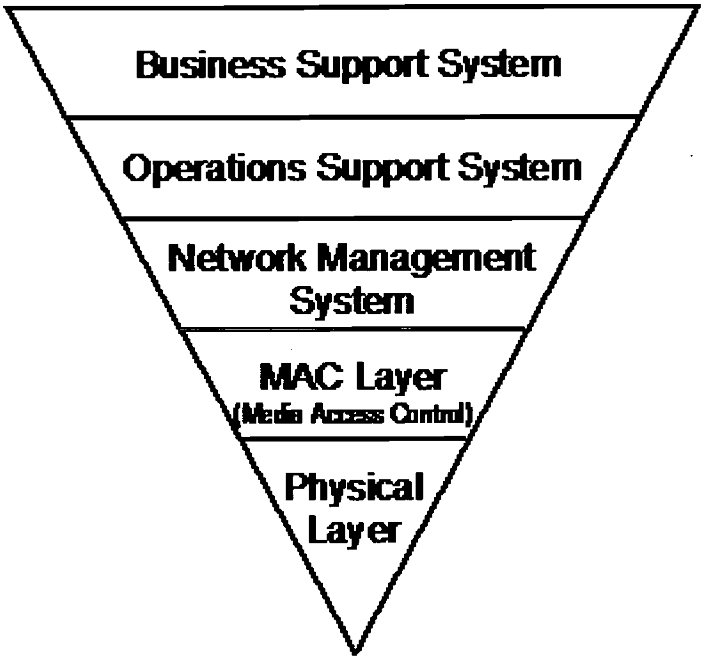


FIGURE 5 - BROADBAND SYSTEM HIERARCHY

TABLE 7 - SYSTEM HIERARCHY ELEMENTS

Element	Description
Business Support Systems	These systems include billing and mediation functions,
Operations Support Systems	These systems include subscriber service profiles, service provisioning, customer care functions and support, trouble ticketing, service measurements and tracking, etc.
Network Management System	The network management system provides control, monitoring and management of network resources. Real-time functions include resource allocation (bandwidth, power, capacity, etc), adaptation control (data rates, coding rates, etc), performance measurements, etc. Non-real-time functions include subscriber terminal parameters, subscriber service profile, satellite channel parameters, database management, etc
Media Access Control	The Media Access Control (MAC) layer is a protocol that controls access to the physical transmission medium on a network. This layer determines how data is transmitted and received on the transmission channel and implements some quality-of-service functions

Physical	The physical layer is the transmission channel. Attributes include frequency band, data rates, coding, modulation, power levels, etc.

Traditionally the satellite industry has focused only on the bottom three aspects (network management, media access and the physical {satellite channel} layer) and has ignored the operations and business support systems. However, service providers know differently, and the entire hierarchy must be implemented successfully to have a viable service offering. The early success of the initial digital cable modem rollouts in the United States was enabled by the emergence of the DOCSIS standard, which addresses all levels of the hierarchy.

While the DVB-S standard has made possible the success of the global digital television broadcasting market, the underlying service is one-way. The Starband and DirecWay systems use the DVB-S standard for the outbound broadcast channel and use their own proprietary technology for the return channel.

In early 1999 an ad-hoc group was formed to facilitate a standard for a return channel via satellite, DVB-RCS. The DVB-RCS specification provided definition of the various network independent layers (e.g., physical and MAC) only and left the network management and offered services for the network operators and service providers to define. The DVB-RCS is emerging as one of the baselines for broadband satellite services as recently deployed by Astra-Net in Europe. Standards are important for a number of reasons:

- enable multi-vendor participation and adaptation
- facilitate high volume production in a competitive environment, ultimately leading to mass-market (low-priced commodity) products
- enable market growth as services/products become widespread.

WildBlue has based its Ka-band system design on a satellite-enabled version of the DOCSIS 1.1 standard. This approach provides four primary advantages: low cost subscriber terminals by leveraging very high volume chip sets; fast time to market through minor modifications to existing chipset design spins;immediate availability of a very mature set of infrastructure products for network control, system management, subscriber management, and billing systems and the ability to leverage the huge investment in advanced networking features in DOCSIS 1.1 that support QoS and other advanced networking features.

In sharp contrast to the consumer market based WildBlue system is the Astrolink system which is focused on the corporate enterprise networking and Internet access market. Astrolink plans to provide:

- data, video and voice services that support business applications;
- interactive or two-way high-speed connections
- point-to-point service, as well as multicasting content delivery services

The Astrolink system approach puts advanced packet switching technology onboard the Ka-band satellite. Using the asynchronous transfer mode (ATM) protocol, the Astrolink network will be able to accommodate multiple types of data, video or voice traffic. ATM's ability to guarantee quality-of-service levels has led to its widespread adoption by the telecommunications industry. In addition, ATM makes it possible to bill customers for their actual network usage if they so desire. By paying only for the bandwidth they use, when they use it, Astrolink will be able to offer customers significant service cost savings. Ka-band operation ensures that network terminal antenna size remain attractively small and low-cost.

6. Summary

Globally there is a strong need for new two-way broadband systems to reliably deliver IP-based services to large numbers of residential subscribers and enterprise users. Current infrastructures do not provide the necessary capacity, reach capability and service price points to satisfy this growing demand in all geographical areas-and satellite based systems are being deployed to provide the needed broadband "local-loop" service. Because of the diverse market requirements-service and network terminal costs, types of services, throughput performance and service quality levels-no single broadband system can address multiple market segments.

To achieve commercial success, service providers must tailor the network implementation to fit the market needs. The limited success of the first generation satellite broadband systems is restricted in part by the high-cost of satellite space segment and the less-than-optimal network throughput and operational performance. The new second generation systems are customized to address their target markets. With significantly reduced bandwidth costs and greater subscriber population capabilities, these second generations systems have a significantly greater chance at achieving commercial success.

back to index

Abstract

There are a number of economic, business and technical considerations in bringing broadband services to the marketplace using satellite based facilities. The basic concept that "one network can satisfy all broadband markets and applications" is challenged in this paper and shown to be too simplistic. In light of these three considerations, the basic satellite systems concepts (GEO and non-GEO) are evaluated, along with the requirements of the various market segments (consumer, direct-to-home, enterprise, VSAT, SOHO, and mobile), and the various system approaches being deployed or under construction. The intent of this paper is to inform the reader concerning market needs, economic drivers, system performance and service costs trade-offs and considerations. In addition some new concepts are presented that address what broadband service users and operators are really looking for.

back to index

Mark Dankberg

Mark Dankberg is Chairman, President and CEO of ViaSat, Inc. He co-founded ViaSat in 1986 and has led the company to fourteen consecutive years of revenue growth. ViaSat has been on the Inc. 500 list of the fastest growing privately held companies three times, and twice has been listed on the Business Week Hot Growth list. ViaSat went public in 1996 and is listed on NASDAQ under "VSAT".

Mr. Dankberg earned BSEE and MEE degrees in electrical engineering from Rice University. He began his career as a systems engineer in the Collins Radio Division of Rockwell International. While employed at Rockwell Collins he was also a part-time instructor in electrical engineering at Cal State Long Beach. Prior to co-founding ViaSat, he was a business area vice president at M/A-Com's Linkabit subsidiary in San Diego. There he led programs in satellite networking and digital voice communication, and helped establish Linkabit's VSAT business, which along with another M/A-Com division, became Hughes Network Systems.

Mr. Dankberg has had influential roles in establishing a number of US government satellite communications standards, including those for Demand Assigned Multiple Access (DAMA) networking, jam resistant satellite links, and satellite messaging systems. He has authored numerous technical papers on satellite networking, digital voice communication and jam resistant communications. He is now involved in developing new standards for commercial satellite networks for national and international public switched network access.

Mr. Dankberg is a member of the board of directors of REMEC, a publicly traded San Diego-based manufacturer of multi-function microwave modules and subsystems; and Connected Systems, a privately-held Santa Barbara producer of digital voice messaging network systems. Mr. Dankberg also serves as a founding member of the board of directors of the San Diego Telecommunications Council and on the San Diego County Regional Economic Task Force. He is also a member of AFCEA and IEEE and at one time was Chairman of the Communications Society for the San Diego section.

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John Puetz is President of MasterWorks Communications, a consulting firm based in San Diego County, California. MasterWorks provides business and technical engineering consulting services to the global satellite communications industry, Wall Street and private industry. MasterWorks launched the Internet's first information portal, www.esatcom.net, dedicated to the satellite communications industry,.

Mr. Puetz has been in the satellite communications industry for over 17 years and has been intimately involved in the VSAT industry since it's commercial inception in 1985. He has authored numerous papers, spoken to audiences around the world and writes a monthly column and feature articles for Broadband Satellite Magazine. Mr. Puetz's fields of expertise in satellite communications include Internet access, wide area networking, VSATs, IP multicasting, rural telephony and digital audio broadcasting. He was key in the formation of the Global VSAT Forum in 1997 in which MasterWorks is an active member. He is also a member of the Pacific Telecommunications Council (PTC) and the Society of Satellite Professionals International (SSPI).

Prior to forming MasterWorks in 1999, Mr. Puetz was director of business development at ViaSat, Inc and was instrumental in launching their commercial satellite networks division. Before joining ViaSat in 1994, he worked in business and engineering roles for ComStream, Inc and for M/A-COM Linkabit from 1983 through 1989.

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back to index

The Benefits of Taking the Long View – Assessing the Effect of Life Cycle Costing and Risk Management on the Business Plan of Next Generation Ventures. A Case Study in the Submarine Networks Environment

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View Abstract

1. Introduction

The task of assessing the business plans for next generation telecommunication network build is complicated by the unprecedented uncertainty in both the economic and technology markets. Future proofing the plan against changes in technology/pricing levels between achieving seed finance and ready for service dates, is difficult enough. To consider the impact of possible market changes over the projected lifetime of the system could be considered as the rightful remit of the fortune-teller. For submarine cable systems the risk associated with using un-proven technologies along a unique route, on a hostile seabed, makes the challenges facing a network project even more daunting. Additional analysis is needed to aid decision-making in such an environment.

Historically much of the focus in business plan analysis has been on revenue; timing; technology and quality trade-offs that mainly relate to the specification and procurement of the system. Little regard was paid to how the system would be maintained. An arbitrary 25 year system lifetime was assumed. Some system specifications still request 15 to 25 years design lifetimes. These were originally specified for transatlantic systems when it was thought that this would be the time before another cable was required. We are beginning to see actual economic and technological lifetimes of cable systems less than half of this, and still decreasing. In practice, once the network is installed, the actual useful life of the system in the system could be considered to be simply the crossover point of when operational and maintenance costs exceed the current market revenue for saleable capacity on the network. This is at the point where the system may be taken out of service.

2. The project whole life costs

The impact of the uncertainties on the lifecycle and profitability of a project is illustrated in Figure 1.

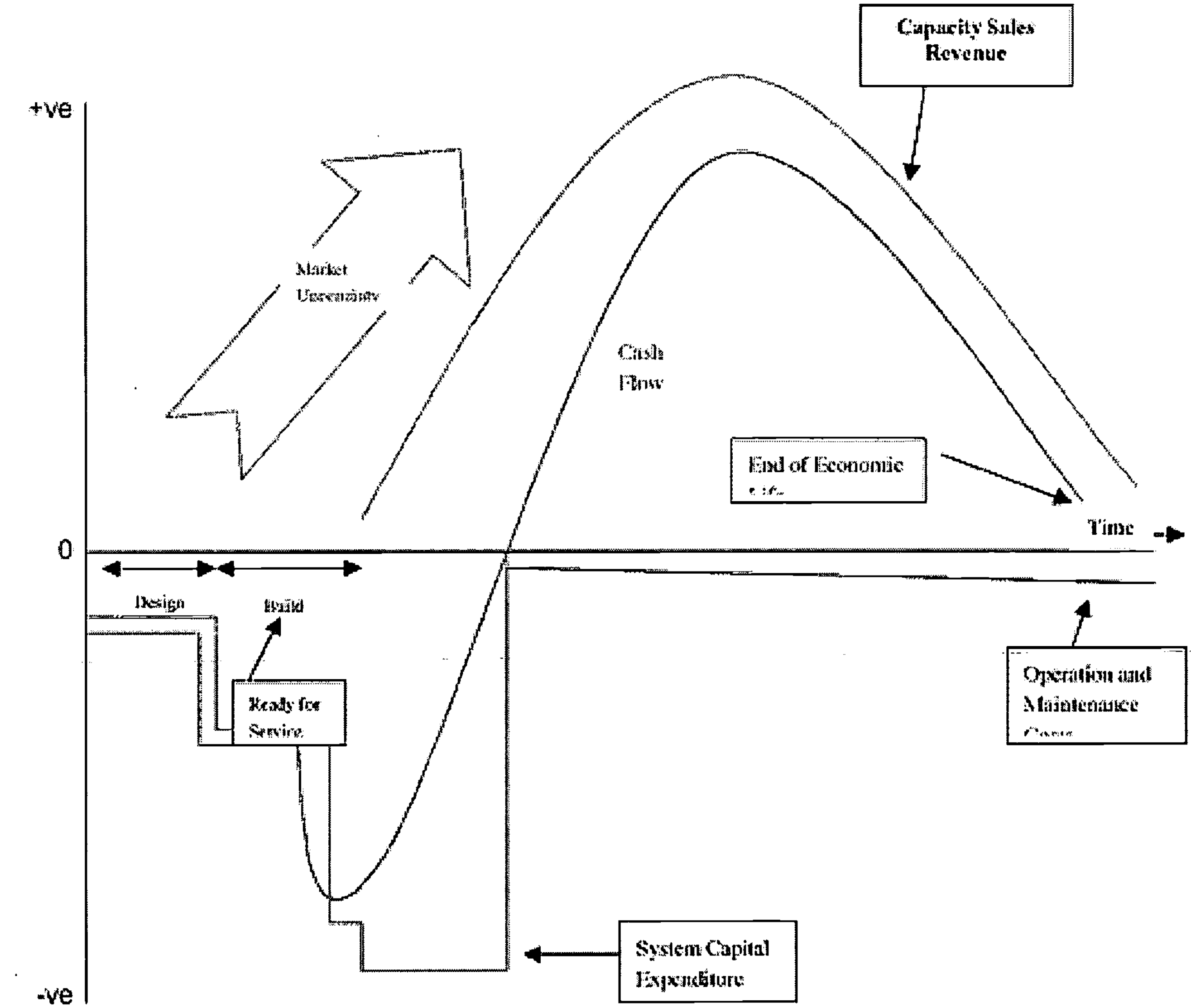

FIGURE 1: UNCERTAINTY AND ITS IMPACT ON PROFITABILITY OF NETWORK BUILD

This illustrates the importance of both minimising time to ready for service dates and operation and maintenance costs to maximise the area 'above the line'. The investor has much less control over the other variables, for example sales revenues.

Recent risk analysis of submarine cable projects, by the insurance industry[1], has shown that 80% of project uncertainties can be managed by appropriate care in survey, burial assessment and the selection of marine resources.

3. Managing risk associated with ready for service dates

The industry is rightly focussed upon the need to minimise time from the inception of a project, to ready for service dates when revenue can commence. Much has been done already to improve the time-scales involved. Figure 2 illustrates this improvement by looking at the project time frames for successive generations of SEA-ME-WE consortia cable systems[2]. The comparison, when normalised for length against duration, show that SMW3 was brought into service in less than a third of the time of SMW1.

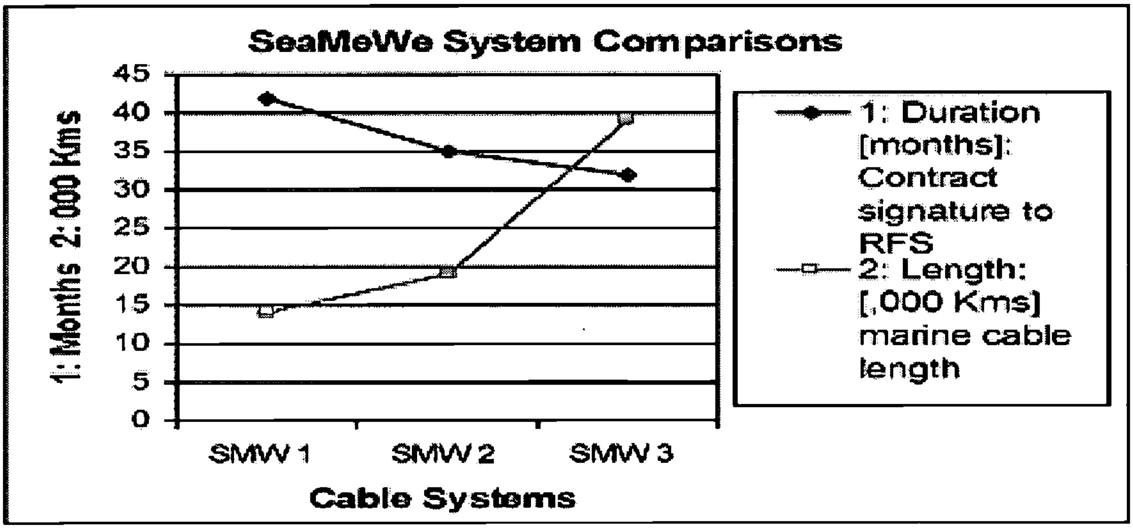

FIGURE 2: TIMESCALE IMPROVEMENTS FOR THE SEA-ME-WE CABLE SYSTEMS

In order to find any additional improvements in timescales for bringing systems into service, a more radical approach may be needed. Focussing on operations that are on the critical path of a submarine cable project identifies where operational efficiencies are likely to achieve the most reward. Figure 3 is the result of analysis of the operations on the marine critical path of recent Trans-Pacific cable networks[5].

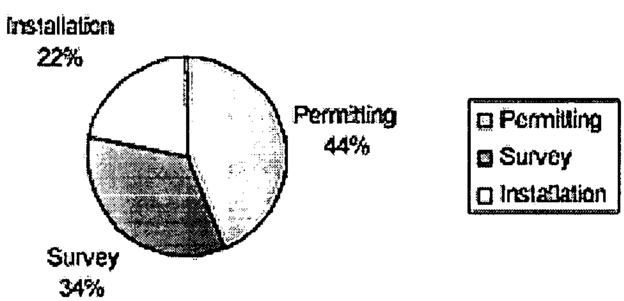

FIGURE 3: DURATION OF MARINE OPERATIONS ON THE CRITICAL PATH

These findings are completely inline with Pareto Analysis (or the 80/20 rule). In addition significantly less than 20% of the marine costs are spent on Permitting /Survey activities which occupy the critical path for almost 80% of the time.

Looking at each of these operations in turn:

3.1 Permitting

Recent delays in permits for Trans-Pacific systems underline the need to consider permitting at the earliest stages of the project. Experience of past projects, combined with a global database of agencies/requirements, can be used to perform detailed permitting plans and risk assessments. These should be included as part of the initial project feasibility study. Over 80% of the information required, to support permit application, is in the domain of the Marine Contractor3. Sub-marine cable maintenance also needs ongoing permitting and fishery liaison to 'maintain' the relationships with outside agencies that are essential for prompt repair operations.

3.2 Survey and Burial Assessment

Time pressures can make the results of surveys and burial assessments too late to have the appropriate influence upon cable armouring, cable routing or burial depth decisions for the system. Better planning of survey and burial prediction can ensure the right data is available in time to support high quality decisions. The most time efficient method of doing this is to undertake the feasibility study/survey/BAS independent of main system contractor selection.

Survey time can be minimised by using other data sets (such as Global Marine Systems' fault performance model), to identify high-risk areas where appropriate survey/ BAS techniques can be concentrated.

Again a comprehensive feasibility study to support the business plan is key to early identification and minimisation of the project risks.

3.3 Installation

Although installation is not a major contributor to the marine critical path, some improvements can be made without affecting the security of the cable. For example, jetting ploughs can be used to achieve target burial faster and faster multi-vessel installations, such those achieved for East Asia Crossing and APCN2 (where up to 7 main lay vessels) were in operation at the same time.

4. Managing the lifecycle cost- the impact of a secure system upon business plan viability

The lifecycle cost of a system is the total cost of procuring, financing and administering the system prior to it coming into service, and thereafter the ongoing operational and maintenance costs for the economic life of the system.

4.1 Minimising operation and maintenance costs

It has already been established that, to maximise the economic life of a cable, the operation and maintenance costs must be minimised. This is a more complex matter than just finding the most cost effective maintenance solution. The principal driver for maintenance costs is the number of repairs that the system will have during its lifetime. The planning and quality that is applied to the system before RFS is a major influence on these costs.

More than 80% of all faults occur in water depths of less than 1000m[4]. Analysis of four years of global repair records in these depths showed more than 70% reduction of fault rate between marine installation contractors. This reduces the system repair costs by a similar amount and greatly increases the cable's availability figure.

A fault data model has been developed that can estimate the expected fault rate of a planned cable system, based on its regional and depth profiles. This can be used, in conjunction with a risk scorecard, to estimate the future fault history of a system and thus its life cycle costs. The depth/length profile for a system similar to SEA-ME-WE2 is shown in Figure 4.

	Regions				
Depth of Cable	Atlantic	SE Asia	North Sea	Mediterranean	Rest of the World
0<D<100		1148			784
100<D<200		94			84
200<D<500		23			254
500<D<1000		80			1054
1000<D<2000		43			1464
D>2000		1921			5573
All Depths	0	3309	0	0	9213

FIGURE 4: LENGTH- DEPTH PROFILE OF THE CABLE MODELLED

The expected faults for the cable will lie between the upper and lower bounds of the ten-year fault projection given in Figure 5.

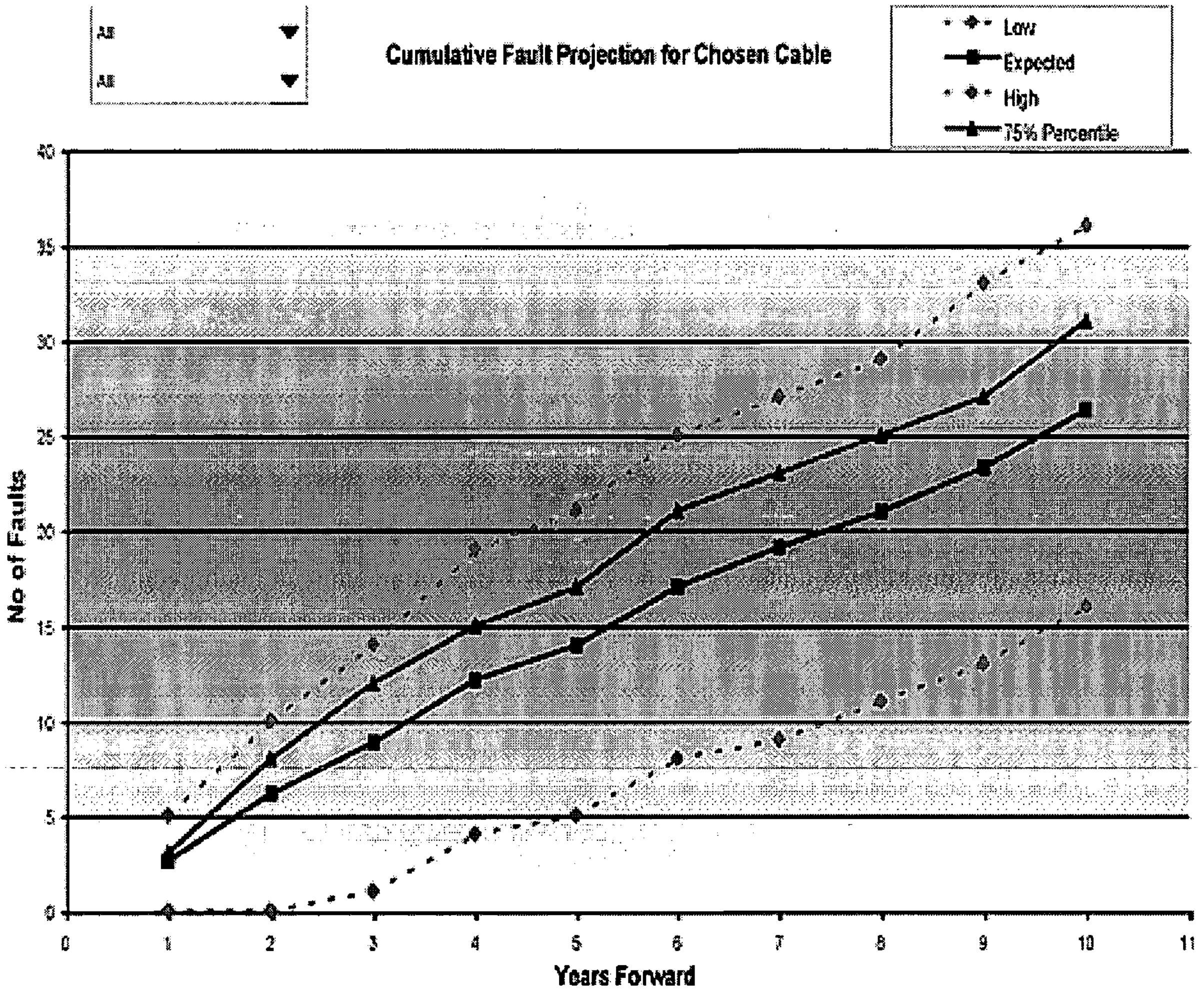

Figure 5: Fault projection over the first ten years of the cable's life

Many factors determine which boundary that the fault trend will follow. Installation and planning quality have already been mentioned. The other major factors that affect the fault rate of a system are shown in Figure 6.

Risk No.	Identified Risk	Risk Level
1	**Number of Landing Points**	**HI**
2	**Cable Route**	
	Topography:	
	Sand waves > 2 metres	**LO**
	Miscellaneous features	**HIGH**
3	**Seabed Geology**	**LO**
	Stiff Clay	**LO**

	Mud		**Med**
	Sand		**Med**
	Gravel		**Med**
	Rock		**HI**
	Chalk		**HI**
4	**Water depth**	0-100m	**HI**
		100-1000m	**Med**
		1000m+	**LO**
5	**Route Length**		**HIGH**
6	**Crossings**		**LO**
7	**Fishing Activity**		
	Trawling		**HI**
	Other Fishing		**HI**
8	**Anchoring Area**		
	Large Vessels Anchors>10 T		
	Small Vessels Anchors< 10T		
9	**Fault History**		
	Commensurate with the region:		
10	**Burial protection**		
	Commensurate with Burial Protection Indices		

Figure 6: Marine operational risk assessment

4.2 The impact of different marine fault rates on life cycle costs

There will be considerable difference in the impact to both the owner's business case and reputation, between the low case prediction of 15 faults over 10 years and the high prediction of 35 faults over 10 years.

Figure 7 summarises the effect of a 'good' and 'bad' cable planning/installation in terms of life cycle costs

A nominal figure for ships repair time and replaced submarine plant is assumed at $420k dollars per repair. Thus the impact upon system profit is an additional $8.4 million. However the implications are more far reaching than simple repair costs. The increased frequency of repairs increases the probability that subsequent repairs will incur greater cable downtime. This is due to the vessel could already be working on a previous repair. If the system is not able to be fully restored, the impact on the availability figure is significant. For example, one average 14-day repair per year on such a system will reduce the availability figure to 96%, well below the normal Service Level Agreement (SLA) value. An additional 5% to the system cost has been assumed to improve cable risk profile for example by improved route survey/selection and burial assessment and burial

The adoption of bandwidth trading by the telecommunications industry would have tremendous impact upon the lifecycle costs. Cable system availabilities will be measured (and probably published, by independent organisations and penalties charged if the SLA is not met.

The magnitude of such penalties is best illustrated by example of a SLA for bandwidth trading. For any month with service unavailability of greater than 36 hours, one and one half (1.5) times the Monthly Contract Price would be payable as the penalty. Although there may be relief credits for the occasional breach, recurring faults would incur such a penalty. If just 10GB/s of a 80GB/s transpacific system were committed to bandwidth trading, at a monthly lease price of $13 million, the penalty would be almost $20million for each repair that caused the SLA to be breached. Even if the system were fully restored using another carrier's network, the costs for restoring such a high capacity system could also be of the same order of magnitude.

Lifecycle cost	**Low fault scenario** (15 over 10 years)	**High Fault scenario** (35 over 10 years)
Cable System purchase	$793 million	$755 million
Cost of repairs	$ 6 million	$ 15 million
Cost of SLA penalty/restoration	$ 300 million	$700million
Total repair cost	$306 million	$715 million
Total repair cost as % of system cost	39%	95%
TOTAL LIFE COST	$1099 million	$1470 million

Figure 7: Comparison of life cycle costs for high and low fault rate cable.

5. Managing the technology- how a long-sighted approach to maintenance future proofs the system life

The risk impact of adopting immature technology in the Marine Environment is much greater as submerged plant cannot be upgraded. The balance between competitive advantage of the latest technology, and the risk of delays in bringing it into service are best managed by an independent risk analysis. The common approach is to implement the system using currently proven technology, but promising future upgrade ability to more wavelengths and higher transmission speeds.

The design capacity of many systems currently being installed in the Pacific can be more than 30 times higher than the initial capacity configured at ready for service dates. One of the major limitations to upgrading such systems is the need to manage a signal distortion effect called dispersion in the cable. It is vital that a clear and practical marine repair philosophy is used to manage dispersion during repairs. Otherwise the future upgrade ability of the system can be compromised by a repair rate higher than anticipated at system design. Using a marine contractor trained to manage many different dispersion regimes, as well as minimising the amount of repairs, on the cable is key to achieving this aim. Proposed transmission solutions must be tested for their robustness in a number of repair scenarios.

6. Conclusion

There are many aspects of life cycle cost of a submarine cable system that are influenced by the managing of marine risks. Both financial and technological risks need careful assessment.

A detailed feasibility study (including permitting risks), survey and cable protection analysis is key to managing these risks. To ensure the minimal impact on system Ready for Service dates; these operations should be let independent from system supplier selection. The independent marine contractor is uniquely placed to provide this service.

The management of its transmission performance during maintenance operations is key to ensuring the future proofing of a system against obsolescent technology. Marine expertise needs to be used to ensure the practicality of doing this in the marine environment.

The system should be designed and installed for minimum repairs, thus minimising life-cycle costs and maximising the cable system's profitability. The advent of commodity bandwidth markets and terabit capacity systems will increase the importance of system security in the future.

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back to index

Abstract

This paper examines how risk management techniques and life cycle costing can assist the financial markets in business plan assessment. It also suggests how the marine contractor can support this assessment. In particular the following phases of a submarine cable network business plan are considered:

a) Managing risk associated with ready for service dates.
b) Managing the lifecycle cost- the impact of a secure system upon business plan viability
c) Managing the technology - how a long-sighted approach to maintenance lengthens the system life.

back to index

Murray Eldridge

Global Marine Systems Limited, UK

After 13 years at sea culminating as a Master Mariner in the oil and gas industry, Murray joined Dutch company Smit Internationale in 1984 as Chartering Manager. He moved into project management of subsea oilfield development after which he became General Manager for Smit's UK operations in 1987. Murray joined BT Marine in 1990, where he obtained his MBA, and in 1994 moved to Singapore as Regional Manager, Asia Pacific. In 1997 he moved to Cable & Wireless Marine's Chinese joint venture company S B Submarine Systems as General Manager where he was honoured in 1999 with the coveted Magnolia Award by the Shanghai Government. As Global Marine's Director of Customer Services, Murray is responsible for strategy, sales and proposals, resource utilisation, service development, cable system maintenance opportunities and for shallow water services.

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back to index

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Jan Stringer is Senior Manager, Service Development. Jan completed her honours degree in Electrical and Electronic Engineering in London and is a Chartered Engineer with various postgraduate qualifications in both Management and Marketing. She has over twenty years experience in the Telecommunications Industry, fulfilling both technical and marketing roles in Satellite, Mobile and latterly Submarine Cables. Within Global Marine Systems Jan is responsible for translating market demands and trends into new services and resources.

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back to index

Meeting the Business Plan Milestones for New Submarine Cable Systems — The Interdependence and Phasing of Key System Planning Processes

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View Abstract

1. Introduction

The submarine telecommunications industry needs no reminder that the bubble of explosive growth in the demand for new systems and capacity has well and truly burst. Parallel with the inflation of the bubble, the industry had been undergoing radical changes in structure from being an industry largely controlled by a relatively small number of state owned PTTs to an industry in which deregulation had brought about a rapidly increasing number of competing private carriers. Among these new carriers was an aggressive entrepreneurial breed of investors who challenged the old conservative order. What we now see are many of these new players, even the largest and seemingly most robust, filing for bankruptcy protection, or disappearing altogether.

The seemingly insatiable demand for telecommunications capacity has suddenly dried up and the hype of rapid payback on investments has been silenced. These factors coupled with deregulation and the new order entrepreneurs, were not only driving the spectacular pace of advances in submarine telecommunications technology, these factors were fuelling competition. Competition in the submarine telecommunications industry until the downturn was not restricted to competition between carriers for the available traffic, competition could also be found in the application of leading edge technology, competition for the most secure subsea routes, and competition for the available system implementation capacity including system manufacturing capacity, availability of experienced route planners and engineers, availability of survey and installation vessels.

The carrier's reaction to competition was to squeeze system suppliers into ever-faster response times. The resultant compression of lead-time between wish list to ready for service flowed through all system implementation phases such as system planning, the proving and delivery of contracted technology, the manufacturing process, the route survey, installation and system commissioning.

The purpose of this paper is to consider the lessons learned from compressed lead-times on critical components of the system planning process. Specifically, the paper addresses some of the pitfalls experienced in the system planning and to long-term system security by attempting to compress the uncompressible and argues that by adopting properly thought out, well organised and systematic planning processes, the *more haste less speed* scenario and compromised system security so frequently seen during the "silly season" clamour to install new systems (1998 — 2000) can be avoided without necessarily jeopardising the declared milestones in the Business Plan and targeted ready for service date.

2. Wish List to RFS — A Review of the Processes

From the initial development of the concept that it might be a good idea to construct a new submarine telecommunications system, a number of interlinked and interactive processes are required to convert the concept into a secure, financially successful reality.

Some of the more important processes may be summarised as:

- The development of the Business Case to present to banks, potential investors and capacity buyers
- Feasibility study and preliminary system planning
- Detailed system planning
- Desktop study
- Marine route survey
- Burial assessment survey
- System manufacture
- System installation
- System commissioning

In the days when the club consortia cable ruled supreme, the above activities progressed more or less sequentially with adequate time for review during and at the completion of each phase. The planning and implementation lead-time of a long haul system under the old consortium model was typically in the range 3 — 4 years. In the highly competitive and aggressive environment prevailing during the peak of new system launches, owners were requiring even long haul ring systems to be earning revenue within as little as 18 months from, eureka "what a good idea", to RFPA.

To meet these highly compressed implementation lead-times, parallel tasking was clearly required; however, with parallelism came some potentially serious consequences. The pitfalls of parallelism frequently stemmed from attempting to compress uncompressible tasks that lay firmly on the project execution critical path. These tasks in many cases had lead-times that were independent and outside of the control of the owners and/or the various parties contracted to implement the system. When such tasks were run in parallel with activities that could respond to task acceleration, unless there had been proper phasing of activities, bottlenecks that obstructed the forward progress on the project were inevitable.

Parallel tasking phase disruption were major causes of cost and schedule overruns, which, because of the pressures exerted by frustrated and impatient owners, often resulted in either inadequately thought out attempts at reactive remedial measures that all too often exacerbated the situation, or compromises were made to long term system security. The following sections offer some examples to illustrate the above scenarios.

3. Developing the Business Case

As part of the development of the Business Case for the new system, initial system architecture and configuration will have been determined by the location of centres to be serviced which would have been backed up with traffic and capacity take-up forecasts, existing network infrastructure, nodes and back-haul availability. While it is beyond the scope of this paper to look at the development of the Business Case specifically, it is nevertheless important to mention that even at this early stage in the evolution of the system when RFS targets will be considered, consideration should be given to potential critical path activities.

Among the critical path tasks will be the availability of supplier manufacturing slots, installer availability, possibly even the potential availability of survey contractors and survey vessels. However, what is often neglected or at best underestimated at this early stage are issues that are major contributors to project delays and cost overruns. Issues concerning lead-times for complying with regulatory and permitting matters, lead-times to conclude landing party agreements, lead-times to resolve way leaves and rights of way, lead-times to conclude negotiations with fisheries, and the impact on the project of seasonal weather patterns and their influence on marine operations, and a common lack of understanding of the interdependence of the various permitting and regulatory issues.

While the documentation from the studies that comprise the eventual output of the Business Case are formatted more as a document to attract investors, financing and capacity purchase; banks and other financial institutions have become considerably more discriminating and more demanding that the issues discussed above have been properly considered. Without a demonstrably properly argued and properly thought out auditable business case fully addressing these issues new projects are unlikely to attract financing.

One of the more successful reality checks when considering critical project milestones is reverse engineering. Reverse engineering the system constrains the system developer to work backward from the target RFS milestone, factoring in to the project scheduling issues such as those discussed above. However, this process will not deter those who wish to adopt the rose tinted view of the project, or those who adopt the approach of the flowing down of problems to those lower in the project food chain, hoping they will disappear. An illustration of this last point is the attempt by some owners to flow down responsibility of certain critical permitting activities to their suppliers, where the regulatory requirements demand direct owner/regulator communications.

4. Permitting

Underestimating permitting issues is a frequent cause of project delay and missed Business Plan milestones. A thorough understanding of the permitting requirements pertinent to the construction of the system is therefore imperative, and certainly prior to committing to RFS dates. There is no doubt that under the prevailing economic conditions, any Business Plan audit will pay particular attention to how well permitting has been addressed and lead-times anticipated in the Business Plan. Permitting regulations vary by country and it is therefore impossible to provide an exhaustive and definitive discussion in this paper on the subject. The following presents a generic example of permitting procedures as might apply to a new system.

Embedding a cable into the seabed is often regulated under an Environmental Impact Assessment Ordnance (EIAO) requiring an Environmental Permit (EP) to be approved and issued prior to construction. The EP may require that the application forms part of a mandated EIA, or in certain cases, a direct application for an EP may be entertained by the regulating authority rather than going through the typically more lengthy EIA (Environmental Impact Assessment) process. The direct approach may be based on submitting a Project Profile, which incorporating a general environmental assessment. Part of this process would typically require meetings with all relevant concerned parties, comprising government bodies include environmental protection agencies, and agencies having interests in agriculture, fisheries and conservation.

Depending on the route, it there may also be a requirement to undertake ecological studies, water quality monitoring and modelling studies and a marine archaeological investigation (MAI) may be requested.

It should be noted that any significant change to the route or methodology during the permitting process might require the Environmental Permit to be re-issued if the route installation impacts any sensitive areas. Where changes are deemed to present minor impact, a variation to the original submission to qualify changes may be allowed. The lead-time for these processes may vary from two to six months. Where a variation is required this lead-time may well be extended by between one and three months.

As submarine cables terminate at the beach manhole (BMH) it is typical that ordnances governing the near shore and foreshore will be in force. Such ordnances may require that the regulator gazette details of the intended installation and maintain such a gazettal for a prescribed period of time which may range from two to as long as six months. This process will typically require provision of the system RPL and overall project information (similar to the Project Profile). Where routes pass through areas regulated by local marine departments policing vessel movements, safety and navigation, any requirements directed by these departments would typically included in this process.

In addition to any gazettal for the marine portion of the route, an additional permission is typically required from the local lands department and/or local landowner for the land portion of the route. This would be in the form of a Wayleave Application to occupy the land. Depending on the area concerned for the proposed land part of the route, this application may have to include submission to ant geotechnical controls office. In addition, if any trees or ecologically sensitive areas are to be effected, then a permit must be obtained from the relevant regulating authority. Similar approvals will also have to be sought to bury cables across a beach if it is near a bathing beach.

It should be noted that where significant changes to the route are made once the permitting process has started, the gazettal will be impacted. If changes exceed certain published (sometimes unpublished) criteria this may severely impact the gazettal schedule as such changes will have to be reincorporated into the gazettal with both the government and public consultation periods restarted.

5. Preliminary Planning & Route Engineering

Pre-survey planning and route selection processes comprise three main elements:

- Preliminary Planning
- Landing Site Selection
- Desk Study

These issues are discussed in more detail in Evans 1998 [1].

5.1 Preliminary Planning

Preliminary planning and route selection in some cases will have been addressed when developing the Business Case, particularly where system suppliers have been requested to submit Rough Order of Magnitude pricing or where an Executive Desk Study has formed part of the Business Case process.

The preliminary phase of system planning is an area where lead-times can and have been compressed due to the availability of public and private domain databases available on the Internet or other electronic media. These databases reside with national and international institutions, government agencies and in private service companies supporting the submarine cable community. These databases and route planning software packages such as the Global Marine Systems GeoCable and Makai Route Planner, provide the system planners with useful tools to quickly gather and consolidate a wide range of information that has traditionally required time consuming research from a range of disparate sources, and, provides for higher level planning at the preliminary route selection stage.

Information is available on many of the political, cultural and physical parameters impacting route planning. Although the availability of these databases contributes to accelerating the processes of route planning in general, it is the large transoceanic and interregional systems where the greatest potential for compressing planning lead-time has been realised.

The pitfalls of placing too much emphasis on the use of databases in planning the system lies primarily in the inconsistency, accuracy of information and geographic coverage of critical information such as hydrocarbon production areas, military exercise areas, accuracy of seabed features and topography etc. Such pitfalls make it essential for system planners to be cognisant of the strengths and weaknesses of the information being used and correlate information between multiple data sources

During the preliminary planning phase of the project, it is important for the design team to identify, assess and evaluate the risks and hazards to which the cable system may be exposed during its design life. The system planners are then able to design a route either avoiding potential hazardous areas or, where this is not feasible, estimate the costs of damage prevention engineering. These considerations are particularly important where systems are to be installed where traffic restoration possibilities are restricted and where system owners may have limited access to maintenance facilities. During the preliminary planning stage, the potential need for exotic installation procedures should be identified and costed together with the system life cycle maintenance budget.

5.2 Landing Site Selection

Landing site selection has been treated separately in this paper as this process has proven to be one of the most important contributors to project delays and cost overruns. Often landing site finalisation does not respond to attempts at lead-time compression, and owners and planners should therefore be aware of the potential dangers of parallel tasking this process as discussed in Section 3 above. The problems associated with landing site selection are more prevalent with private systems than with the traditional club cables. There are several contributing factors within which problems are experienced when attempting to finalise landing site locations, these include:

- Club carriers own and control most existing landing sites and cable stations resulting in potential conflicts of interest with private system investors
- Failure of new carriers to understand lead-times to conclude landing party agreements, and the interdependence of landing party agreements and permitting requirements.
- Protracted multiple negotiations between owners and alternative landing parties
- Regulators lack of experience in dealing with new permit applications in recently deregulated countries
- Political intervention
- Underestimating lead-times for negotiations with fisheries
- Failure to understand and/or anticipate environmental regulations governing the establishment of new landing sites and the construction of new cable stations
- Insensitivity by new aggressive system owners to differences in owner/landing party culture
- Technical non viability of sites selected

Notwithstanding the above, to meet Business Plan declared RFPA dates, every effort needs be made to finalise landing site locations, and thus be confident that landing party agreements and all required permitting will be achievable during the feasibility study and preliminary planning phase of the system planning process.

The final bullet point above refers to technical viability of the site. Technical viability can often only be proven by making landing site visits during which information is gathered that cannot be gathered from reference to database material. Avoidance of the potential requirement for costly re-surveys at landing sites that need to be relocated following the completion of the route survey should be a prime objective of the system planners. Key factors in selecting the system landing sites are addressed above, however, the following must be in place before the route survey:

- The availability of all the necessary permits, rights of way and way leaves for the route approaches, manhole position and terminal station site
- Signed landing party agreements between landing party and system owner
- Compliance with environmental regulations and requirements
- Confirmation of technical viability taking account of:
- Design life of the system.
- Protection and burial requirements
- Constraints imposed by cultural activities.
- Constraints imposed by other cables sharing the same landing site.
- Constraints imposed by the physical environment.

5.3 Desk Study

The importance of the desk study has been discussed in detail in previous papers by the author and cannot be overstated. Errors and omissions during the desk study phase of the planning process can have extremely costly and far-reaching consequences during the later phases of the project. However, notwithstanding these sentiments, during the peak of new system announcements, the desk study was a prime target for lead-time compression and parallel tasking. This frequently resulted in either an inadequate or incomplete desk study being produced through reactive responses to demands to accelerate the process.

Such compromises being made had and will have again if the same culture prevails, the potential to impact long term system security, they did, can and do result in delays during the survey, typical examples being third party induced requirements for route changes or the need to change a landing site location, situations which would have been avoided had the desk study scope of work been allowed to be completed fully. These delays negate the intended advantage of an accelerated desk study and add further frustration within the project team.

The desk study should be considered as a risk assessment document, the primary objective of which is to provide a more in-depth continuation of the processes performed during the feasibility study and preliminary planning phases of the project. It should also act as a reality check on the continuing validity of the Business Plan milestones. Where there is pressure on system implementation lead-times, serious consideration needs to be given to performing a high-level overview Executive Desk Study early in the project planning process or as an adjunct to developing the Business Case.

Desk studies should address the following key objectives:

- Confirmation or refinement of preliminary system design, route engineering and configuration parameters.
- Identification and definition of cultural activities and physical conditions along the preliminary cable

route that may impact system design.

- Identification of all permitting processes and confirmation of lead-times and permit interdependence.
- Definition of political and environmental constraints that may impact system design.
- Definition of the route survey scope and procedures.

The desk study processes should provide an in-depth analysis of existing literature and information held both in the public domain or, where available, other less accessible databases. This part of the desk study process does benefit from the databases discussed above in Section 6.1.

Close attention to system security and survivability potential is fundamental to the system planning and route engineering process performed during the desk study. Key areas of focus are the evaluation of physical conditions prevailing along the provisional route developed during the preliminary system design, and cultural activities along and close to the selected route. Such third party activities have been shown to be a far greater cause of cable system outages than the impact of the physical environment.

An important function during the desk study is to identify and notify all parties of the intention to install a cable across the seabed where such parties may have a conflicting interest. Where it is found necessary to negotiate a mutually acceptable route, this will be done at this time. This negotiation process must be concluded prior to the commencement of survey operations and is one of the activities where progressing negotiations to a mutually satisfactory outcome is largely outside the control of both owners and contractors.

The most common routing conflicts occur with existing cables crossing or in close parallel with the route, offshore hydrocarbon developments or with seabed mining operations. Coastal fishing activities, marine conservation areas and coastal tourism developments may also influence routing. As submarine cables typically land at and/or link main coastal population centres, it is important for the desk study to identify routing conflicts due to existing or planned future coastal construction projects for example ports and harbours, coastal power stations and chemical plants.

During the desk study, a clear understanding must be gained of political issues that can impact on cable route planning and selection, installation, and long-term maintenance of the system. Such issues include permitting which can seriously impact system implementation programs, international boundary crossings and territorial claims of both landing and non-landing parties.

Visits to all the landing sites normally form an important integral part of the desk study task. As discussed above, the site visits should be used to test the technical viability of the site and should be used to gather information from local government offices and other relevant authorities administering the regions in which the landing sites are located.

It should be apparent from the above, that the output from the desk study should form an indispensable component of the overall process of route selection and engineering, and while there may be opportunities to compress some desk study tasks through the use of databases and route planning software, other critical objectives of the desk study are independent and largely outside the influence of the desk study team.

Route Survey

Compression of the route survey program can be achieved in a number of ways without necessarily jeopardising system security. It is routine for the marine route survey to be performed using multiple vessel solutions with vessels working in parallel. For large transoceanic ring systems from four to six vessels may be employed, even with large interregional systems like APCN-2 and C2C, as many as ten vessels may be operating simultaneously.

However, route survey task compression is strongly linked to certain desk study activities being completed. Where these critical tasks have not been completed, and the reactive management response requires the commencement of survey operations, prior to desk study task completion, costly delays in the operational schedule of one or more of the vessels can be incurred. Typically these delays result from the need to re-survey already completed sections of the route, vessels are required to stand by waiting on permits, or the approaches to a landing site are changed after survey.

Each survey vessel will be equipped with an efficient means of acquiring high-resolution high-density data that will yield accurate representations of the seabed topography along the route where the cable will be installed. The technology available enables routing decisions to be made in near real-time when adverse bathymetric terrain is encountered.

With cable burial being the preferred method for cable protection within the depth range of rapidly advancing fishing technologies, and the attendant requirement to bury cables to greater water depths, technologies have been developed to enable sub seabed soils data to be collected and characterised semi-concurrently with the electronic survey. Burial assessment techniques now typically employ electronic burial assessment (E-BAS) systems, mini CPT systems and hybrid systems employing both electronic and CPT technology. The use of these systems allows simultaneous burial assessment and route engineering to be performed concurrently with the route survey operations.

On-board data acquisition, processing and management systems together with web-based report and chart delivery systems offer the greatest opportunity to compress lead-times of the marine route survey activities by enabling the integration of very large multi-parameter data sets to be efficiently handled and delivered to the system purchaser and builder. These procedures also provide the route engineer with the capability to develop a comprehensive understanding of the along-route conditions and the impact that these conditions have on cable engineering and installation. Thus the technology and procedures are in place to minimise the time from the collection of data, through data processing, analysis and interpretation, to having a final surveyed route, charts, RPLs and SLDs available for the purchasers and cable factory, segment by segment as the survey proceeds.

While the flow of data from acquisition to delivery to the cable supplier and purchaser can be expedited, the delivery of a 'final' route requires approvals from the system purchaser. For the traditional 'club' cable systems, the route approval process can and often is protracted, conversely, more aggressive entrepreneurial carriers, typically devolve responsibility of final route selection to the chosen supplier. Whichever system procurement process is being followed, it is the purchaser approvals which lie firmly entrenched on the critical path of final route selection.

7. Burial Assessment

The results of the Burial Assessment Survey (BAS) are critical to both developing final protection levels for the cable system and the finalisation of installation planning. The fact that burial assessment activities are the final pre installation phase of the route engineering processes, the demands for lead-time compression have, in the past, been applied most vigorously.

Parallel tasking for BAS operations can mirror the multi vessel solutions seen during the route survey. However, as BAS operations can never overtake the route survey, the planning of these activities must be carefully phased to avoid operational "catch-up" of the BAS vessel with the survey vessel.

It will therefore be apparent that any delays incurred during the survey, will have a direct knock-on effect to the BAS, it should also be apparent that such delays will be tied into the ability of the cable supplier to finalise cable armouring levels, and therefore the suppliers ability to meet delivery schedules, which in turn can impact installation vessel scheduling and ultimate slippage of the RFPA date. The fact that the potential for delays are directly connected through the survey into the desk study activities such as permitting and rights of way issues further emphasises the dangers of shortcutting the desk study process in an attempt to accelerate the project program.

In some cases where ambitious project schedules have been committed to when "selling" the system to potential investors and capacity buyers, greatly increased risks to system security have been de facto accepted by owners by cancelling the BAS operation due to unforeseen delays being incurred by permitting and/or re-routing which have resulted from attempting to parallel task compressible with uncompressible activities. In these cases, cable protection and installation procedures are entirely reliant on electronic route survey data backed up by seabed samples.

In today's aggressive contracting climate, the availability of results from traditional invasive mechanical plough and burial assessment devices are more often than not too late to influence final system design and cable engineering.

Notwithstanding the above, compression of BAS activities has been achieved with the development of procedures which integrate electronic remote sensing data collected during the route survey, data from new generation burial assessment tools, and from the application of new generation direct testing techniques. These procedures can be successfully and cost effectively integrated into the route survey operations and used as the primary data sets for burial and plough assessment.

The new generation burial assessment technology and procedures discussed under Section 6 above, meet the demands for reduced lead-times in the overall route selection process by allowing operations to run semi concurrently, with the route survey operating sufficiently ahead of the BAS to allow analysis of the geophysical data.

While the traditional burial assessment methods are still occasionally used, with the increased demands being placed on the cable installer to bury cables deeper and over longer sections of the route, together with the pressures imposed by reduced lead-times, greater emphasis has been placed on the use of these more innovative burial assessment methods. These new technologies have the capability to provide continuous, accurate and reliable data to the maximum required burial depth for both plough and post lay burial operations.

8. Conclusions

This paper has tried to show how meeting the Business Plan milestones committed to when trying to attract system financing has historically presented the system suppliers, route engineers, survey organisation and installer with program accelerating challenges, that in some cases cannot be either met, or if met, have the potential of compromising the long term system integrity.

Some of the dangers of parallel tasking to the project schedule and long term system security and the more haste less speed consequences that can result from reactive management by attempting run concurrent interlinked compressible and uncompressible activities has been highlighted.

The critical role of the feasibility study, understanding the permitting processes, and desk study activities as a means of identifying long-term risks to the security of the system as well as reducing the risk of program delays has been discussed, and the importance of ensuring the desk study has been completed prior to the commencement of the marine route survey has been strongly emphasised.

Contributions being made by the route engineering and marine route survey community to meeting the demand for compressed lead-times in cable route selection and survey has been presented as well as the key constraints and limitations that impact the route selection processes and that are beyond the control of system planners and survey contractors.

The importance of understanding the interaction and interrelationship between key implementation tasks has been stressed as have the consequences of inadequately thought out reactive remedial fixes to the dislocation of interrelated and interdependent activities.

References

[1] Evans G. S. 1998 *Developing Standardized Procedures for the Planning of Secure Submarine Telecommunications Systems* (ICPC Plenary, Orlando, USA May 1998)

Abstract

The prevailing economic climate has resulted in the securing of financing for a new project is under greater scrutiny than ever before. The auditable integrity of the project Business Plan can therefore be a critical factor in securing investment. This paper discusses the potential impact on achieving declared Business Plan milestones by failing to understand the interdependence and need for proper phasing of key system planning processes including:

- The pitfalls to system planning by attempting to parallel task compressible and incompressible activities.
- Recognition and resolution of environmental constraints to system implementation and maintenance over the systems' design life
- Understanding the lead-times in planning for and meeting environmental-related commitments
- The complexity, consistency and lead-times required to meet national regulatory requirements
- The impact of disputed territorial claims
- The impact of commercial fishing activities and fishery organisations, and the lead-times for fishery related permitting and negotiation of compensation claims
- Resolving conflicts with other seabed users
- System manufacturing schedules
- The marine route survey and system installation schedules
- Evaluating the impact these constraints will on system RFS

The paper argues that by adopting properly thought out, well organised and systematic planning processes, the more haste less speed scenario and compromised system security so frequently seen in the clamour to install a new system can be avoided without jeopardising the targeted ready for service date.

back to index

Graham Evans

Based in Singapore, Graham Evans has the dual role of Director of International Business Development for the EGS Group and C & C Technologies Inc. Graham has more then twenty-five years experience as a geologist and applied geophysicist. During this time he has been engaged in the design, project management, implementation supervision and reporting for a wide range of geoscience applications, both offshore and onshore.

Graham is known throughout the telecommunications and offshore industries for his knowledge of the application of integrated cross discipline geoscience investigative techniques and procedures for submarine fibre optic cable route surveys.

Graham is a Supervisory Board member and Alliance Coordinator of the C & C - EGS - Global Marine Systems Alliance, which services the Submarine Fibre Optic Cable Route Survey Industry worldwide. Graham is a Chartered Geologist and holds a Bachelor of Science degree in Geology from the University of Manchester, UK and a Bachelor of Arts degree in Earth and Environmental Sciences from the Open University, UK.

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back to index

PTC2002 Conference Plenaries

Sunday, 13 January 2002

Sunday, 13 January 2002
1630-1800
Tapa II

Conference Opening

Convener:
HOYT ZIA, Pacific Telecommunications Council

Welcoming Remarks:
EIJI HAYASHI, Chairman, Board of Trustees, Pacific Telecommunications Council
HANSUK KIM, President, Pacific Telecommunications Council
GOVERNOR BENJAMIN CAYETANO, State of Hawaii, *USA*

Chair:
DAVID LASSNER, Director, Information Technology, University of Hawaii, *USA*

Speakers:
DEANE NEUBAUER, Interim Chancellor, University of Hawaii, *USA*

Telecommunication and the Global Education Challenge (PowerPoint Presentation)
ABDUL KHAN, Assistant Director-General, Communication and Information, UNESCO

YOSHIO UTSUMI, Secretary-General, International Telecommunication Union **(View Speech)**

Monday, 14 January 2002

Monday, 14 January 2002
0845-1030
Tapa II

Plenary Session

Chair:
BRUCE DRAKE, Executive Director, Industry Canada, *Canada*

Speakers:

Integration of Mobile and Fixed Network
HARUO MURAKAMI, Chairman, Telecommunication Carriers Association & Chairman, Japan Telecom Co., Ltd, *Japan*

Competition and Partnership: Drivers of Success in Asia (PowerPoint Presentation)
WILLIAM KEEVER, CEO-Asia Region, Vodafone Group Plc, *USA*

Embracing the New Challenge of Global Information Networking
WU JICHUAN, Minister, Ministry of Information Industry, *People's Republic of China*

YANG SEUNG-TAIK, Minister, Ministry of Information and Communication, *Republic of Korea* (video clip)

Tuesday, 15 January 2002

Tuesday, 15 January 2002
0900-1030
Tapa II

Plenary Session

Chair:
JOHN HIBBARD, Executive Board Member, Pacific Telecommunicatons Council

Speakers
ROBERT MAO, President and Chief Executive Officer, Nortel Networks China, *People's Republic of China*
(View Abstract)

PEKKA TARJANNE, Special Advisor to the Secretary-General of the United Nations on Information and Communications Technology (ICT), United Nations, New York, USA and former Secretary-General, ITU

JOHN GAGE, Chief Researcher and Director of Science Office, Sun Microsystems, Inc., *USA*

Wednesday, 16 January 2002

Wednesday, 16 January 2002
1045-1215
Tapa I

Plenary Session

Civil Liberties Post 9/11

Moderator:
TEDSON MEYERS, Senior Telecoms Advisor, Coudert Brothers LLP, *USA*

Keynote Speaker:
MARC ROTENBERG, Executive Director, Electronic Privacy Information Center, *USA*

Respondents:
TEDSON MEYERS, Senior Telecoms Advisor, Coudert Brothers LLP, *USA*

MICHAEL HELM, Director-General, Industry Canada, *Canada*

JEANETTE CHAN, Partner and Head of Asian Comm and Tech Practice, Paul Weiss Rifkind Wharton & Garrison, *Hong Kong SAR , China*

PTC2002 Super Sessions

Monday, 14 January 2002
1100–1230
Tapa III

Super Sessions

SS2 Pacific Region Telecoms Issues—a User Perspective

Chair:

ERNIE NEWMAN, Vice Chairman-Asia Pacific, INTUG, *New Zealand*

(View Chairman's Introduction)

Speakers:

Pacific Region Telecom Issues- Japan User's Perspective (PowerPoint Presentation)

MUTSUYA ASANO, Japanese Keidanren & Director, Telecommunication Relations, IBM Japan, Ltd, *Japan*

Australian Telecoms- A User's Perspective (PowerPoint Presentation)

STUART CORNER, Founder & Managing Director, 3rd Wave Communication Pty Ltd and member of the Australian Telecoms Users Group (ATUG), *Australia*

JUDITH SPEIGHT, Chairman, Telecoms Users Association of New Zealand (TUANZ) & CEO, VoiceEdge Ltd, *New Zealand*

India's Telecommunications Regulatory Environment- A Corporate Perspective

(PowerPoint Presentation)

IAN SMITH, Regulatory Affairs Director, Asia Pacific Region, American Express and Board Member of the Australian Telecoms Users Group (ATUG), *Australia*

So often industry conferences focus on internal technical and carrier issues with comparatively little attention given to the customer - the fulfillment of whose needs is the purpose for which the industry exists. In this session, a group of leading telecommunication user advocates from around the Pacific will present the key issues for users in their respective constituencies.

back to super sessions

PTC2002 Super Sessions

Monday, 14 January 2002
1100–1230
Tapa II

Super Sessions

SS1 Leaders' Forum—"Challenges in Making IT Work for the People"

Chair:
HOYT ZIA, Executive Director, Pacific Telecommunications Council

Speakers:

Challenges in Making IT Work for the People: The Malaysian Experience

(PowerPoint Presentation)

TAN SRI NURAIZAH ABDUL HAMID, Chairman, Malaysian Communications & Multimedia Commission, *Malaysia*

SETHAPORN CUSRIPITUCK, Former Director-General, Post & Telegraph Dept, *Thailand*

WINSTON THOMPSON, CEO, Telecom Fiji, *Fiji*

JIN SHENG SU, Director-General, Ministry of Information Industry, *People's Republic of China*

back to super sessions

Mahalo Message

Dear PTC2002 attendees,

Our 24th annual conference, PTC2002 Next Generation Communications: Making IT Work, was a success thanks to your support and participation. We are pleased to be able to provide you with this complimentary CD-ROM containing the proceedings from the conference and appreciate your patience during its preparation.

The proceedings have been formatted to appear and function identically as our web site proceedings with which you may already be familiar. As an attendee, you should have already received the password to access the proceedings online making the material available to you anytime, from anywhere in the world, with Internet access.

We hope that you enjoyed attending PTC2002 and that it met or exceeded your expectations. We truly appreciate your participation, and we will continue striving to improve the quality of our conference each year. We look forward to having you back for PTC2003.

Sincerely,

Hoyt H Z

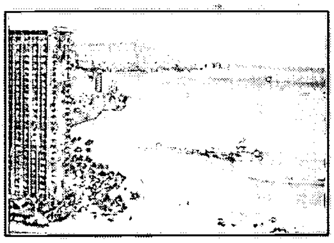
Hoyt H. Zia Executive Director

Introduction

Next Generation Communications: Making IT Work
13 - 17 January, 2002
Hilton Hawaiian Village, Honolulu, Hawaii USA

Download PTC2002 Conference Program (posted January 7, 2002)

PTC2002



With its theme "Next Generation Communications: Making IT Work", the PTC2002 annual conference seeks to focus on harnessing the complexities of the broadest range of communications technologies and services for the user.

Join us at PTC2002 as we exchange thought-provoking views and ideas on issues such as:

The use of information and communication services, and how social and cultural factors shape and are shaped by the new technologies.

What are the new applications and services developments for business, industrial and consumer interests? What models of successful implementation are available?

The status, plans, directions, trends, issues, dependencies and critical success factors for effective communication developments in the Pacific Islands, and East, South and Southeast Asia.

New developments in wireless communications, network technology, digital technology, broadcasting, fiber optic cable systems and internetworking, and the relationship of these developments to the user needs.

Policy and regulatory formation as they affect e-commerce, digital divide, broadband deployment, Internet governance and trade in telecoms.

The economic and financial views of the industry, including models for funding infrastructure construction, deployment of services, and ways to promote access to the global information infrastructure from developing nations.

So mark your calendar today! Come and experience for yourself what it is like to be part of the Pacific region's premier telecommunications event.

Featured Speakers

Wu Jichuan

Keynote Speaker

WU JICHUAN, Minister, Ministry of Information Industry (MII), PRC

Minister Wu Jichuan is a veteran of the Ministry of Post and Telecommunications (MPT), which was merged with the Ministry of Electronics and information (MEI) to create the MII. The latter is now a super-agency overseeing telecommunications, multimedia, broadcasting, satellites, and the Internet. As the gatekeeper to China's cyberspace (all Internet ventures must pass through his ministry), Wu has pressed hard to make the Internet more accessible to ordinary Chinese (among his achievements: forcing state-backed China Telecom to cut prices).

Other key speakers include:

YANG SEUNG-TAIK, Minister, Ministry of Information and Communication, *Republic of Korea*

YOSHIO UTSUMI, Secretary-General, International Telecommunication Union

ABDUL KHAN, Assistant Director-General, Communication and Information, UNESCO

TAN SRI NURAIZAH ABDUL HAMID, Chairman, Malaysian Communications and Multimedia Commission, *Malaysia*

FIONA BECK, President and Chief Executive Officer, Southern Cross Cable Network, *Bermuda*

SETHAPORN CUSRIPITUCK, Former Director-General, Post & Telegraph Department, *Thailand*

DAVID FARBER, Alfred Fitler Moore Professor of Telecommunication Systems, University of Pennsylvania, *USA*

JEAN GODELUCK, Chief Executive Officer, Alcatel Submarine Networks, *France*

ROBERT MAO, President and Chief Executive Officer, Nortel Networks China, *People's Republic of China*

HARUO MURAKAMI, Chairman, Telecommunication Carriers Association and Chairman, Japan Telecom Company Ltd., *Japan*

DEANE NEUBAUER, Interim Chancellor, University of Hawaii, *USA*

WINSTON THOMPSON, Chief Executive Officer, Telecom Fiji, *Fiji*

Dear Colleague:

The excitement is already building, and the stage is being set for PTC2002, the premier telecom event of the Pacific.

The global landscape for technology has changed dramatically over the past year. The technology is here, but it still needs to be placed in the right hands, at the right times, and in the right places. PTC2002 will provide you a glimpse into the future and help you prepare for the next wave of change.

A tremendous line-up of speakers and panelists is being assembled for you to hear from and interact with. You will have opportunities to see the latest technology and meet the providers, and you are sure to make important new contacts because this conference consistently draws top leaders and movers from the industry.

If this is your first opportunity to attend our annual conference, I am confident that you will find it a comprehensive and thought provoking experience. If you are returning, rest assured that we are hard at work preparing to deliver another high quality event that you have come to expect, with some new added features.

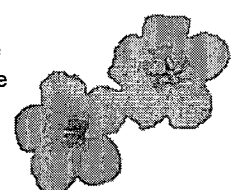
I truly look forward to seeing you at **PTC2002: Next Generation Communica-tions: Making IT Work**, our 24th annual conference: 13–17 January 2002.

Aloha,

Executive Director, PTC

P.S. Don't forget our special early registration rates. The sooner you register, the more you will save –especially if you are a PTC member.

Hawaii



Hawaii has become a focal point for international meetings, business and technology that bridge Asia, Oceania and the Americas. Hawaii's natural beauty and temperate climate serve to provide a congenial atmosphere for the serious business of the many conferences that take place throughout the year. In addition to Hawaii's largest annual technology conference–PTC, major international telecommunication and technology conferences have included ORACLE, INET 95, WebNet 99, combined Internet2 Joint Techs/APAN Workshops and the Hawaii International Conference on Systems Sciences (HICSS). IEEE and ACM groups meet regularly in Hawaii. Technology had a key role in the 2001 Asian Development Bank conference held in Honolulu.

As the "Crossroads of the Pacific," Hawaii has quietly evolved into an international business center. Ideally positioned on the world clock between the largest economies of East and West, Hawaii's strategic location allows business people to communicate with partners and customers in New York, San Francisco, Seoul, Tokyo, Hong Kong, Singapore and Sydney–all in the same day. Hawaii supports all types of business activity with large bandwidth available from the major competitive transpacific fiber optic cables that land in the islands, with a major research University, and with a variety of new tax incentives for high tech business. Hawaii is emerging as a significant telecommunication and technology center in the Pacific.

BENJAMIN J. CAYETANO
GOVERNOR

EXECUTIVE CHAMBERS
HONOLULU

MESSAGE FROM GOVERNOR BENJAMIN J. CAYETANO TO THE PACIFIC TELECOMMUNICATIONS COUNCIL

January 13-17, 2002

On behalf of the people of the State of Hawaii, I extend my greetings and warmest aloha to all who are attending the 24[th] annual Pacific Telecommunications Council's Annual Conference at the Hilton Hawaiian Village.

I extend a warm welcome to our visitors who have traveled from throughout the world to attend this prestigious conference. This event promises to be a showcase of the latest developments in the rapidly evolving world of high technology. Representatives from business, education and government sectors from Asia, the Pacific and the United States mainland will have the rare opportunity to share ideas and to collaborate in the promotion of telecommunications and related industries.

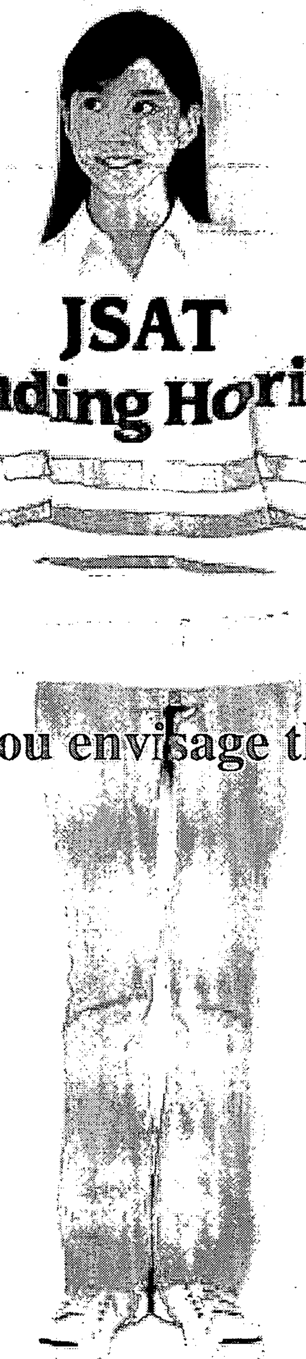
I extend my gratitude to the Pacific Telecommunications Council for recognizing Hawaii's value as a place to conduct business and to nurture the development of high technology. I am certain that our visitors will quickly realize why Hawaii is uniquely positioned to capture the region's technological growth.

Best wishes for a fruitful conference and for the continued success of the participants.

Aloha,

Benjamin J. Cayetano

BENJAMIN J. CAYETANO



JSAT
Expanding Horizons

How do you envisage the future?

JSAT is expanding the horizons of communications and broadcasting to give form to your vision of a better future. Communications satellites have already brought significant changes to our lives through such avenues as SKY PerfecTV! direct-to-home (DTH), Internet access in schools, Intranet use in business offices and international data transmissions. Applications are poised to expand even further in the future, beyond borders and beyond the limits of our imagination. JSAT's satellites are turning dreams into reality by actively expanding possibilities worldwide. We will soon launch the new CS broadcasting service from the 110-degree east orbital slot which is expected to operate in synergy with SKY PerfecTV!. In our every endeavor we seek to harness the vast potential of satellites to improve everyday life. JSAT is now entering a dramatic new stage in our development as the largest satellite operator in the Asia-Pacific region. As our corporate slogan "JSAT, Expanding Horizons" suggests, we remain committed to future development and growth. JSAT shares your vision of a brighter future.

JSAT
Expanding Horizons

〈Share our expanding vision of the future〉

JSAT Corporation http://www.jsat.net

OFFICE OF THE MAYOR
CITY AND COUNTY OF HONOLULU

MAYOR'S MESSAGE

Aloha. Welcome to Honolulu for the 24th annual Pacific Telecommunications Conference.

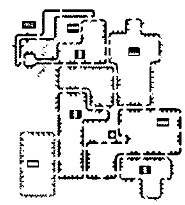
This is a very important international event that will bring together high tech companies to network and to share ideas and the latest industry trends. This year, for the first time, this conference will receive round-the clock television coverage by Network Media, the official television station of the Hawaii Visitors & Convention Bureau. The coverage will be televised to all rooms in participating hotels throughout Waikiki and will feature daily highlights - a service most appropriate for this venue!

Our city deeply appreciates the opportunity to be the host location for this event, especially as our visitor industry recovers in the aftermath of the terrible events of September 11. We invite those of you who are visiting to please enjoy our beautiful weather, excellent beaches and our world-famous aloha spirit.

On behalf of the citizens of the City and County of Honolulu, I extend best wishes for a productive and successful conference.

Jeremy Harris

JEREMY HARRIS, Mayor
City and County of Honolulu



interoute - the network inside

Schedule at a Glance (Subject to Change)

PTC2002
www.ptc.org/ptc2002

Sunday 13 January 2002

0900–1200
Workshops

1130–1530
PTC Board of Trustees' and Members' Meeting

1300–1600
Panel Discussions and Roundtables

1630–1800
Conference Opening Plenary

1800–1930
Opening Reception

Monday 14 January 2002

0730–0830
First-time Attendee/New Members' Breakfast

0730–0815
Speakers' Breakfast

0845–1030
Plenary Session

1030–1100
Morning Break

1100–1230
Super Sessions

1130–1630
Exhibits Open

1230–1400
Lunch

1400–1530
Concurrent Sessions

1530–1600
Afternoon Break

1600–1730
Concurrent Sessions

Tuesday 15 January 2002

0730–0815
Speakers' Breakfast

0900–1030
Super Sessions

1030–1100
Morning Break

1100–1230
Concurrent Sessions

1130–1800
Exhibits Open

1230–1430
Lunch

1430–1600
Concurrent Sessions

1645–1800
Exhibitors' Reception

Wednesday 16 January 2002

0730–0815
Speakers' Breakfast

0830–1130
Exhibits Open

0845–1015
Concurrent Sessions

1015–1045
Morning Break

1045–1215
Plenary Session

1215–1400
Lunch with Speaker

1400–1530
Concurrent Sessions

1530–1600
Afternoon Break

1600–1730
Concurrent Sessions

1800–1930
Closing Reception

Thursday 17 January 2002

0800–1000
Membership Committee Meeting

Media and Communications Committee Meeting

Education & Seminars Committee Meeting

Research Committee Meeting

1000–1200
PTC Conference Committee Meeting

1200–1330
PTC Coordination Meeting

1400–1800
PTC Executive Board Meeting

Pacific Telecommunications Council (PTC) 2454 S. Beretania St., 3rd Floor, Honolulu, HI 96826 www.ptc.org Tel: +1.808.941.3789 Fax: +1.808.944.4874 Email: ptc2002@ptc.org


Your communication is our focus

PTC2002 General Conference Information
(subject to change)

PTC2002 Conference Registration

The Registration Booth is located in the Coral Lounge on the 6th Floor of the Mid-Pacific Conference Center at the Hilton Hawaiian Village.

REGISTRATION HOURS

Saturday, 12 January 2002:	1400–1700
Sunday, 13 January 2002:	0800–1830
Monday, 14 January 2002:	0700–1700
Tuesday, 15 January 2002:	0730–1630
Wednesday, 16 January 2002:	0730–1630

BADGES AND ADMITTANCE

Official PTC badges must be worn at all times for admittance to all conference sessions, social events and the exhibition. There will be a US$50 charge to replace badges.

RECOMMENDED ATTIRE

Casual Business Attire (Aloha shirts recommended)

PTC2002 Exhibits

The exhibits will be open during the following days and times:

Monday, 14 January 2002
1130–1630

Tuesday, 15 January 2002
1130–1800

Wednesday, 16 January 2002
0830–1130

The exhibits are located in the Coral Ballroom on the 6th Floor of the Mid-Pacific Conference Center. Exhibits are open to the public. Official PTC badges must be worn at all times for admittance to the exhibition hall or present your business card at the Exhibit Registration Booth in exchange for a "Temporary Pass."

PTC2002 Services

BOOKSTORE

Waldenbooks will be present with a host of books on telecommunications, communications, management topics, golf, children's books, Hawaiian history and more, from Monday, 14 January through Wednesday, 16 January 2002.

CELLULAR PHONE RENTAL

PTC has appointed Wireless Rentals of Hawaii the official cellular phone rental company for PTC2002. Their counter will be located on the 6th Floor of the Mid-Pacific Conference Center at the Hilton Hawaiian Village. Their operating hours are:

Sunday, 13 January 2002
0730–1800

Monday, 14 January 2002
0700–1630

Tuesday, 15 January 2002
0700–1800

Wednesday, 16 January 2002
0700–1200

For more information about their wireless phone package and airtime rates, contact Jack Lee at Tel: +1.808.926.8300, Fax: +1.808.926.8809, Cell: +1.808.227.1983 or Email: jlee@wirelessrentals.com

COMPUTER KIOSK

Additional facilities are available at the Computer Kiosk for delegates to view and print the PTC2002 conference papers.

Sponsored by: FLAG Telecom

CONFERENCE NEWS DAILY

NEW

Available to all PTC2002 attendees, exhibitors and visitors, this daily newspaper will keep you informed of everything that is happening at PTC2002. A special daily telecom news summary from the New York Times will keep you in touch with international developments from the industry. As a bonus to advertisers, the paper will be distributed at the U.S. Congress, the U.N. headquarters in New York and Geneva, as well as other U.N. centers throughout Europe. For advertising information, contact Pretty Dawra at pdawra@earthtimes.org or phone +1.212.297.0488 x 12.

LITERATURE BINS

A literature area will be designated for those wishing to have their organization's literature and/or publications prominently displayed and easily accessible by all conference attendees. A nominal fee of US$150 per title is charged for this service. For more information, contact Neal Riel at neal@ptc.org or call the PTC Secretariat at +1.808.941.3789.

Sponsored by: ignite BT

LOST AND FOUND

Located at the Information Counter on the 6th Floor of the Mid-Pacific Conference Center.

MESSAGES

May be left electronically on the messaging system at Planet PTC.

PLANET PTC

Located in the Coral Lounge on the 6th Floor of the Mid-Pacific Conference Center.

Planet PTC provides 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 Planet PTC to make contacts, set up meetings and request information. Relax with colleagues over a cup of cappuccino at Planet PTC and discuss the latest telecommunications technologies. The convenience of wireless Internet access for your laptop computer will be available through Planet PTC.

Sponsored by: BOEING

PTC2002 General Conference Information

(subject to change)

PRESS CONFERENCES

To schedule a press conference, contact Puja Borries at puja@ptc.org or call +1.808.256.3423.

PTC MEMBER SERVICES

Stop by the Membership Desk located in the Coral Lounge on the 6th Floor of the Mid-Pacific Conference Center for all information concerning services and benefits offered by PTC. The Membership Desk is open during conference registration hours.

PTC-TV

NEW

PTC is partnering with Convention Television (CTV), the official TV station of the Hawaii Visitors & Convention Bureau. Accessible to more than 28,000 hotel rooms throughout Waikiki, this highly effective daily telecast will feature same day coverage of the sessions, a news anchor-style daily wrap-up of PTC2002 highlights, a daily real-time video text schedule of events, venue and program changes, as well as enlightening interviews with conference attendees.

PTC-TV's daily telecast will be available to all PTC2002 attendees' participating hotels, 24 hours per day, each day of the event. This is an excellent opportunity to showcase your company to an international audience of attendees and businesses that reaches beyond PTC2002. Surveys indicate that CTV is viewed by 85% of convention attendees, 2-4 times per day, in the delegates hotel room.

Sponsored by: Southern Cross

SPEAKERS' BREAKFAST

All Chairpersons, Speakers and Panelists are advised to meet on the morning of their session days during the Speakers' Breakfast from 0730-0815.

Monday, 14 January 2002	Coral I
Tuesday, 15 January 2002	Coral I
Wednesday, 16 January 2002	Tapa III

Sponsored by: TCSI

PTC2002 Key Locations

CONFERENCE SECRETARIAT

Located in Sea Pearl I, II and III at the Mid-Pacific Conference Center.

PRESS OFFICE

The Press Office is available for working press only. Media kits, advertising kits and other conference materials will be available in the Press Office located at Sea Pearl IV.

Sponsored by: M3COM MILLENNIUM 3 COMMUNICATIONS

SPEAKER READY ROOM

Located in Sea Pearl VI at the Mid-Pacific Conference Center. Audio-visual equipment is available for speakers to test their presentations. Audio-visual preview equipment is also available in the same room.

PTC2002 Transportation and Travel Services

AIRPORT SHUTTLE

An airport shuttle is available between the airport and Waikiki Hotels.

US$8.00 one-way or US$13.00 round trip per person (Gratuity not included)

Two regular suitcases and one carry-on are acceptable. Prior arrangements are encouraged. For further information, contact Lena Stoycheff at Tel: +1.808.373.2263 or 222.4587, Email: jazzylena@yahoo.com, or access www.abcshuttlehawaii.com

CAR RENTAL

Budget is the official car rental company for PTC2002. Special rates are available one week before and after the meeting dates. Call Budget toll-free at +1.800.777.0169.

International attendees may contact Budget at +1.808.838.1111. When making reservations, please provide the **Group Code: U066649** to guarantee special PTC2002 rates.

PTC2002 Official Social Events

CONFERENCE OPENING RECEPTION

Sunday, 13 January 2002
Hilton Hawaiian Village
Lagoon Green
1800-1930

- PTC 'Participant' badges and guest tickets are required for admittance to the Conference Opening and Opening Reception.
- Additional tickets may be purchased for US$55 from the Cashier at the Conference Registration Booth.

Sponsored by: verizon

FIRST TIME ATTENDEES' AND NEW MEMBERS' BREAKFAST

Monday, 14 January 2002
Honolulu Suite
0730–0815

A Welcome Meeting for new members and first time conference attendees is scheduled.

EXHIBITORS' RECEPTION

Tuesday, 15 January 2002
Coral Ballroom
1645–1800

After a day of exciting sessions, enjoy cocktails and network with industry leaders at the exhibitors' cocktail reception held in the exhibit hall. Drink tickets are provided in the registration packet

CONFERENCE CLOSING EXTRAVAGANZA

Wednesday, 16 January 2002
Hilton Hawaiian Village, Poolside
1800–1930

In order to provide an accurate guarantee to our host, attendance to the event must be reserved at the Information Counter located on the 6th Floor of the Mid-Pacific Conference Center. Vouchers must be exchanged for admittance tickets at the Information Counter during conference registration hours from Saturday, 12 January to 12 noon on Monday, 14 January 2002.

Admittance: Registered conference delegates with badges and paying guests.

- PTC 'Participant' badges and guest tickets are required for admittance to the PTC2002 Closing Function.
- Additional tickets may be purchased for US$55 from the Cashier at the Conference Registration Booth.

Sponsored by:

Asia Global Crossing™

ALTERNATE HOTELS

Numerous other events will take place in Hawaii in January and hotel room occupancy is expected to be high. For this reason, PTC has made arrangements with alternate hotels for additional rooms. For more information, contact Dolores Fung at dolores@ptc.org or call +1.808.941.3789.

GUESTS

Guests are welcome to attend the Opening and Closing social functions provided a guest ticket has been purchased for each specific event. A guest is defined as a spouse/significant other, friend or an adult child (18 or older). Children under 18 are not allowed to attend any PTC functions. If you wish to arrange for childcare, please contact the hotel concierge for the Keiki Program.

PTC2002 Policies

NO SMOKING POLICY

In consideration of the conference delegates, we request that there be no smoking during all conference sessions and in the conference foyer. Thank you for your cooperation.

TURN OFF CELL PHONES AND PAGERS

All conference delegates are reminded to turn off their cell phones and pagers before attending a session. Your cooperation is greatly appreciated.

Hilton Hawaiian Village Services

BUSINESS CENTER

Business services are provided by the Business Center located on the Ground Floor of the Diamond Head Tower.
Open 24 hours. Tel: +1.808.949.0656;
Fax: +1.808.951.5458

KEIKI CLUB—RAINBOW EXPRESS

The Hilton Hawaiian Village provides a fun, safe environment for guests aged 5–12. Full and half-day programs are available, Monday through Sunday. Activities relating to Hawaiian culture are scheduled for each day. For further information, call the Hilton Hawaiian Village at +1.808.949.4321 or sign up at the social director's desk in the main lobby.

SHIPPING

The Hilton Hawaiian Village Business Center will be present at the Coral Lounge on the last day of the conference to assist delegates and exhibitors with their shipping needs.

WIRELESS INTERNET ACCESS

The Hilton Hawaiian Village will be offering wireless access from your laptop computer into the PTC2002 Internet conference messaging system—Planet PTC. Access will be available from the common areas on the grounds of the Hilton Hawaiian Village for a nominal rental charge.

Acknowlegdements

PTC2002 www.ptc.org/ptc2002

Opening Reception
Verizon Global Solutions, Inc.

Morning Breaks
Dynegy
Philips Broadband Networks
T Soja & Associates, Inc.

Afternoon Break
Subic Telecom

Luncheon with Speaker
SK Telecom

Vendor Lunch
InfoVista (Asia-Pacific) Pte Ltd.

Closing Extravaganza
Asia Global Crossing

Assistance Fund
NEC Corporation
REDCOM Laboratories, Inc.

Badge Holder
Verizon Global Solutions, Inc.

Cellular Phones for PTC Staff
AT&T Wireless

Literature Bin Tables
BT Ignite
(The Submarine Cable Systems Division)

Mouse Pads
Band-X

PC Kiosks
FLAG Telecom
PTC-TV
Southern Cross

Pens
Mitsubishi Electric

Phone Cards
TelStar International, Inc.

Planet PTC
Boeing Satellite Systems

Pocket Survival Guide
Clarity

Press Room
Millennium 3 Communications

Program Printing
DishnetSEACN

Speakers' Breakfast
TCSI

Stationery Boxes
ePhone Telecom, Inc.

T-Shirts
Qwest Communications International, Inc.

Tote Bags
Alcatel

Two-Way Radios
Motorola

Pacific Telecommunications Council (PTC) 2454 S. Beretania St., 3rd Floor, Honolulu, HI 96826 www.ptc.org Tel: +1.808.941.3789 Fax: +1.808.944.4874 Email: ptc2002@ptc.org

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 700 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.

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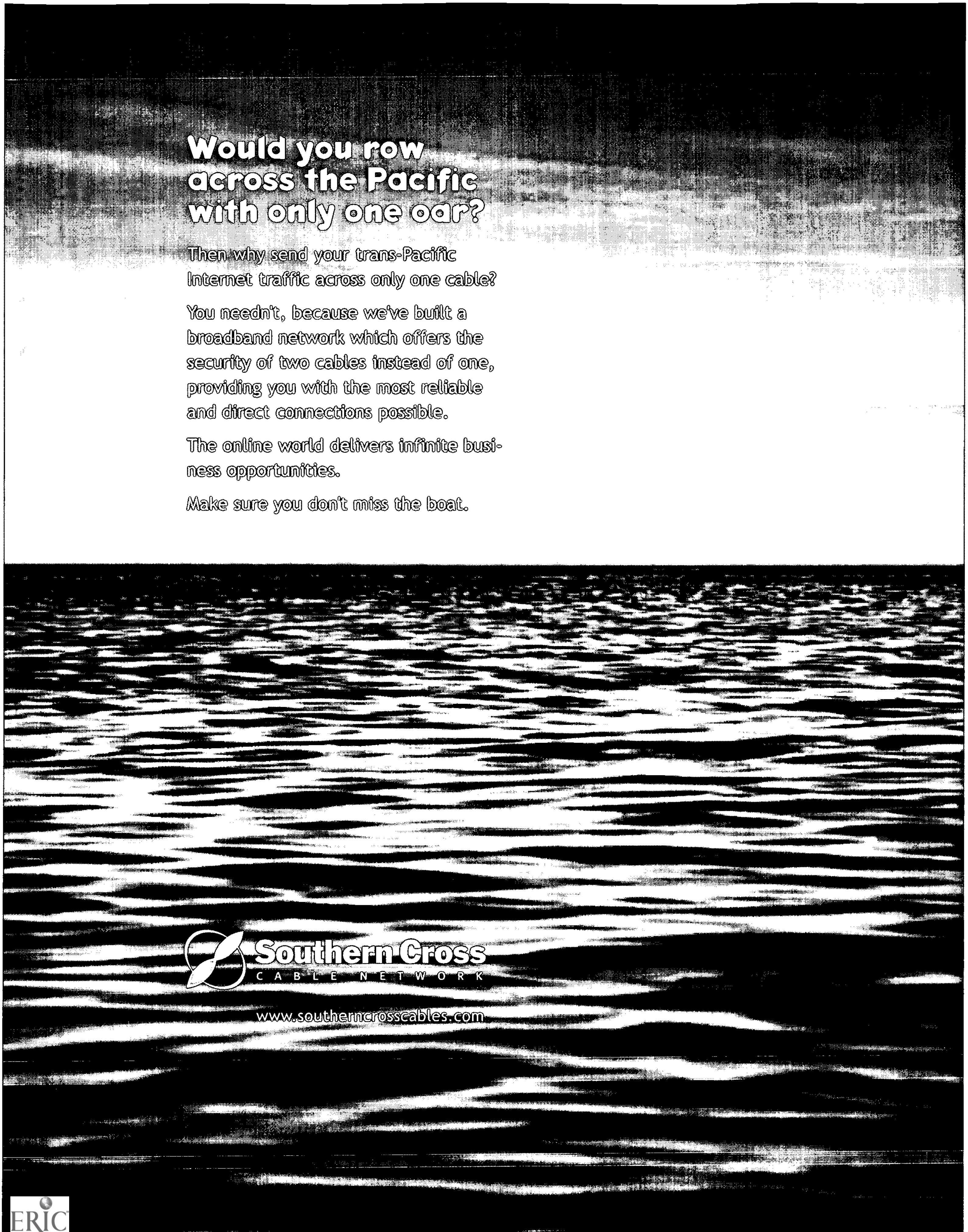
Would you row across the Pacific with only one oar?
Then why send your trans-Pacific Internet traffic across only one cable?
You needn't, because we've built a broadband network which offers the security of two cables instead of one, providing you with the most reliable and direct connections possible.
The online world delivers infinite business opportunities.
Make sure you don't miss the boat.
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www.southerncrosscables.com

Alcatel

Alcatel is the only vendor to master all optical network elements, and to provide both terrestrial and marine services for the installation and maintenance of global optical networks.

According to RHK's 2000 study, Alcatel holds the number two position in global optical transport market, and has the number one position in submarine networks. Alcatel claims to be the world leader in total terrestrial and submarine DWDM systems, in digital cross-connects, in SDH networks, and in microwave radio links. Alcatel is the world leader in delivering full turnkey submarine network solutions and services.

Alcatel's optics business comprises terrestrial and submarine transmission systems, fiber optics, optical components and microwave radio links.

Alcatel builds next generation networks, delivering integrated end-to-end voice and data networking solutions to established and new carriers, as well as enterprises and consumers worldwide, operating in more than 130 countries. For more information, visit Alcatel on the Internet: http://www.alcatel.com

ALCATEL

Asia Global Crossing

Asia Global Crossing (NYSE: AX), a public company whose largest shareholders include Global Crossing (NYSE: GX), Softbank (Tokyo Stock Exchange: 9984), and Microsoft (Nasdaq: MSFT), provides the Asia Pacific region with a full range of integrated telecommunications and IP services. Through a combination of undersea cables, terrestrial networks, city fiber rings and complex web hosting data centers, Asia Global Crossing is building one of the first truly pan-Asian networks, which, in combination with the worldwide Global Crossing Network, will provide the Asia Pacific region with seamless access to major business centers worldwide. As part of its strategy to provide city-to-city connectivity, Asia Global Crossing partners with leading companies in each country it connects to provide backhaul networks.

Asia Global Crossing™

AT&T Wireless

From simple calling plans with affordable rates to comprehensive voice and data solutions, AT&T Wireless is your single source for everything wireless.

AT&T Wireless

Band-X

Band-X, pioneering new methods of trading telecommunications capacity since launching the first independent bandwidth trading platform in 1997, operates two streams of business: Telecom Capacity Trading Services —IP Routed, Switched, Networks; and Specialist services for the telecoms industry—Co-location, Information and Recruitment.

BAND-X

Boeing Satellite Systems

Boeing Satellite Systems is the world's premier supplier of commercial communications satellites, having built more than 40 percent of the satellites in use today.

BOEING
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BT Ignite

The Submarine Cable Systems division of BT Ignite is a unique engineering team structured to deliver "plan, provide and operate" functions for complete Submarine Cable functionality to meet customer needs. A full range of the services provided can be obtained from:
Reg Mercer
+44 28 7131 1163 reg.mercer@bt.com
Mick Green
+44 12 7387 0384 mick.p.green@bt.com

ignite
BT

DishnetSEACN

1272

Dynegy

As a $29 billion provider of energy and communications solutions worldwide, we have developed an expertise and a passion for logistics. Dynegy delivers essential commodities where and when they are needed while creating financial value for our clients. Our network of physical and human assets is a valuable resource for communications providers, media companies or any organization managing large volumes of data.

ePHONE

ePHONE Telecom, Inc. is a next generation, facilities based, marketing and sales oriented telecommunications company providing domestic and international voice and data services using VOIP protocols. The company holds an FCC 214 carrier-to-carrier and retail services license. ePHONE's strategy is to utilize management's breadth of experience in information technology, telecommunications and marketing to integrate the latest in data (IP) and VOIP technologies for our customers. This expertise enables ePHONE to deploy a robust and scalable tier-1 grade international telecommunications network capable of supporting virtually every telephony protocol and existing or emerging IP global standard at a fraction of the cost of a traditional network.

ePHONE's strategy is to capitalize on each element decreasing costs while increasing market penetration. ePHONE is a technology and sales driven organization. The company philosophy is the catalyst for innovative marketing and sales approaches, the development of relationships and a commitment to customer service. ePHONE is meeting the demand partners and sales channels are placing on the company for increased network coverage, innovative products and new technologies. ePHONE is poised to meet the challenges of the 21st century telecommunications market; technically and commercially.

FLAG Telecom

FLAG Telecom is a leading global network services provider and independent carriers' carrier providing an innovative range of products and services to the international carrier community, ASPs and ISPs across an international network platform designed to support the next generation of IP over optical data networks. FLAG Telecom has the following cable systems in operation or under development: FLAG Europe-Asia, FLAG Atlantic-1 and FLAG North Asian Loop. Leveraging this unique network, FLAG Telecom's Network Services business markets a range of managed bandwidth and value added services targeted at carriers, ISPs, and ASPs worldwide. Principal shareholders are: Verizon Communications Inc., Dallah Albaraka Group and Tyco International Ltd. Recent news releases and information are on FLAG Telecom's website at: www.flagtelecom.com

InfoVista

InfoVista is the Leading Provider of Real-Time, QoS Performance Management Software Solutions

InfoVista designs, develops and markets technologically advanced software which monitors, analyzes and reports on the performance, availability and quality of service of information technology infrastructure ("IT"), including networks, servers and applications.

Our products are part of the software market segment known as Service Level Management ("SLM"). We market our products primarily to telecommunications companies and Internet service providers ("ISPs"), as well as to other IT-intensive organizations such as financial services companies, outsourcers of IT services, application service providers and other multinationals. Our products' easy-to-use interface enables IT managers and non-technical users alike to proactively manage their IT resources, analyze Internet network resource activity and trends, anticipate future demands and prepare customized quality of service reports.

InfoVista (Asia-Pacific) Pte Ltd
750C Chai Chee Road
#03-16/17 Technopark@chai chee
Singapore 469003

Tel : +65 449.7641
Fax : +65 449.3054

sales-ap@infovista.com
www.infovista.com

Millennium 3 Communications Company

Millennium 3 Communications (M3Com) is a Bermuda based international facilities and value added services provider that owns and operates its own fully resilient and redundant distribution network. The Company's core business is providing reliable high-quality international point-to-point fiber-links connecting the US to 15 countries throughout Asia. The Company currently offers managed end to end International Private Lines, ATM services, Frame Relay, Virtual Private Networks, and Internet connections to its client base. Clients include long distance carriers, foreign PTTs, Internet Service Providers, financial institutions, and multinational corporations.

The Company has plans to extend its service area into South America and the Middle East.

M3COM
MILLENNIUM 3
COMMUNICATIONS
Access the Planet.®

Mitsubishi Electric

Mitsubishi Electric is the world's leading submarine & terrestrial optical equipment supplier. We are able to offer turnkey solutions to meet market demands and have supplied our equipment to many projects including TPC-5CN, APCN, FLAG, SMW3, JIH, China-US, PC-1, Japan-US, TAT14, EAC and C2C.

We manufacture repeaters, submarine line terminal equipment, maintenance controllers, back haul DWDM equipment and optical network protect equipment. And with knowledge gained from working on over 200 satellites and providing the many technologies that support them on the ground, we are also at the forefront of today's satellite communications.

For more details please contact:
Mitsubishi Electric Corporation
Telecommunication Systems Sales & Marketing Division
Phone: +81-3-6221-2656
Fax: +81-3-6221-2775
E-mail: submarine@tmd.hon.melco.co.jp
http://www.mitsubishielectric.com/bu/communication/index.html

MITSUBISHI ELECTRIC
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Motorola

Motorola brings Power to the Person by providing both integrated communications and embedded electronic solutions for people everywhere.

We take the power of wireless, broadband, the Internet and multimedia to deliver solutions for individuals, work teams, homes and autos.

We see a world without restrictions and endless business opportunities for you.

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NEC

Founded in 1899, NEC Corporation is a leading international supplier of electronic products that comprise primarily communications systems and equipment, computers and industrial electronic systems, and electronic devices.

Empowered by Innovation NEC

Philips Broadband Networks

Philips Broadband Networks is a leading global manufacturer of broadband communication transport solutions capable of delivering video, voice, and interactive data services. The company's fiber optic and RF solutions range from high-capacity optical transport systems using DWDM and binary multiplexing techniques to optical nodes, RF amplifiers, optical and RF passives, and element management systems. See their website at www.philips.com.

PHILIPS

1274

PTC2002 Sponsors

Qwest

Qwest Communications International Inc. (NYSE: Q) is a leader in reliable, scalable and secure broadband Internet-based data, voice and image communications for businesses and consumers. The Qwest Macro Capacity® Fiber Network, designed with the newest optical networking equipment for speed and efficiency, spans more than 104,000 miles globally.

ride the light

Qwest.

REDCOM Laboratories, Inc

REDCOM is an engineering design and manufacturing company specializing in digital telecommunications systems. For over twenty years, REDCOM has introduced new products that provide their customers with state-of-the-art, high quality systems at an excellent cost-to-performance ratio. REDCOM's Switching Systems include the following applications: Public, Private, Wireless, Programmable, Rapid Response, Emergency, ISDN, International Gateway, Operator Services and Call Center. REDCOM also designs and manufactures testing equipment.

REDCOM LABORATORIES, INC.

SK Telecom

SK Telecom is committed to enhancing corporate value by taking the lead in promoting Mobile Commerce as a wireless portal service provider in the domestic market by 2003. The remarkable growth within SK Telecom, in both sales and profitability, is unprecedented in its history. The doors on SK Telecom, which inspires a win-win spirit, are always open for partnerships with the world. For more information, please come to the World Wide Web at http://www.sktelecom.com.

SK Telecom

Southern Cross

The Southern Cross Cable Network provides the fastest, most direct, and most secure international bandwidth from Australia, New Zealand and Hawaii to the heart of the Internet in the USA. Southern Cross has the huge capacity bandwidth increase that is required for the widespread adoption of broadband Internet connections in its markets. Originally designed to deliver 120 gigabits per second of fully protected capacity, Southern Cross plans to be upgraded to 240 gigabits of lit capacity by early 2003. The network has the potential to increase to 480 gigabits when capacity demand growth requires. With offices in Bermuda, Sydney, Auckland and Wellington, Southern Cross has potential to provide for Australasia's growing bandwidth requirements for the next five years. Southern Cross is owned by Telecom New Zealand (50%), Cable & Wireless Optus (40%) and MCI WorldCom (10%).

Southern Cross CABLE NETWORK

Subic Telecom

Subic Telecommunications Company, Inc. (Subic Telecom), a Joint Venture formed by PLDT, AT&T and SBMA in November 1994, is a "full service" telephone company designed to provide the telecommunications requirements of the Subic Bay Freeport Zone.

SUBIC TELECOM

T Soja & Associates

TSA was founded in 1996 as a consultancy specializing in the analysis of market opportunities in international and domestic telecommunications, technologies and businesses. As an independent venture, our mission is to provide telcos, customers, investors and suppliers with the most accurate and reliable market analysis of telecommunications systems.

TSA specializes in conducting independent analysis of fiberoptic telecom cable systems and markets and is focused on the development of winning strategies for clients that construct, finance and/or use telecom networks worldwide. TSA client services include strategic planning for telecom networks and investors; independent and accurate market analysis; business plan review; benchmarking financial projections and funding structures; and analyzing industry trends and demands. We offer subscriber clients a variety of tools that are provide constant and continual information about the undersea fiberoptic and global telecom markets.

TSA has more than 50 years of experience in analyzing, forecasting, and serving the information needs of our clients worldwide. With offices in Boston and Singapore, TSA is committed to bringing comprehensive service and information to our worldwide client base.

TSA

TCSI Corporation

TCSI is a global software company focused on solving business problems for communications companies and global corporate customers. Since 1983 the company has been a leader in providing network and service management solutions for customers including Motorola, Lucent, NTT, NEC, and Shanghai Telecom. TCSI has the technology, track record and expertise to understand the problems faced by service providers, and has developed products that simplify ways of doing business in a competitive, complicated environment.

Verizon Global Solutions

Verizon Global Solutions Inc. is expanding our global network to deliver advanced solutions you can rely on. Our network will interconnect the leading financial and commercial centers in the world, and will be backed by superior customer support dedicated to the specific needs of international carriers and other service providers. Verizon leverages our strong partnerships with major international providers including Flag Telecom, Genuity and MFN, giving you access to an extensive selection of advanced products and services. www.verizon.com/global

Telstar International, Inc

Telstar International, Inc. is a leading enhanced telecommunications service provider. Telstar offers a broad range of wholesale and retail services worldwide including VOIP networks, enhanced voice and data services, alternative access and global long distance services, expert systems and ASP applications. Telstar is the largest privately held provider of debit card platform services in the United States, with 2001 revenues of approximately $70M. Since it was founded in 1995, Telstar's growth has been financed from operations. Telstar is headquartered in White Plains, New York. For more information on Telstar, visit www.telstar-usa.com.

1276

PTC2002 Exhibitors Information

The PTC2002 exhibits showcase the latest applications and services in the industry. Come and network with the leading industry experts who are gathered for this reputable event.

The exhibits are located in the Coral Ballroom on the 6th Floor of the Mid-Pacific Conference Center. Exhibits are open to the public. Official PTC badges must be worn at all times for admittance to the exhibition hall or present your business card at the Exhibit Registration Booth in exchange for a "Temporary Pass."

The exhibits will be open during the following days and times:

Monday, 14 January 2002
1130–1630

Tuesday, 15 January 2002
1130–1800

Wednesday, 16 January 2002
0830–1130

EXHIBITORS	BOOTH #
Adir Technologies, Inc.	**309, 310**
Advanstar Telecom Community	**704, 705**
Advantech Advanced Microwave Technologies Inc.	**204**
Agile NZ Ltd.	**217**
Arianespace Inc.	**614, 615**
The Boeing Company	**209, 210, 300, 301**
China Quantum Communications, Ltd.	**200**
Comtech EF Data Corporation	**404**
Cordell, Inc.	**510**
Dantel, Inc.	**512**
ECI Telecom—NGTS	**403**
Enavis Networks	**401**
ePHONE Telecom	**400**
Epoch Internet	**303**
France Telecom	**513, 514**
General Telecom, Inc.	**313**
Globecomm Systems Inc.	**205**
Guam Telephone Authority	**505**
Henkels & McCoy, Inc.	**613**
InfoVista	**212**
Intele-CardNews	**708**
Intelsat	**601, 602**
InternetSpeech	**215**
Interoute Telecommunications	**502, 503**
interWAVE Communications International, Ltd.	**402**
IP Access International	**302**
Japan Asia Network Consulting Co., Ltd.	**215**
JSAT Corporation	**616, 617**
Kapolei Hawaii	**608**
LYNX Technologies, Inc.	**702**
MediaRing.com Ltd.	**500**
Minerva Networks	**501**
Mockingbird Networks	**506**
NACT	**203**
NECA	**417**

EXHIBITORS	BOOTH #
NetEnterprise Inc.	**305**
New Skies Satellites NV	**407, 408**
NTT Communications	**609, 610, 700, 701**
Nuera Communications, Inc.	**508**
OTL Software Limited	**412**
PacAmTel	**511**
Pacific LightNet Inc.	**517**
Pacific Resources for Education and Learning (PREL)	**307**
Pacific Star Communications	**411**
PBI Media	**304**
PHONE+ International	**306**
Pihana Pacific	**603**
Pulsecom	**612**
Qwest Communications International Inc.	**600**
REDCOM Laboratories, Inc.	**409, 410**
SatNews Publishers	**216**
SED Systems	**405**
Sinotel Ltd.	**201**
Smit-Oceaneering Cable Systems, LLC	**312**
Space Foundation	**211**
Space News	**606**
Strategic Service Alliance	**611**
Switch Management Corporation	**311**
Syracuse University School of Information Studies	**703**
Telemobile Inc.	**509**
The Aerospace Corporation	**202**
Time Warner Telecom	**607**
TransTeleCom Company	**604, 605**
USAsia Telecom	**516**
Verestar, Inc.	**314**
Via Satellite	**515**
ViaSat	**413, 414**
Vision Accomplished Hawaii	**706**
Voiceware Systems	**707**
WorldCom	**317**

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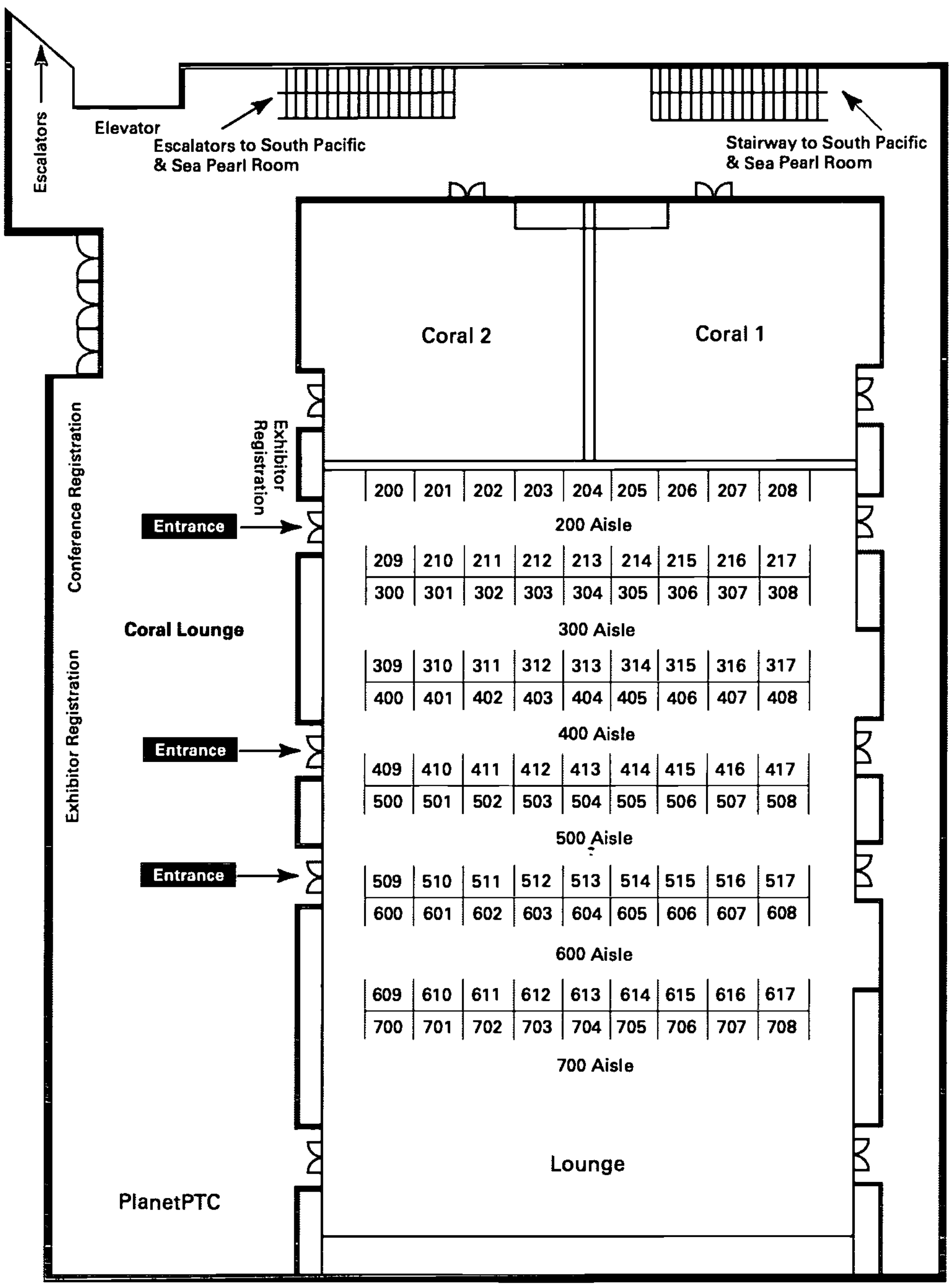
PTC2002 Exhibit Layout

www.ptc.org/ptc2002

PTC2002 Exhibit Layout
Hilton Hawaiian Village
Mid-Pacific Conference Center
6th Floor



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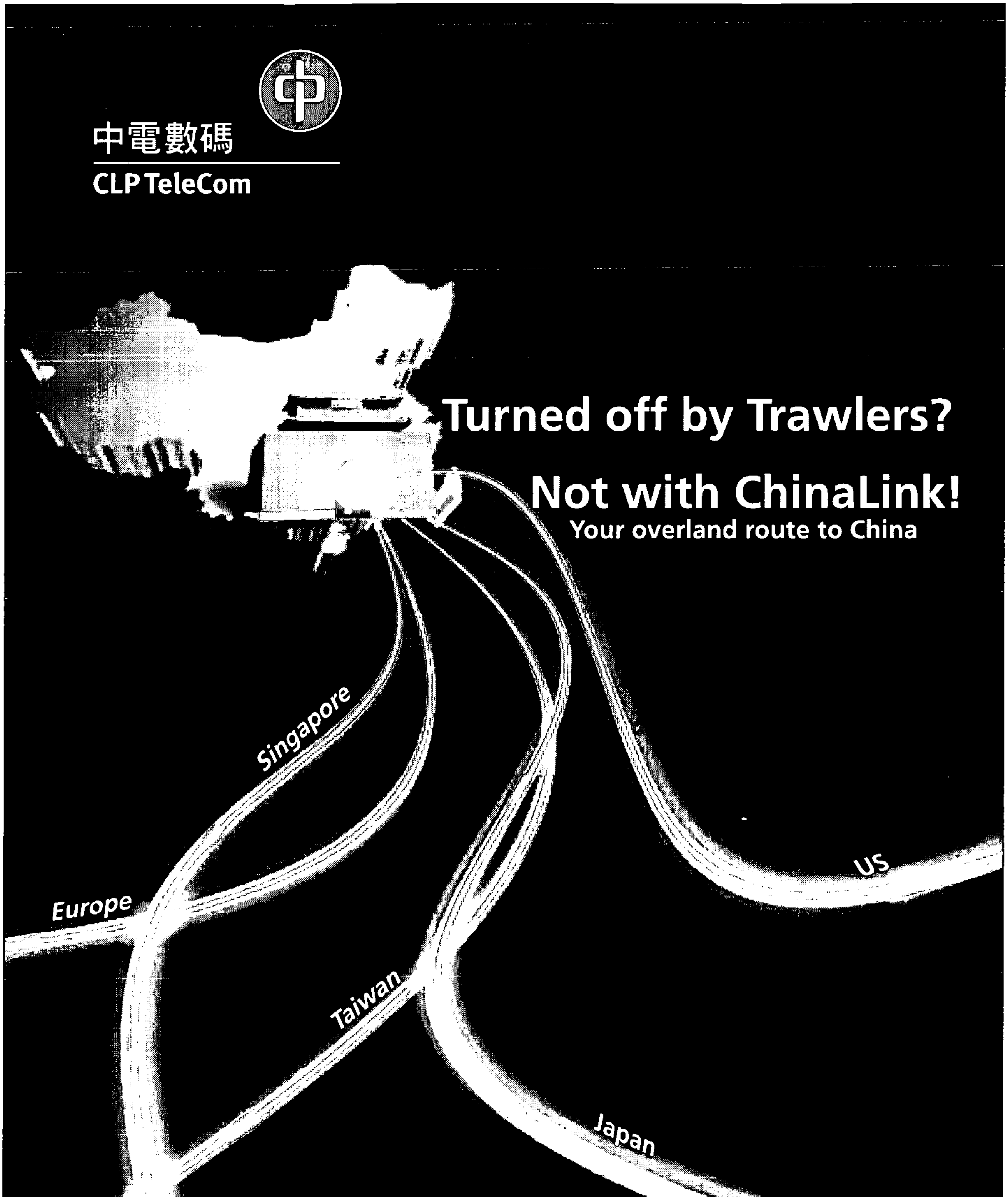
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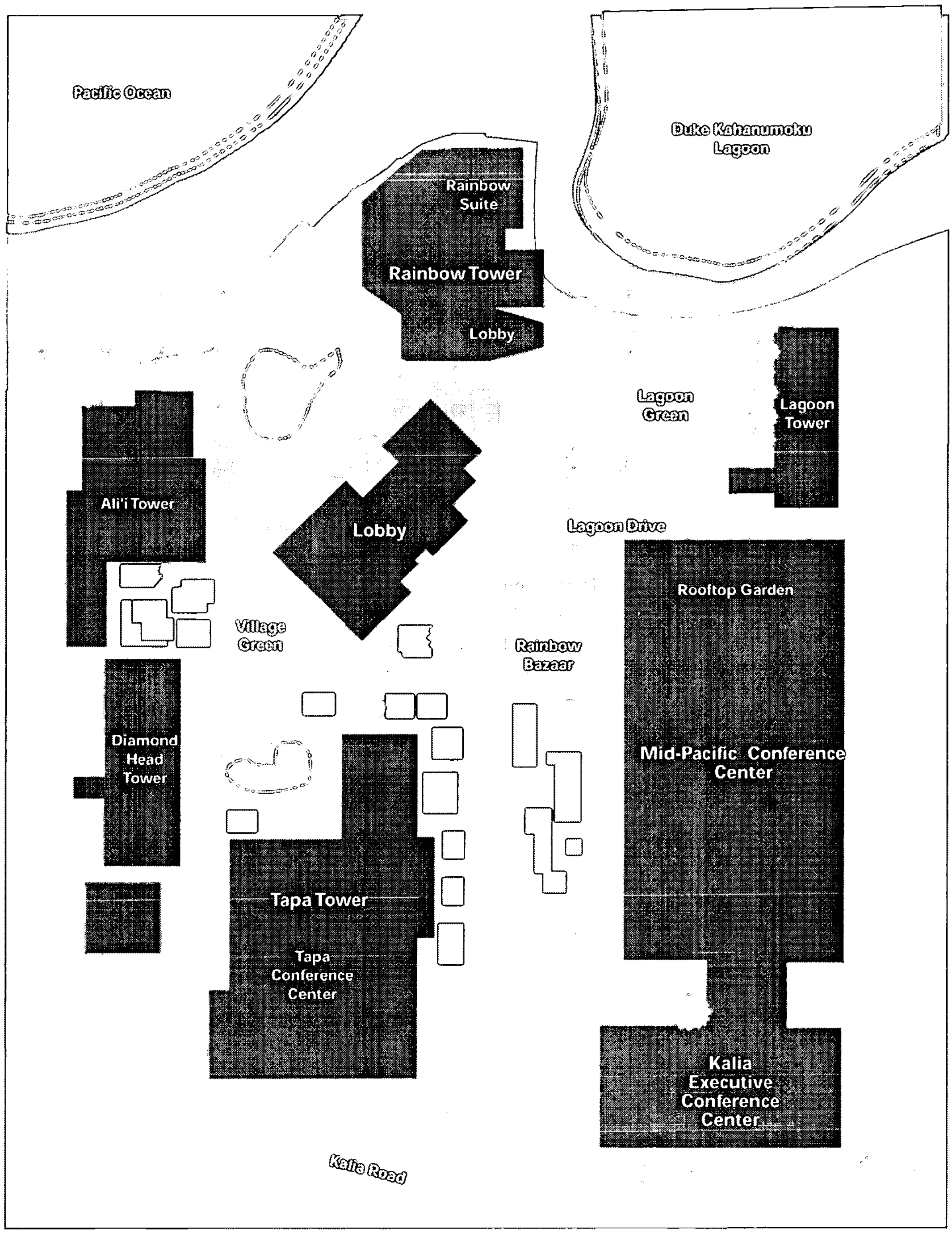
PTC2002 www.ptc.org/ptc2002

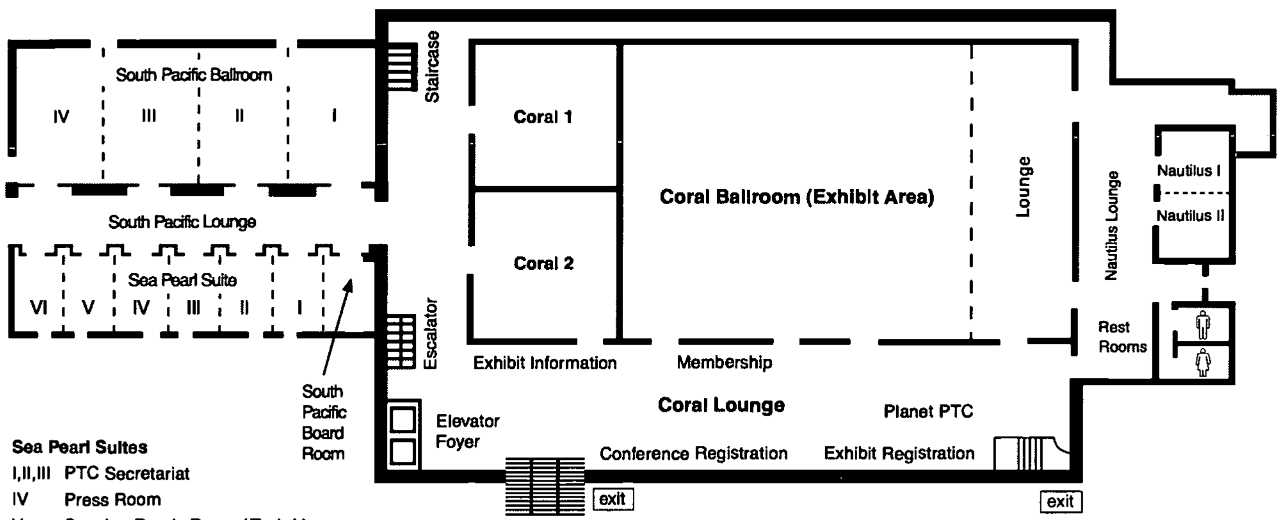
Hilton Hawaiian Village



1280

PTC2002 Meeting Room Layout

Mid-Pacific Conference Center



Sea Pearl Suites

I,II,III PTC Secretariat
IV Press Room
V Speaker Ready Room / Tech Manager
VI Speaker Ready Room / Floor Manager

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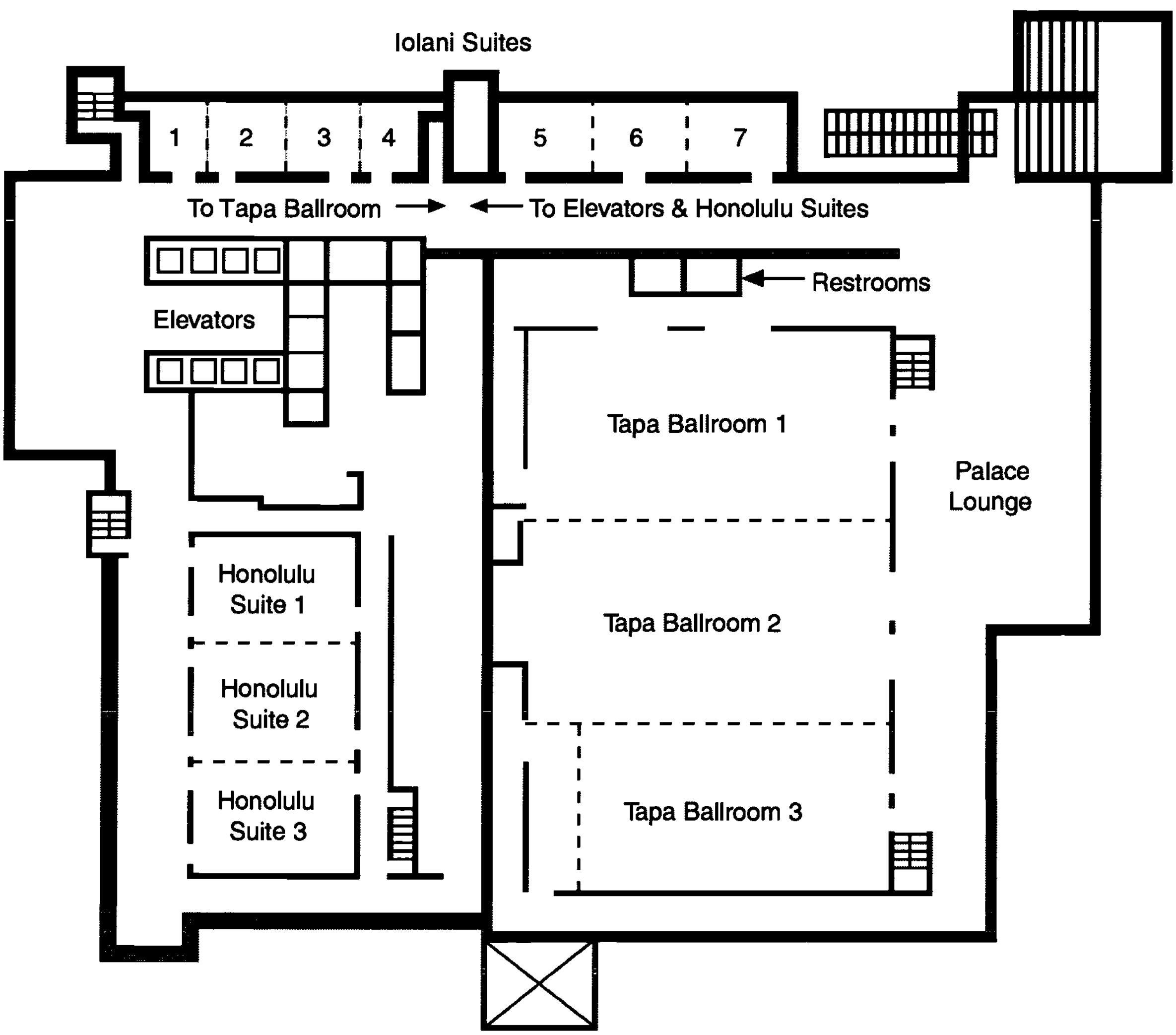
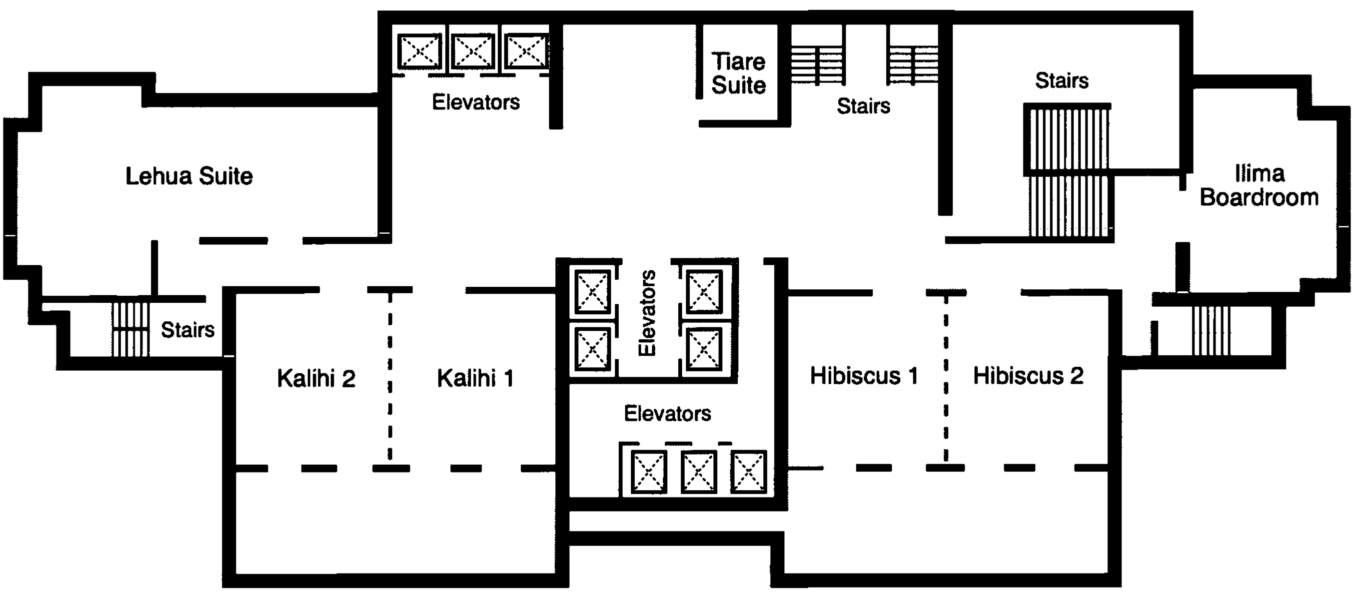
Tapa Tower



1282

www.ptc.org/ptc2002

Kalia Executive Confence Center



Associated Seminars and Meetings

Asia Pacific Distance Learning Forum (APDLF)

11-12 January 2002
East-West Center

For the third consecutive year, the Asia Pacific Distributed Learning Forum (APDLF) will provide PTC attendees with the opportunity to join in an intensive pre-conference workshop created specifically to advance the availability of high-quality electronically-delivered educational services in the Asia-Pacific region. The APDLF has been designed to meet the needs of Asia-Pacific institutions, consortia or organizations considering the startup of their own distance learning program, those seeking educational services from an established provider, or those contemplating hybrid partnerships to enable them to develop internal capacity over time. Vendors and providers of distance learning services and products are also welcomed.

The APDLF program weaves together two components. A high-quality intensive interactive workshop will provide participants with a common basic knowledge and framework for distance learning. Each participant will also have an opportunity to share their issues and services with others in a supportive environment designed to generate new ideas and insights from workshop faculty and other participants. Workshop content will be drawn from the Western Cooperative for Educational Telecommunications' highly successful Institute for the Management of Distance Education which is now in its 6th year of operation.

The APDLF will be conducted at the East-West Center and is sponsored by PTC, the University of Hawaii, the University of Alaska and the Western Cooperative for Educational Communications.

For more information or to register, see:
http://www.hawaii.edu/apdlf/
Or send email to apdlf@hawaii.edu

China Telecom 2002

11-12 January 2002
Westin Hawaii Prince Hotel

Information Gatekeepers, Inc. (IGI), in cooperation with the Pacific Telecommunications Council (PTC), will hold the China Telecom 2002 conference at the Westin Hawaii Prince Hotel on 11-12 January 2002. As a precursor to the conference, IGI will hold five segmented workshops along with our brand new "Executive Summit".

The theme of the conference is "WTO, the Beijing Olympics and Your Opportunities." Major telecom operators and ISPs in China and executives from international telecom companies are expected to address the conference. The event offers the best opportunities to network and exchange views on future business development strategies in the post-WTO China. It is conveniently scheduled to allow you to attend the PTC annual conference, 13-17 January 2002.

For more information visit our conference website: www.chinaconf.com or contact us at:

Information Gatekeepers, Inc.
214 Harvard Street, Suite 200
Boston, MA 02134
Phone +1.617.232.3111
Fax: +1.617.734.8562

Pacific Island Telecommunications Association (PITA)

12 January 2002
Hilton Hawaiian Village
South Pacific II
0800-1300

(Members Only Meeting)

Pacific Islands Regulatory and Carrier Issues

12 January 2002
Hilton Hawaiian Village
South Pacific II
1400-1700

Organized by Pacific Islands Telecommunications Association (PITA) and The East West Center (EWC) and MCI Worldcom (Hawaii).

Regulators and carriers in this panel will discuss issues and concerns about their different work environment and how they can improve relationships and understand each other's concerns in order to further telecommunications development in the region.

Pan Pacific Distance Learning Association (PPDLA)

12 January 2002
Hilton Hawaiian Village
Honolulu II and III

The 14th annual Pan Pacific Distance Learning Association (PPDLA) conference will be held on Saturday, 12 January 2002 at the Hilton Hawaiian Village. PPDLA, a local chapter of the National Distance Learning Association, is a non-profit association formed to promote the development and application of the information technologies and distance learning to education and training in Hawaii and the Pan Pacific region.

The theme of this year's conference is "Distance Learning, The Next Generation," and will highlight the emerging technologies as well as practical and promising strategies for developing successful distance learning programs for K-12, Higher Education, Telehealth and Government Training.

This conference is held in conjunction with the annual Pacific Telecommunications Council's (PTC) Conference. Anyone interested in the opportunities provided by distance learning is invited to attend and network with distance learning educators, providers, and technical advisors from around the world. Registration may be done online at PPDLA.ORG

Sunday
13 January 2002

0800-1700
Workshops

WKS1

New Investment and Business Models in the Communications Sector

Location:
South Pacific I

Presenter:
BRENDAN COADY, Partner, Gilbert & Tobin, *Australia*

This introductory tutorial will examine the recent trends in investment and business models in the communications sectors across the world. In the last 12 months, business models emerged including Mobile Virtual Network Operators, International Bandwidth Trading and Wholesale DSL Providers. These new business models are increasing the competitiveness of telecommunications markets and increasing the diversity of financing options. We have also seen a downturn in options such as Vendor Financing.

Picking the winning option is an important issue to telcos across the region. There are not necessarily any definite winners or losers and some models are compatible. Learning about the options is the purpose of the tutorial.

The business models that will be examined include (1) New Models for Building and Funding Infrastructure; (2) International Bandwidth Trading; (3) New Wholesale Models in Fixed Networks; (4) Mobile Virtual Network Operators; (5) The Role of Wholesale xDSL and Unbundled Local Loop; and (6) The Role of Equipment Manufacturers in Funding Networks.

The tutorial will focus on the practical aspects of each emerging model.

WKS2

Joint Ventures and Strategic Alliances in Asia

Location:
South Pacific III

Chair:
PHILIP SPECTOR, Partner & Chair, Communications & Technology Practice Group, Paul Weiss Rifkind Wharton & Garrison (PWRW&G), *USA*

Presenters:
JEANETTE CHAN, Partner, PWRW&G, *Hong Kong SAR, China*

MICHAEL REEDE, Partner, PWRW&G, *Hong Kong SAR, China*

LISA YANO, Partner, PWRW&G, *Japan*

A key element of the telecommunications market in the Asia-Pacific region is the strategic alliance—a joining together of two or more entities in pursuit of a common goal. It is increasingly the case that companies in the region recognize the need for the synergies and complementarities that a joint venture or other alliance can bring, particularly as they seek means to deal with the phenomenon of convergence and the increasing demands for access to information. In the information technology ("IT") industries, the transnational joint venture—as a means of starting up a new telecom service offering or enhancing an existing one—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, with a particular emphasis on the next generation of IT. After an overview of issues common to all such alliances, the workshop will provide a country-specific analysis with respect to China (including Hong Kong), Japan, and Australia. The speakers addressing these subjects will be an international panel of lawyers from Asia and the United States.

WKS3

Mutual Recognition Agreements/Arrangements (MRAs)

Location:
South Pacific IV

Chair:
WILLIAM MCCRUM, Director, Telecommunications Engineering & Certification, Industry Canada, *Canada*

Presenters:
JOE DHILLON, Program Manager, Global Standards and Information Program, National Institute of Standards and Technology (NIST), *USA*

ART WALL, Associate Chief, Policy and Rules Division, Office of Engineering and Technology, Federal Communications Commission, *USA*

MARCUS OLIVIERA, Certification Manager, Agencia Nacional de Telecommunicaciones (ANATEL), *Brazil*

TAKAYUKI SUZUKI, Deputy Director, Electromagnetic Environment Division, Telecommunications Bureau, Ministry of Public Management, Home Affairs, Post and Telecommunications (MPHPT), *Japan*

Mutual Recognition Agreements/Arrangements are an important new policy instrument being used by governments of the Asia-Pacific region and elsewhere for simplification of international trade in regulated products. An MRA essentially recognizes the competence of an exporting partner to carry out the regulatory procedures of the importing partner. The focus of this workshop is MRAs in Conformity Assessment for telecommunication equipment. The workshop will explain MRA concepts in detail and compare them to other trade facilitation measures such as Memoranda of Understanding (MoUs) and Treaties e.g. NAFTA. Actual examples of multilateral MRAs now in operation between various countries and regions will be described. These will include the APEC telecommunications MRA, USA-European Union (EU) MRA, InterAmerican MRA and Canada-EU MRA. MRA implementation issues and challenges will be outlined by experts who are actually responsible for MRAs in their respective countries. Future prospects for MRAs on a wider global scale will be discussed, as will their impacts on legislative and regulatory regimes in implementor countries.

The Asia Satellite Communications Summit

"Broadband, Narrowband and Everything in Between"

Organized by the Global VSAT Forum in conjunction with the International Satellite Sector and Pacific Telecommunications Council

13 January 2002 • 0840–1700
Nautilus Room

0840 **Registration**

0900 ***Executive Briefing: Asia-Pacific and the Path to IP-Based Satellite***

Satellite communications are again taking center stage in the Asian telecoms arena. In recent months, the private sector has been seizing upon VSAT-based voice, data and video solutions at an unprecedented rate. The public sector, meanwhile, has also been moving to facilitate service providers' efforts by expanding market access.

Against this dynamic backdrop, the Asia Satellite Communications Summit will be opened by DAVID HARTSHORN—the Global VSAT Forum's Secretary General—who will give an overview of the latest commercial and regulatory trends impacting the provision of Asian narrow- and broadband services.

0930 **Q&A**

0940 ***Open vs. Closed Skies: The Truth About Satellite Competition***

The ITU says it's good. The lawyers and consultants like it. But is liberalisation everything it's cracked up to be? This open-forum session will explore exactly what effect satellite liberalisation is having in Asia from the practical standpoint of promoting communications.

Meanwhile, an increasingly rich supply of bandwidth is parked above Asia. Satellite operators have answered the call to provide versatile and reliable links to, from and within the region. Are regional telecom applications being served via satellite? And should—indeed, must—something be done to improve operating conditions? Join this session to find out.

1040 **Refreshment Break**

1120 ***VoIP Via Satellite: Too Much Too Fast?***

Perhaps no other telecom service generates more questions than Voice over IP (VoIP). But as demand increases, Asian PTTs and other service organisations increasingly are relying upon satellite as a tool to move voice traffic—whether or not they admit it. Attend this session to hear from leading VoIP experts how satellite is being used to strengthen service portfolios, and how Asia's governments are moving to address the trend.

1230 **Lunch Break**

1430 ***Trends and Analysis: The Crystal Ball Revisited***

Earth station prices have dropped exponentially. Service providers have amassed tremendous expertise in implementing cost-effective networks. And state-of-the-art services are available to support national and international applications throughout the Asia-Pacific region. STÉPHANE CHENARD, Senior Consultant with Euroconsult, and JEREMY ROSE, Senior Analyst with U.K.-based COMSYS, will reveal the top Asia-Pacific satellite trends and plot the way forward.

1530 **Refreshment Break**

1600 ***Do Broadband VSAT Networks Really Make Sense for Asia?***

Pent-up demand for IP-based applications is driving hundreds of thousands of potential end users toward satellite solutions. Billions of dollars have been invested to roll out next-generation VSAT services. And broadband satellite portfolios have been tailored for small-to-medium enterprise, small-office/home-office, and residential markets, with a valuation well into the billions. Attend this session to learn what the global satellite communications manufacturers and service providers have to offer Asia—and whether it makes sense in the Asian context.

1700 **Meeting Adjourns**

1130-1530

PTC Board of Trustees' and Members' Meeting

1300-1800

Panel Discussions and Roundtables

RT 1

The Commercial Launch Industry Panel

Location:
South Pacific I

Chair:
ED WARD, Vice President, Asia Pacific Marketing & Sales, International Launch Services, *USA*

Panelists:
MARK ALBRECHT, President, International Launch Services, *USA*
***Atlas and Proton** (USA)*

RICHARD BOWLES, Vice President—Asia, Arianespace, *Singapore*
***Ariane** (Europe)*

ROBERT SIRKO, Vice President—Asia Sales, Boeing Launch Services, *USA*
***Delta and Sea Launch** (USA)*

ZHIXIONG LIU, Vice President and Research Professor, China Great Wall Industry Group, *People's Republic of China*
***Long March** (People' s Republic of China)*

Rocket Systems Corp., *Japan*
***The H-IIA** (Japan)*

PTC2002 will reach beyond earth-bound telecommunications and extend itself into space with wide participation by the communications satellite industry and the commercial satellite launch services industry as well.

The Commercial Launch Services Panel for PTC2002 will consist of executive level representatives of the largest commercial launch services providers in the world today and will be asked to address the issues faced by the satellite and launch industry for the coming year. The panel moderator will present the issues to each panel member and will direct questions from the PTC participants to the panel members.

RT 2

New Era Satcoms

Location:
South Pacific IV

Facilitator:
EDWARD SLACK

Panelists:
EUI KOH, Vice President—Asia Pacific, New Skies Satellite Singapore, *Singapore*

RAMIN KHADEM, Chief Financial Officer, Inmarsat Ventures Plc., *United Kingdom*

JOHN STANTON, Vice President, Sales and Marketing, Intelsat, *USA*

This will be a round table discussion amongst those organizations which are undergoing a transition in their existence from that of intergovermental monopoly organizations to private companies competing on equal terms with competitive organizations. The objective is to bring together these companies and have them discuss the forces which caused them to change, the ways in which this change had to be agreed upon by the previous owners, and the basis on which these organizations will compete in the future. The audience will also be encouraged to ask questions considered appropriate for the forum to stimulate the discussion, and the members will be asked to comment on whether the strategies employed were the best, or if they may have functioned better with certain changes. Each of the participating organizations will be invited to offer both opening and closing statements.

RT 3

Pacific Island Telecommunication Issues

Location:
South Pacific II

Organized by:
Pacific Island Telecommunications Association (PITA) and the East-West Center (EWC)

This roundtable will provide an opportunity for Pacific Islanders and others to comment on or clarify discussions during the Saturday panel featuring Pacific Island Regulators and service providers. Focus will be on regulatory issues, user concerns, including costs of Internet and other services, human resource availability and retention, finance and capital for expansion, new services such as broadband via satellite, closing the digital divide, and other topics.

1630-1800
Conference Opening Plenary Session

Location:
Tapa II

Convener:
HOYT ZIA, Executive Director, Pacific Telecommunications Council

Welcoming Remarks:
EIJI HAYASHI, Chairman, Board of Trustees, Pacific Telecommunications Council

HANSUK KIM, President, Pacific Telecommunications Council

GOVERNOR BENJAMIN CAYETANO, State of Hawaii, *USA*

Chair:
DAVID LASSNER, Director, Information Technology, University of Hawaii, *USA*

Speakers:
DEANE NEUBAUER, Interim Chancellor, University of Hawaii, *USA*

ABDUL KHAN, Assistant Director-General, Communication and Information, UNESCO

YOSHIO UTSUMI, Secretary-General, International Telecommunication Union

1800-1930
Opening Reception

Location:
Lagoon Green

Sponsored by Verizon

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Monday
14 January 2002

0730-0815
First Time Attendee/New Members' Breakfast
Location:
Honolulu Suite

0730-0815
Speakers' Breakfast
Location:
Coral I

Sponsored by TCSI

0815-1030
Plenary Session
Location:
Tapa II

Chair:
BRUCE DRAKE, Executive Director, Industry Canada, *Canada*

Keynote Speakers:
MINISTER YANG SEUNG-TAIK, Ministry of Information and Communication, *Republic of Korea*

HARUO MURAKAMI, Chairman, Telecommunication Carriers Association and Chairman, Japan Telecom Co., Ltd, *Japan*

JOHN LEGERE, Chief Executive Officer, Global Crossing & Asia Global Crossing, *USA*

MINISTER WU JICHUAN, Ministry of Information Industry, *People's Republic of China*

1030-1100
Morning Break
Sponsored by DYNEGY

1100-1230
Super Sessions

SS1
Leaders' Forum—"Challenges in Making IT Work for the People"
Location:
Tapa II

Chair:
JANE HURD, Chairman, Pacific Telecommunications Council & President, Severance International Inc., *USA*

Speakers:
TAN SRI NURAIZAH ABDUL HAMID, Chairman, Malaysian Communications & Multimedia Commission, *Malaysia*

SETHAPORN CUSRIPITUCK, Former Director-General, Post & Telegraph Dept, *Thailand*

WINSTON THOMPSON, Chief Executive Officer, Telecom Fiji, *Fiji*

JIN SHENG SU, Director-General, Ministry of Information Industry, *People's Republic of China*

SS2
Pacific Region Telecoms Issues—a User Perspective
Location:
Tapa III

Chair:
ERNIE NEWMAN, Vice Chairman-Asia Pacific, INTUG, *New Zealand*

Speakers:
MUTSUYA ASANO, Japanese Keidanren & Director, Telecommunication Relations, IBM Japan, Ltd, *Japan*

STUART CORNER, Founder and Managing Director, 3rd Wave Communication Pty Ltd and member of the Australian Telecoms Users Group (ATUG), *Australia*

JUDITH SPEIGHT, Chairman, Telecoms Users Association of New Zealand (TUANZ) and CEO, Voice Edge Ltd., *New Zealand*

So often industry conferences focus on internal technical and carrier issues with comparatively little attention given to the customer—the fulfillment of whose needs is the purpose for which the industry exists. In this session, a group of leading telecommunication user advocates from around the Pacific will present the key issues for users in their respective constituencies. The session will be comprehensive and sometimes provocative.

1130-1530
Exhibits Open

1230-1400
Lunch in the Exhibit Area

1300-1330
Vendor Lunch
Location:
Rooftop Tent

Sponsored by InfoVista

1230-1400
Researchers' Lunch
Location:
Iolani V

1290

1400-1530
Concurrent Sessions

M11
Development Challenges for the Asia-Pacific Region

Location:
South Pacific III/IV

Chair:
RICHARD NICKELSON, Senior Advisor, Pacific Telecommunications Council

Telecommunication development has been a central focus of ITU since it was constituted in its present form in 1947. The advent of all-digital telecommunications, including broadcasting and the Internet, has posed new challenges for development, but the digital world also offers unprecedented opportunities for more economical, efficient and reliable services. This session will examine how the new technologies may be applied in the Asia-Pacific region to accelerate the development process and the trade opportunities that arise as a result.

Panelists:
WILLIAM WITHERS, Senior Expert, International Telecommunication Union, Regional Office for Asia and the Pacific, *Thailand*

RICHARD BUTLER, Chairman, AsiaSpace, WorldSpace Asia, *Australia*

DANIEL BRODY, Managing Director, US Information Technology Office, *People's Republic of China*

PEKKA TARJANNE, Special Advisor to the Secretary-General of the United Nations on Information and Communications Technology (ICT), United Nations, New York, *USA*

M12
Distance Learning/Education

Location:
Honolulu Suite

Chair: TBA

M.1.2.1
LIANGYI CUI, Professor, Shanghai Jiaotong University, *People's Republic of China* and KAISU ZHANG, Student, Brigham Young University–Hawaii Campus, *USA*
Corpus-based Multilingual Terminology for Online TCM

M.1.2.2
CHRISTINA HIGA, Director, Pan-Pacific Education and Communication Experiments by Satellite Social Science Research Institute, University of Hawaii, *USA*
PEACESAT Celebrates 30 Years in the Pacific Islands: A Program Update and Look at Public Service Telecommunications in the Region

M.1.2.3
SAM SHAW, President and JEFF ZABUDSKY, Dean, Technology and Curriculum Innovation, The Northern Alberta Institute of Technology, *Canada*
A Strategic Planning Approach to Technology Integration: Critical Success Factors

M.1.2.4
WILL PERATINO, Director, Advanced Distributed Learning (ADL) Initiative, Office of the Assistant Secretary for Policy, Department of Labor and G A REDDING, DL Analyst, Institute of Defense Analyses, *USA*
The Impact of Assistive Technology: Section 508 and You

M13
Pacific Islands

Location:
South Pacific I/II

Organizer:
Pacific Islands Telecommunications Association (PITA)

Chair:
FRED CHRISTOPHER, Manager, Pacific Islands Telecommunications Association

Speakers:
FRED CHRISTOPHER, Manager, Pacific Islands Telecommunications Association
Pacific Islands Telcos Report

WILLIAM WITHERS, Senior Expert, International Telecommunication Union, Regional Office for Asia and the Pacific, Thailand
Pacific Islands Telecom Issue

PETER LOKO, General Manager International Business, Telikom PNG, *Papua New Guinea*
Where Are We At

M14
Network Convergence

Location:
Coral I

Chair:
ELLEN HOFF, President, W.L. Pritchard & Co., L.C., *USA*

M.1.4.1
DAVID GREENBLATT, CEO, ADIR VoIP Technologies, *USA*
The Effects of Convergence: Where the Future Will Take Us

M.1.4.2
A. BAGULA, Research Assistant, Dept. of Computer Science, University of Stellenbosch, *South Africa*
Traffic Engineering Label Switched Paths in IP Networks Using a Threshold Routing Approach

M15
Fostering Competition

Location:
Coral II

Chair:
GLENN GERSTELL, Partner, Milbank, Tweed, Hadley & McCloy LLP, *USA*

M.1.5.1
TIMOTHY DENTON, Head, tmdenton.com, *Canada*
Protocol Interfaces are the New Bottlenecks: What the Internet Means for Telecom Regulation

M.1.5.2
ANTHONY SYLVESTER, Senior Lawyer, Arculli and Associates, *Hong Kong SAR, China*
Unbundled or Undone: Frameworks and Incentives for LLU

M.1.5.3
IAN SCOTT, Vice President, Government Affairs, Call-Net Enterprises Inc., *Canada*
A Strained Relationship: The Uneasy Marriage of Regulation and Competition

M.1.5.4
ROBERT FRIEDEN, Professor of Telecommunications, Pennsylvania State University, *USA*
Who Controls the Internet?

M16

Fostering and Sustaining an Innovation Economy in Washington State

Location:
Tapa III

Chair:
LOUIS FOX, Vice-Provost, University of Washington, *USA*

Speakers:
SUSANNAH MALARKEY, Executive Director, Technology Alliance, *USA*
Fostering Innovation

MARTIN SMITH, Partner, Preston, Gates & Ellis LLP, *USA*
Building Washington's Reputation as a Technology Leader

LOUIS FOX, Vice-Provost, University of Washington, *USA*
Creating a Quality K-20 Education System

BRYAN CHEE, Director, Smart Tools Academy, *USA*
Business, Education, Government & Philanthropy: Working Towards the Common Good

Washington State has adopted a regional approach to sustaining and strengthening the region's technology economy—what is often referred to as the "innovation economy." Such a strategy has required a strong partnership among the business, education, and governmental sectors. This session will explore this partnership, highlighting its priorities and its projects. The panel, made up of representatives from all of the sectors above, will give a brief history of this partnership and an overview of its priorities and recent projects.

1530-1600
Afternoon Break

Sponsored by Subic Telecom

SUBIC TELECOM

1600-1730
Concurrent Sessions

M21

Executive Skills Development in Telecom Industry

Location:
South Pacific I/II

Chair:
HYON-SOOK (SUE) DAMEN, Director, A.T. Kearney Executive Search, *USA*

Speakers:
RICK BRADLEY, Senior Vice President, Human Resources, Cingular Wireless, *USA*
Executive Skills Requirements from HR Perspective

JEANNIE DIEFENDERFER, Group President, Verizon Advanced Networks, *USA*
Evolution of the 21st Century Executive

LISA NAPOLITANO, President and CEO, Strategic Account Management Association, *USA*
Individual and Organizational Competencies for Successful Strategic Customer Management

The human development factors are very important, particularly to the telecom carrier executives in the ever-increasing competitive environment as de-regulation and liberalization progress. The human aspects are starting to far surpass the importance of the technology. Many network operators no longer build, deploy and own networks. Instead, they are focusing on "owning" customers. The managerial and executive skills required in this new environment significantly differ from the "monopolistic," traditional carrier environment. Furthermore, the customer base is becoming more and more diverse and, consequently, the people serving these customers will need to have a better understanding of diverse requirements to be successful.

The speakers in this session will go beyond the "engineering" perspectives and will address the human resource requirements and development aspects from multiple viewpoints. They will discuss the more socially-oriented, customer-focused environment and propagate the understanding of diverse needs of the customer base.

The new business model will put a significant stress on human resources in the business. Executive skills requirements for today's operators are significantly different from a traditional facility-based operator. They have to be very customer-oriented. Also, they have to establish strong partnerships with the other network operators whose networks they will entrust their customers.

The session speakers will also address in the panel discussion the changing nature of communications and the impact of the technological advances on the way people communicate.

Also, as the session participants have a variety of ethnic and cultural backgrounds, they will be uniquely positioned to blend in the social and cross-cultural issues touching the multinational telecommunication companies and draw the connection between a diverse customer base and managing the staff.

M22

Business Strategies—Getting to the Customer

Location:
South Pacific III/IV

Chair:
MITESH DESAI, Vice President, Telecom Solutions, Compaq Telecom, *USA*

M.2.2.1
JEREMY GODFREY, Member of PA Management Group; VIRAT PATEL, Managing Consultant; DAN DODSON, Principal Consultant; MARK NEILD, Consultant and CATHERINE TSUI, Principal Consultant, Telecoms & Interactive Media Practice, PA Consulting Group, *Hong Kong SAR, China*

Presenter:
ALAN KOLNIK, Member of the Management Group, PA Consulting Group, Inc., *USA*

Interactive Television Over Broadband Networks—Can Anyone Make Money From It?

1292

M.2.2.2
GUY TEMPLETON, Global Head, Telecommunications & Interactive Media & Member of PA Management Group, JACKSON KAM, Principal Consultant, Telecommunications and Interactive Media, PA Consultant Group, *Hong Kong SAR, China* and KATE WATERHOUSE, PA Consulting Group, *Australia*
Breaking Out of the Telecom Value Trap—Not All Customers are the Same

M.2.2.3
TAKAO HARA, General Manager, Regional Information Systems Division; SUSUMU WATANABE, Manager, Science Systems Division and KOICHI YAMAKAWA, Manager, Dept. of Satellite Communication Systems, Fujitsu Limited, *Japan*
An Intensive Use of Satellite Weather Information for Agriculture

M23
China

Location:
Tapa III

Chair:
TAO YUN, Chairman, Beijing Star-Net Communications, *People's Republic of China*

Speakers:
ZIXIANG (ALEX) TAN, Assistant Professor, Syracuse University, *USA*
Wireless Communications In China—An Update

ERHAI LIU, Vice President, China Railcom Netcom Co., *People's Republic of China*
Voice Service—A Shining Star in China Quickly Growing Telecommunications Market

XIAOXIN FAN, COO, Beijing Star-Net Communications, *People's Republic of China*
Market Strategy Towards Enterprises in China Telecom/Internet Market

DAVID HONG, Senior Business Development Manager, China Business Development, M3COM Limited, *People's Republic of China*
Broadband Market in China

M24
Future Wireless Systems

Location:
Coral I

Chair:
TBA

M.2.4.1
UMESH AMIN, Director, New Technologies, AT&T Wireless, *USA*
Evolution of Wireless Devices

M.2.4.2
DONG-HAHK LEE and SEONG SOO PARK, Research Engineers and JONG TAE IHM, Principle Researcher, Network R&D Center, SK Telecom, *Republic of Korea*
A Perspective of Mobile Communication Service Beyond IMT-2000

M.2.4.3
TATSUO ITABASHI and SHUSAKU MARUKO, Mobile EC Project Department, I-Card System Solutions Division, Broadband Network Center, Sony Corporation, *Japan*
Development of a New E-Commerce System Using Contactless IC Card and Personal Data Assistant (PDA) Terminal

M.2.4.4
HYUN-CHEOL JEON; YOON-SEOK JUNG; BUM KWON; JONG-TAE IHM, Associate Researchers, Network R&D Center, SK Telecom and BEOM-DAE BAK, National Computerization Agency, *Republic of Korea*

Presenter:
YOON-SEOK JUNG, Associate Researcher, Network R&D Center, SK Telecom, *Republic of Korea*

Analysis on the Effects of Repeater System in 3G Wireless Network

M25
Regulation in Converging Markets

Location:
Coral II

Chair:
LIZ WILLIAMS, Director, AAS Consulting, *Australia*

M.2.5.1
MICHAEL REEDE, Partner, Paul Weiss Rifkind Wharton & Garrison, *Hong Kong SAR, China*
Regulating Broadband Networks Now that Deployment is a Reality

M.2.5.2
CHARLOTTE KONG, Associate and PETER BURGE, Partner, Deacons Grahams & James, *Hong Kong SAR, China*
Regulation of Evolving Utilities Companies as "Traditional Telcos"

M.2.5.3
KUNDAN MISRA, Product Strategist, Clarity International Ltd., *Australia*
Comparison of Official Bodies Established to Address the Convergence of Telecommunications, Broadcasting and IT in Asia Pacific

M.2.5.4
QILIANG ZHU, President, Wholewise Telecom Research Institute and Professor, Beijing University of Posts and Telecoms, *People's Republic of China*
Policy, Regulation and Issues of Network Convergence in China

M26
Alliances & Strategies for Corporate and National Development

Location:
Honolulu Suite

Chair:
ROBERT FRIEDEN, Professor of Telecommunications, Pennsylvania State University, *USA*

M.2.6.1
PETER WATERS, Partner, Arcull & Associates/Gilbert & Tobin, *Hong Kong SAR, China* and ROB SIMPSON, Partner, Gilbert & Tobin, *Australia*
New Models for Network Deployment and Financing—The Impact of Global Trends

M.2.6.2
MIN YI, Analyst, Asia-Pacific, Ryan Hankin Kent, *USA*
Developing Telecom Infrastructure in West China

Tuesday
15 January 2002

0730-0815
Speakers' Breakfast

Location:
Coral I

Sponsored by TCSI

0800-1000
Plenary Sessions

Location:
Tapa II

Chair:
TBA

Speaker:
ROBERT MAO, President and Chief Executive Officer, Nortel Networks China, *People's Republic of China*

PEKKA TARJANNE, Special Advisor to the Secretary-General of the United Nations on Information and Communications Technology (ICT), United Nations, New York, USA and former Secretary-General, ITU

1000-1200
Award Winning Series Ready2Net

Looking Back to the Future—Collaboration & Convergence in International Distance Education

Location:
Tapa I

This webcast will address the following questions. Which projects are successfully overcoming the real demise of boundaries? The demand for relevant content, real-time processes, and certification courseware is exploding. Where are we heading in the Globalization of E-learning and what really works for the Global Learner?

This session will be discussed as part of the Educators' Lunch.

1000-1100
Morning Break

Sponsored by

PHILIPS

1100-1230
Concurrent Sessions

T.1.1
Social Shaping of E-Commerce

Location:
South Pacific I/II

Chair:
YOSHIKO KURISAKI, Senior Manager, SITA

T.1.1.1
ELIZABETH FIFE, Principal Researcher and FRANCIS PEREIRA, Principal Researcher, Center for Telecommunications Management, Marshall School of Business, University of Southern California, *USA*
Economic, Social and Cultural Factors Affecting the Adoption of E-Commerce Applications in Small and Medium Size Enterprises: A Cross Country Analysis

T.1.1.2
KENG-JIN LIAN, Marketing Manager, Asia Pacific Business Group, Hughes Network Systems, *USA*
E-Commerce Via Satellite in Japan

T.1.1.3
A. LEE GILBERT, Associate Professor and SUNANDA SANGWAN, Market Researcher, Nanyang Business School, *Singapore*
Emerging Wireless Data Services Markets—An Asian Perspective

T.1.2
Existing & Emerging Networks

Location:
South Pacific III/IV

Chair:
JIM HEBERLE, President, HeBe Associates, *USA*

T.1.2.1
GEOFF JOHNSON, Research Area Director, Asia Pacific, Gartner, *Australia*
From Internet to Supranet with Mobile Commerce

T.1.2.2
THOMAS AGOSTON, Manager, Asia-Pacific, IBM Global Services, *USA*
Peer-to-Peer Computing—Business Implications of Emerging Distributed Technologies

T.1.2.3
ROBERT JACKSON, Counsel, Communications Group, Reed Smith LLP and JODI COOPER, Partner, Capital Telecom Law, *USA*

Presenter:
JODI COOPER, Partner, Capital Telecom Law, *USA*

Privacy, Security and Universal Service: Three Issues May Control the Future of ENUM

T.1.3
East Asia

Location:
Honolulu Suite

Chair:
JAGADISH RAO, Consultant, East West Alliance Inc., *USA*

T.1.3.1
HYEONMO KU, Director, Planning and Coordination Office, Korea Telecom; IK-SOO SON, Researcher, IT Technology Management Research Institute, ETRI; JAEJOON SHIN, Senior Researcher, Management Research Lab and TAEYOL YOO, Managing Director, Planning and Coordination Office, Korea Telecom; *Republic of Korea*

Presenter:
JAEJOON SHIN, Senior Researcher, Korea Telecom, *Republic of Korea*

The Successful Employment of Broadband and Mobile Internet Access Service in Korea and its Implications

T.1.3.2 ***(Academic peer reviewed)***
NIR KSHETRI, PhD Candidate, College of Business Administration and NIKHILESH DHOLAKIA, Professor, College of Business Administration & Associate Director, Research Institute for Telecommunications and Information Marketing (RITIM), University of Rhode Island, *USA*
Internet and E-Commerce Development in Asian Tigers: A Comparison of Chinese Taipei and Hong Kong

T.1.3.3
CHARLOTTE KONG, Associate and PETER BURGE, Partner, Deacons, Graham & James, *Hong Kong SAR, China*

Presenter:
PETER BURGE, Partner, Deacons, Graham & James, *Hong Kong SAR, China*

Convergence Between Broadcasting and Telecommunications and the Impact of the New Carrier Licenses

T.14

Satellite Delivery

Location:
Coral I

Chair:
TIMOTHY LOGUE, Space & Telecommunications Analyst, Coudert Brothers, *USA*

T.1.4.1
MARK BEVER; DOUGLAS HIXON; KENTON HO; STUART LINSKY; TERRENCE SMIGLA and ERIC WHISWELL, TRW Space & Electronics Group, *USA*
Advanced Broadband Satellite Digital Communication—System for the Emerging K-Band Market

T.1.4.2
BRUCE MIDDLETON, Managing Director, Asia Pacific Aerospace Consultants Pty Ltd, *Australia*
Satellite Communications in the Asia Pacific—Opportunities and Constraints

T.1.4.3
BRUCE ELBERT, Managing Director, Application Strategy Consulting, *USA*
Broadband Data Communications Via Satellite—Networks and Methodology

T.1.4.4
LESLIE TAYLOR, President, Leslie Taylor Associates, Inc., *USA*
The Role of satellites in the Internet: Push, Pull and Last-Mile Delivery

T.15

Universal Service

Location:
Coral II

Chair:
ROBERT GUILD, Economic Infrastructure Adviser, Pacific Islands Forum Secretariat, *Fiji*

T.1.5.1
STEVEN HAAS, Director, Business Development, Marketing for International/State Telecom Programs and Telecom Applications, NECA Services, Inc., *USA*
An Overview of State and Federal Universal Service / Access Support Mechanisms and Administration in the United States

T.1.5.2
ANDREW D'UVA, Vice President & Associate General Counsel, New Skies Satellite N.V. , *Netherlands*
Use of Satellite in Achieving Universal Service Objectives in Underserved and Remote Areas

T.1.5.3
CAROLINE LOVELL, Senior Associate, Clayton Utz Lawyers, *Australia*
Contrasting Universal Service Arrangements—Recent Developments in Australia and New Zealand

T.1.5.4
RICHARD FAWCETT, Partner, Bird & Bird, *Hong Kong SAR, China*
An Update on Universal Service Arrangements in Hong Kong

T.16

Strategic Issues of Submarine Cables and Network

Location:
Tapa III

Co-Moderators:
STEVE MCCLELLAND, Editor-in-Chief, Telecommunications International, *United Kingdom*

THOMAS SOJA, President & CEO, T Soja & Associates, Inc. (TSA), *USA*

Panelists:
FIONA BECK, President and CEO, Southern Cross Cable Network, *Bermuda*

SCOTT DAVIES, Executive Director, Macquaries Bank, *Australia*

JEAN GODELUCK, CEO, Alcatel Submarine Networks, *France*

EDWARD MCCORMACK, COO, FLAG Telecom Ltd, *United Kingdom*

ALAN ROBINSON, Vice President, Global Operations Engineering Services, Cable & Wireless, *United Kingdom*

STÉPHANE TÉRAL, Director, Optical Transport, Ryan Hankin Kent (RHK), *USA*

BRIAN ROUSELL, Vice President, Sales & Marketing, TyCom Ltd, *USA*

1130-1300
Exhibits Open

1230-1430
Lunch in the Exhibit Area

1230-1430
Educators' Lunch

Location:
Rooftop Tent

1230-1430
Lawyers' Lunch

Location:
Golden Dragon Restaurant

Pacific Telecommunications Council (PTC) 2454 S. Beretania St., 3rd Floor, Honolulu, HI 96826 www.ptc.org Tel: +1.808.941.3789 Fax: +1.808.944.4874 Email: ptc2002@ptc.org

1430-1600
Concurrent Sessions

T.21
IT Services

Location:
South Pacific I/II

Chair:
PAULA HELFRICH, Executive Director, Hawaii Island Economic Development Board, *USA*

T.2.1.1
G. MICHAEL MCGRATH, Deputy Director, CSIRO-Macquarie University Joint Research Centre for Advanced Systems Engineering (JRCASE) and ELIZABETH MORE, Professor of Management & Director, Graduate School of Management, Macquarie University & Director, MGSM Pty Ltd, *Australia*
A Case Study of IT Outsourcing in a Large Telco: Power-Political Impacts

T.2.1.2 ***(Academic peer reviewed)***
SUPRIYA SINGH, Senior Research Fellow and TERRY LAIDLER, Director, Centre for International Research on Communication and Information Technologies (CIRCIT) at RMIT, *Australia*
The Use of Government Electronic Service Delivery: The Australian Experience

T.22
Speech Technologies

Location:
South Pacific III/IV

Chair:
ROBERT HARBISON, Principal/Analyst, Venture View Associates, *USA*

T.2.2.1
CHRIS VONWILLER, Director, Appen Pty Limited, *Australia*
Speech Technology—Finally Delivering on the Promises

T.2.2.2
HEEJIN CHUN, Assistant Researcher; CECILIA YOUNJEONG KYUNG, Researcher; YOSUB KIM and WONHEE SULL, Director, Platform R&D Center, SK Telecom, *Republic of Korea*
VIG: VoiceXML-based Platform for Wireless Telephony System

T.23
South Asia

Location:
Honolulu Suite

Chair:
GEORGE LISSANDRELLO, President and COO, Infoserve International, Inc., *USA*

T.2.3.1
SOWRI RAJAN KOMANDUR, Head, Telecom Division, India Telecom, *India*
The New Technologies, Business Ventures and Encouraging Telecom Policies in India

T.2.3.2
MOHAN KISHEN KAUL, Consultant and Former Additional Member (Telecom), Ministry of Railways, *India*
Convergence & Regulatory Issues in India

T.2.3.3
HEATHER HUDSON, Professor & Director, Telecommunications Management and Policy Program, University of San Francisco, *USA*
Telecommunications Policy Under Strain: Toward Universal Access in India

T.2.3.4
FAZLUR RAHMAN, Chairman, South Asia Multi Media and FQM FAROOQ, *Bangladesh*
Basket Case to Emerging Tiger

T.24
Future Networking

Location:
Coral I

Chair:
YASUHIKO KAWASUMI, General Manager, Japan Telecom Co., Ltd, *Japan*

T.2.4.1
NAN CHEN, President, Metro Ethernet Forum & Director, Product Marketing, Atrica, Inc., *USA*
Integrating Ethernet & Optical Networking in High Bandwidth Public Networks

T.2.4.2
SHINYA KUKITA, Senior Manager and TERUYUKI NAKAJIMA, Assistant Manager, Optical Network Product Marketing Division, NEC Corporation, *Japan*
Terrestrial and Submarine Integrated System for Global Mesh Network

T.2.4.3
JINGSHA HE, Senior Member of Research Staff and TAKAFUMI CHUJO, Manager, Fujitsu Laboratories of America, Inc., *USA*
A Framework for Optimized Content Delivery Over the Internet

T.2.4.4
RUSSELL SHARER, Vice President of Marketing, Occam Networks, *USA*
The New Access Edge: Economic and Technical Reality of a Converged Network

T.25
Digital Divide

Location:
Coral II

Chair:
JANET PEARCE STENZEL, President, ICM Insights, *USA*

T.2.5.1
JAMES SAVAGE, Director, Global Corporate Communications, Philips Broadband Networks, Inc., *USA*
Chasing the Broadband Utopia: An Assessment of Global Digital Divide Initiatives

T.2.5.2
JONATHAN DRALUCK, Vice President, Business Affairs & General Counsel, iBasis, Inc., *USA* and CRAIG INOUYE, Vice President, Asia Pacific, iBasis, Inc., *Hong Kong SAR, China*
Taking the Pacific by Storm (or at Least Arriving on a Small Boat): Deregulation or Conquering Fear of the Digital Divide

T.2.5.3
JIM HOLMES, Principal Consultant, Ovum Pty Limited, *Australia*
The Future of USOs: Making the USO Relevant in Bridging the Digital Divide

Discussant:
MORLEY WINOGRAD, Executive Director, Center for Telecommunications Management, Marshall School of Business, University of Southern California, *USA*

T.26

Quantitative & Qualitative Elements in Bandwidth & Spectrum Planning

Location:
Tapa III

Chair:
GREGG DAFFNER, President, G[3] Global Communications Consulting, *USA*

T.2.6.1
YANN D'HALLUIN, PhD Student and PETER FORSYTH, Professor, Dept. of Computer Science and KENNETH VETZAL, Associate Professor, Centre for Advanced Studies in Finance, University of Waterloo, *Canada*
Capacity Risk Management Using Real Options

T.2.6.2
ANDY KOWALIK, Director of Strategic Information; MARIA DELA CRUZ, Senior Manager, Strategic Information and DAVE GERHART, Senior Manager, Capacity Planning, TyCom Ltd, *USA*
Beyond Transport: Comprehensive Bandwidth Solutions

T.2.6.3
ANDREW SIMPSON, Registered Foreign Lawyer, Arculli & Associates, *Hong Kong SAR, China*
The Bandwidth Tsunami, Network Innovation and the Evolution of Bandwidth Markets

1645-1800

Exhibitors' Reception

Wednesday
16 January 2002

0730-0815
Speakers' Breakfast

Location:
Tapa III

Sponsored by TCSI

0830-1130
Exhibits Open

0845-1015
Concurrent Sessions

W11
Communicating in an Electronic World

Location:
South Pacific I/II

Chair:
PHILIP BOSSERT, Chairman & CEO, China Hawaii Investment Corporation, *USA*

W.1.1.1
JO STEYAERT, Researcher and ULRIKE MARIS, Research-Assistant, Dept. of Communication Science, Catholic University of Leuven, *Belgium*
Towards a Better Accessible World? Public Sector Information in a Digital World

W.1.1.2
THOMAS COOPER, Professor, Dept. of Visual and Media Arts, Emerson College, *USA*
The Next Generation: Empirical Research, Ethical Issues, and the Implementation of Choreographed Intelligent Agents in the Pacific

W.1.1.3
T.H. CHOWDARY, Information Technology Advisor, Government of Andhra Pradesh & Director, Center for Telecom Management & Studies, *India*
Internet for Public Service

W.1.1.4
EMMA SMITH, President & CEO, At Large Media, *United Kingdom*
Stop Advertising, Start Doing! Connecting With Customers in the Information Age

W12
Business Models for Tomorrow

Location:
South Pacific III/IV

Chair:
JOHN SPENCE, John A. Spence & Associates, *Australia*

W.1.2.1
SHARAD SADHU, Senior Engineer, Asia Pacific Broadcasting Union
Broadcasting on the Internet: Making it Happen

W.1.2.2
LAURIE KAN, CEO, i100 Limited, *Hong Kong SAR, China*
Business Models for Tomorrow: Generating Revenue from Wireless Data Applications at Entertainment

W.1.2.3
STEVEN CHOU, Vice President and General Manager, The Americas and CELEST LEE, iSoftel Ltd, *USA*
Maximizing Profitability with Bundled Products and Services

W13
Southeast Asia

Location:
Honolulu Suite

Chair:
WHAJOON CHO, Vice President B, KT ICOM, *Republic of Korea*

W.1.3.1
JOHN HIBBARD, Vice President for Media and Communications, PTC, *Australia*
Trends in Asia-Pacific Data Services Markets

W.1.3.2
WONSUK KANG, Assistant Professor and LORA LEE, Research Scholar, Nanyang Technological University, *Singapore*

Presenter:
LORA LEE, Research Scholar, Nanyang Technological University, *Singapore*

Internet Commerce Models in Asia: Case Studies of the Four Dragons

W.1.3.3
WIDJAJANTO BUDISULISTIJO, Senior Officer, Business Project; AGUNG SUTANTO, Chief Engineer, Information Technology Research and Development Division and AMBAR KUSPARDIANTO, Project Manager, PT Telekomunikasi Indonesia, TELKOM, tbk, *Indonesia*
Telecommunication Development Plan in TELKOM Indonesia: Reviving from the Calamity

W14
Cable Network Architecture

Location:
Coral I

Chair:
TBA

W.1.4.1
HIDENORI TAGA, Deputy Director; TOSHIO KAWAZAWA, Manager and KOJI GOTO, Director, KDDI Submarine Cable Systems Inc., *Japan*

Presenter:
KOJI GOTO, Director, KDDI Submarine Cable Systems Inc., *Japan*

Capacity Expansion from the Designed Limitation of Optical Fiber Undersea Cable Systems

W.1.4.2
NEAL BERGANO; HOWARD KIDORF; EKATERINA GOLOVCHENKO and MORTEN NISSOV, TyCom Laboratories, *USA*
Transmission Technology for Trans-Oceanic Transmission

W.1.4.3
HOWARD KIDORF, Director, Services Engineering Division; WILLIAM MARRA and MATTHEW MA, TyCom Ltd, *USA*
New Network Architectures for Global Undersea Networks

W.1.4.4
TONY FRISCH, Director, Product Marketing, Alcatel Submarine Networks, *United Kingdom*
Practical Technologies for High Capacity Subsea Cables

W15

E-Commerce

Location:
Tapa I

Chair:
RAMESH KUMAR NADARAJAH, MANPEC, Malaysia National Information Technology Council (NTIC), *Malaysia*

W.1.5.1
RICHARD PASCOE, Partner, Gilbert & Tobin Lawyers, *Australia*
E-Commerce and Regulation in the Asia Pacific Region—United We Stand?

Presenter:
JONATHAN CALLAGHAN, Partner, Gilbert & Tobin Lawyers, Australia

W.1.5.2
PHILIPPA LAWSON, Counsel, Public Interest Advocacy Centre, *Canada*
Regulating Consumer Protection in the Online Marketplace

W.1.5.3
BECKY BURR, Wilmer, Cutler and Pickering, *USA*

W16

Next Generation and Internet Development Strategies

Location:
Coral II

Chair:
RICHARD TAYLOR, Palmer Chair in Telecommunications, The Pennsylvania State University, *USA*

W.1.6.1
STEVE OTT, Executive Vice President, Global Sales, ITXC Corporation, *USA*
The Digital Divide: How Developing Nations can Jointly Pursue Telecommunications and Internet Development Through Voice Over Internet Protocol

W.1.6.2
MARGRIT SESSIONS, Managing Director, TARIFICA—pbi MEDIA UK Ltd, *United Kingdom*
Accessing the Factors Necessary for the Successful Pricing of New Internet Services in the Asia Pacific Region

1015-1045
Morning Break

Sponsored by TSN

1045-1215
Plenary Session

Location:
Tapa I

Moderator:
TEDSON MEYERS, Senior Telecoms Advisor, Coudert Brothers LLP, *USA*

Keynote Speaker:
DAVID FARBER, Alfred Fitler Moore Professor of Telecommunication Systems, University of Pennsylvania, *USA*

Respondents:
TEDSON MEYERS, Senior Telecoms Advisor, Coudert Brothers LLP, *USA*

MICHAEL HELM, Director-General, Industry Canada, *Canada*

JEANETTE CHAN, Partner and Head of Asian Comm and Tech Practice, Paul Weiss Rifkind Wharton & Garrison, *Hong Kong SAR, China*

1215-1400
Lunch with Speaker

Location:
Tapa II/III

Sponsored by SK Telecom

SK Telecom

Pacific Telecommunications Council (PTC) 2454 S. Beretania St., 3rd Floor, Honolulu, HI 96826 www.ptc.org Tel: +1.808.941.3789 Fax: +1.808.944.4874 Email: ptc2002@ptc.org

1400-1530
Concurrent Sessions

W21
Education, Business and Technologies

Location:
South Pacific I/II

Chair:
BARRY BROWN, Professor, University of Saskatchewan, *Canada*

W.2.1.1
DEBBIE KEMP, Business Development Officer, Marketing Division and JOHN SPENCE, Communications Research Centre Canada, *Canada*
Using Broadband Technologies to Enhance Collaborative Learning for Schools

W.2.1.2
N.K. CHHIBBER, Secretary General, PTC India Foundation, *India*
Communication Technologies for Basic Education to Boost Literacy in South-Asian Developing Countries

W.2.1.3 ***(Academic peer reviewed)***
ROSS KELSO, Senior Research Fellow, Centre for International Research on Communication and Information Technologies (CIRCIT) at RMIT University, *Australia*
Fibre Infrastructure for Schools of Tomorrow

W.2.1.4
STEFAN JUCKEN, Area Director, Sales and Business Development, North America, ND Satcom, *USA*
Tailored Broadband Network Solutions for E-learning, Streaming and Multi-Media Collaboration Via Satellite

W22
The Issues: Security QoS and Network Architectures

Location:
South Pacific III/IV

Chair:
HIYOSHI YOKOGAWA, President, InfoCom Consultancy International, Ltd, *Japan*

W.2.2.1
SYED AHAMED, Professor, Computer Science, City University of New York and VICTOR LAWRENCE, Vice President, Advanced Communications Technology, Bell Laboratories Technoloies—Lucent Technologies, *USA*
Evolving Network Architectures for Medicine, Education and Government Usage

W.2.2.2 ***(Academic peer reviewed)***
JAY GILLETTE, Professor, Center for Information & Communication Sciences, Ball State University and GREGORY JONES, Ball State University, *USA*
"Information is Knowledge in Motion": Innovative Knowledge Management Using an Open Source Initiative

W.2.2.3
GENICHIRO SEKINE, Manager, Engineering and TOSHIO SUZUKI, Senior Manager, 2nd Network Node Engineering Department, 1st Network Engingeering Division, NEC Communication Systems, Ltd, *Japan*
A Study on QoS Control and Network Architecture for Voice Over xDSL

W24
Next Generation Cables

Location:
Coral I

Chair:
SEIICHI TSUGAWA, Senior Manager, Head of International Organizations Section, Global Business Development Section, Global Business Development Division, KDDI Corporation, *Japan*

W.2.4.1
COLIN ANDERSON, Senior Account Executive, Sales & Marketing Dept., Global Business Group, Networks and TATSUO MATSUMOTO, Senior Director, Submarine Telecommunications Engineering Division, Fujitsu Limited, *Japan*
Optimum Architectures & Technologies for Multi-Terabit/second Broadband Trans-Pacific Submarine Cable Networks—the Impact of Emerging Technologies on the Overall Network Cost and Cost Per Bit

W.2.4.2
HIROSHI SAKUYAMA, NEC Corporation; ROKURO MORIKAWA, OCC, *Japan*; JAMES RAMSHAW and JAN STRINGER, Global Marine Systems Limited, *United Kingdom*

Presenter:
JAN STRINGER, Senior Manager, Service Development, Global Marine Systems Limited, *United Kingdom*
From Giga-Hertz to Grapnel: The Interplay Between Terabit Plus Submarine Networks and Their Implementation in the Marine Environment

W.2.4.3
TIM BRANTON, Director, Business Development and JEREMY FEATHERSTONE, Senior Manager, Service Development, Global Marine Systems Limited, *United Kingdom*
The Role of Submarine Cables in Next Generation Communications

W.2.4.4
OSAMU HARADA, Senior Manager, and MARCELO COUTO, Submarine Network Division, NEC Corporation, *Japan*
Meeting Demands for Submarine Networks

W25
Wireless & 3G

Location:
Coral II

Chair:
CHARLES COSSON, Public Policy Senior Counsel, Vodafone Americas Asia Region, *USA*

W.2.5.1
CLAIRE WRIGHT, Partner, Allen & Overy, *Hong Kong SAR, China*
The Challenges of the Unwired Economy

1300

W.2.5.2
MASAYUKI AIZAWA, Senior Corporate Officer & General Manager, Operation and Maintenance (O&M) Dept., J-PHONE Co., Ltd., *Japan*
Allocation and Licensing Process of 3G Spectrum in Japan

Disscussant:
PERTTI JOHANSSON, Senior Vice President, Motorola, *USA*

W26
Bridging the Digital Divide

Location:
Tapa I

Chair:
MEHEROO JUSSAWALLA, Senior Fellow/Emerita, East-West Center, *USA*

W.2.6.1
RAKHMAN IMANSYAH, Junior engineer, Rural Communication Lab and SAMUDRA PRASETIO, PT Telekomunikasi Indonesia, *Indonesia*
Bridging the Digital Divide: Alternative Solution for the Impact of High Cost of Computer and Internet Access in Indonesia

W.2.6.2
MEHEROO JUSSAWALLA, Senior Fellow/ Emerita and SUNYEEN PAI, Project Assistant, East-West Center and RICHARD TAYLOR, Palmer Chair and Professor of Telecommunications Studies & Professor of Information Science and Technology & Co-Director, Institute for Information Policy, The Pennsylvania State University College of Communications, *USA*

Presenter:
SUNYEEN PAI, Project Assistant, East-West Center, *USA*

Lessons of Investment in Technology Parks and Their Role in Bridging the Digital Divide

W.2.6.3
STEPHEN BEYNON, CEO, Band-X, *USA*
Overcoming Telecommunications and IP Challenges in Developing Countries

Presenter:
RICHARD ELLIOT, Vice President, Global Trading Development & Co-Founder, Band-X, *USA*

W.2.6.4
PETER FALSHAW, Director, Consultancy, Ovum Pty Ltd., *Australia*
Telecommunications Industry Rationalization: The Driving Forces for Change in the Asia Pacific

1530-1600
Afternoon Break

1600-1730
Concurrent Sessions

W32
Special Interest Group Federation of Regional Associations

Location:
South Pacific I/II

Facilitator:
HOYT ZIA, Executive Director, Pacific Telecommunications Council (PTC)

This open round table, a continuation of such meeting in past years, is designed to provide a sharing of information and concerns, among the heads of international and regional non- profit, membership-based organizations which focus on telecommunications and information technology.

W33
Oceania

Location:
South Pacific III/IV

Chair:
RICHARD J. BARBER, Adjunct Fellow, East-West Center

W.3.3.1
NORMAN OKAMURA, Faculty Specialist and CHRISTINA HIGA, Director of PEACESAT, Telecommunications and Information Policy Group, Social Science Research Institute, University of Hawaii, *USA*
Distance Education, Learning and Telehealth Applications Partnerships and Networks in the Pacific Islands Region: Lessons for Regional and Global Networking

W. 3.3.2
PATRICK Y. JULIEN, Executive Director and Chief Operating Officer, COL International, Canada
A Strategy for Information and Communications Technology in the Pacific

W34
Other Wireless Systems

Location:
Coral I

Chair:
TBA

W.3.4.1
SIMON DURRANT, Senior Director, Global Marketing, Motorola, *USA*
Phased Migration: The Legal Choice for the Evolution to 3G

W.3.4.2
SE JUNG LEE; SANG JIN PARK; YONG HEE LEE; CHI YOUNG AHN; BOK CHUL SHIN; BYUNG CHUL AHN and JONG TAE IHM, Researchers, Network R&D Center, SK Telecom, *Republic of Korea*
Radio Network Optimization Method with Statistical Analysis in CDMA2000 1X System

W.3.4.3
TOM MCKEOWN, President and SAM VELARDE, Vice President, Technology, Vista Group International Ltd., Inc., *USA*
A Strategic Methodology for Adapting Wireless Media

W.3.4.4
HO JUN LEE, Assistant Manager and SUNG HO JO, Assistant Manager, Access Network Development Team, SK Telecom, *Republic of Korea*
Study on Forward SCH Data Rate Decision Algorithm Based on Fast Power Control of CDMA2000 1X

W35

Internet Governance

Location:
Coral II

Chair:
LEN ST. AUBIN, Director, Business and Regulatory Analysis, Telecommunications Policy, Industry Canada, *Canada*

W.3.5.1
MILTON MUELLER, Syracuse University School of Information Studies, *USA*
Governments and Country Names: Is ICANN Transforming into an Intergovernmental Regime?

W.3.5.2
ULRIKE MARIS, Research-Assistant, Dept. of Communication Science and KEITH ROE, Professor of Communication & Dean, Faculty of Social Sciences, Catholic University of Leuven, *Belgium*
The Internet: a True Paradise for Freedom of Speech?

W.3.5.3
TIMOTHY DENTON, Head, tmdenton.com, *Canada*
The Governance of the Domain Name System

W.3.5.4
JANE FORSTER, Partner, Clayton Utz, *Australia*
Uncomfortable Bedfellows: Privacy Protection and Laws to Protect against Cybercrime and Terrorism

W36

Pricing and Forecasting Issues

Location:
Honolulu Suite

Chair:
ROBERT AAMOTH, Attorney, Kelley Drye & Warren, *USA*

W.3.6.1
BYUNG-WOON KIM, Senior Researcher and PANG-RYONG KIM, Team Head, Techno-Economics, Fair Competition Study Team, Electronics and Telecommunications Research Institute (ETRI), *Republic of Korea*
Comparative Approaches in Implementing Broadband Satellite Services

W.3.6.2
MARK DANKBERG, President & CEO, ViaSat, Inc. and JOHN PUETZ, President, MasterWorks Communications, *USA*
Comparative Approaches in the Economics of Implementing Broadband Satellite Services

W.3.6.3
MURRAY ELDRIDGE, Director, Customer Services and JAN STRINGER, Senior Manager, Global Marine Systems Limited, *United Kingdom*
The Benefits of Taking the Long View—Assessing the Effect of Life Cycle Costing and Risk Management on the Business Plan of Next Generation Ventures. A Case Study in the Submarine Networks Environment.

W.3.6.4
GRAHAM EVANS, Director, International Business Development, C&C-EGS Subsea Geosciences, *Singapore*
Meeting the Business Plan Milestones for New Submarine Cable Systems—The Interdependence and Phasing of Key System Planning Processes

1800-1930

Closing Reception

Location:
Poolside

Sponsored by Asia Global Crossing

Asia Global Crossing™

Thursday
17 January 2002

0800-1000
PTC Committee Meetings

Membership
Location: Hibiscus 1

Media and Communications
Location: Hibiscus 2

Education & Seminars
Location: South Pacific Boardroom

Research
Location: Ilima Boardroom

1000-1200
PTC Conference Committee Meeting

Location:
South Pacific I

1200-1330
PTC Coordination Meeting

Location:
South Pacific I

1400-1800
PTC Executive Board Meeting

Location:
South Pacific IV

1303

ADIR Technologies, Inc.
BOOTH #309-310

ADIR Technologies, Inc. was created to offer proven, carrier-scale VoIP network management and service delivery software for telecommunications, Internet, wireless, broadband and next generation service providers worldwide. ADIR was formed by Net2Phone, the leading provider of Internet telephony services, and Cisco Systems Inc., the world's leading manufacturer of networking equipment. ADIR's technology is based on the proven, industry-leading VoIP network that Net2Phone has been operating since 1995 ... a network that currently handles millions of VoIP calls per day.

In August of 2001, ADIR acquired NetSpeak Corporation of Boca Raton, Florida and with it an expanded set of exceptional VoIP product offerings. For more information about our complete VoIP product line, please visit us in booths 309/310 or on our web site at www.adirtech.com.

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Email:	info@adirtech.com
Website:	www.adirtech.com

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Suite 300
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Tel:	561.998.8700
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Email:	info@adirtech.com
Website:	www.adirtech.com

Advanstar Telecom Community
BOOTH #704-705

Reaching nearly 200,000 Telecom Carriers and Service Providers Worldwide, Advanstar's Telecom Community provides an effective medium to connect with telecom decision-makers. This comprehensive portfolio of 6 magazines and 8 websites including Telecom Asia, Wireless Asia, The Euronet, America's Network, RNT, and Telepress Latinoamerica offer valuable content and local expertise in Asia-Pacific, Europe, North America, and Latin America.

The Advanstar Telecom Community is part of Advanstar Technology Communities, which produces 33 events, 32 publications and 50 web sites and two B2B web portals. These properties address the full range of technology applications—from content creation through communications to customers and builders of e-commerce. For more information, visit www.AdvanstarTech.com

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USA

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Fax:	714.513.8634
Email:	bportnoff@advanstar.com
Website:	www.advanstar.com

Advantech Advanced Microwave Technologies Inc.
BOOTH # 204

Advantech Advanced Microwave Technologies Inc. (Advantech) is a Montreal (Canada) based, world-class designer and manufacturer of leading-edge Microwave Communication products for Satellite Ground Stations (L-Band to Ka-Band) and for Wireless Base Stations (1.9 GHz to 38 GHz frequency range including PCS, MMDS, 3.5 Ghz, WLL, and LMDS).

The main products designed and manufactured by the company are Solid State Power Amplifiers (SSPA) with output power ranging from 1 Watt to 3,200 Watts, Transmitters, Mast Head Units for Cell Extenders/Repeaters, Boosters, Multiplexers, and other related sub-systems. Company's products, which follow CE and ISO-9001 standards, are compact and operate under very harsh environmental conditions.

In 2001, Advantech has acquired UK based Signal Processor Limited and Arizona, US based ACT Wireless. SPL-ACT Wireless designs and manufactures Satellite Modems, low cost Data Satellite Terminals, Data Broadcast Receivers and Antenna Control Systems.

Advantech Advanced Microwave Technologies Inc.
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Dorval, QC H9P 1G1
Canada

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Email:	info@advantech.ca
Website:	www.advantech.ca

Agile NZ Ltd.
BOOTH #217

Agile NZ Ltd. (part of the Comworth Group) is the RAD distributor for NZ and the South Pacific Islands, and has been supplying and supporting a large range of flexible and cost effective RAD Telecommunications Access solutions to many of the Telco's throughout this region for many years. This includes:

- Digital Cross Connects
- X25 / IP / Frame Relay packet switches
- HDSL & 2B1Q high speed modems
- E1 / E#3access
- LAN WAN extension
- Sub 2Mbps Voice and Data Multiplexers
- Compressed Voice Solutions
- etc.

We will have on the stand, (Stand 217) with a representative from RAD Data Communications, a selection of this equipment as well as some general information covering:

- IP Telephony / VoIP
- VoDSL
- ATM Access
- Ethernet MAN networks
- Compact SDH networks
- New Wireless technologies.

So feel free to drop in and discuss any questions or applications that you may have.

Agile NZ Ltd.
P.O. Box 100120 NSMC
Auckland
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Website:	www.agile.co.nz

Arianespace Inc.

BOOTH #614-615

Arianespace is the commercial launch services leader, holding more than 50% of the world market for satellites placed in geostationary transfer orbit (GTO). Formed as the first commercial space transportation company in 1980, Arianespace has signed contracts for more than 200 satellite payloads.

The key to Arianespace's success is the Company's unbending focus on meeting customer requirements by continually adapting to changes in the international launch market. Arianespace offers its customers unrivaled launch services, with worldwide support from corporate headquarters in Evry (near Paris), the launch site in Kourou, French Guiana, a subsidiary in Washington, DC and offices in Tokyo and Singapore.

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Email:	mp@arianespace-inc.com
Website:	www.arianespace.com

The Boeing Company

BOOTH #209-210, 300-301

Combining a tremendous 50-year heritage of space and communications progress, Boeing offers a wide range of launch and satellite services to address industry needs for the 21st century. Sea Launch and the family of Boeing Delta vehicles launch payloads to GTO ranging from 0.9 to 13.1 metric tons. The Boeing Delta IV will make its debut in early 2002. Boeing is committed to being the worldwide leader in providing low-cost access to space. For more information, visit us at www.boeing.com

The Boeing Company
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USA

Tel:	714.896.3294
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Email:	launchservices@boeing.com
Website:	www.boeing.com

China Quantum Communications, Ltd.

BOOTH #200

China Quantum Communications Ltd. (CQCL) is a next generation communication enabler. It provides the most comprehensive IP content deliver services for carriers and services providers between China and the rest of world using its most efficient content deliver network, Quantum One. Quantum One is a business-class IP network that has its Gateway Centers and Gateway Nodes in many major cities throughout Asia, Europe, and North America. In China, Quantum One peers with ten regional business-class IP networks and reaches 90% of total communication density in China.

CQCL delivers voice, data, audio, and video contents in IP format with efficiency, security, and reliability. It offers VoIP, International VPN, audio/video streaming, and e-commerce solutions for the international carriers, services providers, and content providers.

China Quantum Communications, Ltd.
33 Wood Avenue South
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Website:	www.cqcl.net

Comtech EF Data Corporation

BOOTH #404

Comtech EF Data Corporation provides the Satcom industry a complete portfolio of high quality, technologically advanced satellite communications products and systems. Including a wide selection of Digital Satellite Modems, Frequency Up and Down Converters, Transceivers, Low Noise and High power Amplifiers, Satellite Network Management Systems and IP Multicasting Solutions. Comtech EF Data, Your One Stop Source for SatComs.

Comtech EF Data is a division of Comtech Telecommunications Corporation.

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Website:	www.comtechefdata.com

Cordell, Inc.

BOOTH #510

The Cordell Hut-toNOC core capabilities include complete alarm surveillance centers CiNAS, intelligent mediation and data management devices ISD3000, and two models of discrete alarm collection units with every protocol option, Centurion and Centurion II. Cordell also offers e-Traffic Software Solutions, early warning radar for your network, and Billing Verification Software, turning errors into profits. These products were developed to the TMN Standards using the distributed processing architecture. Cordell's distinctive competitive advantage as a niche player is offering the end-to-end solution as a quasi manufacturer, integrator, reseller and broker of the latest state of the art products, supported by a staff of Cordell experts.

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Dantel, Inc.

BOOTH #512

Dantel, Inc., headquartered in Fresno CA, manufactures a variety of network alarm monitoring, control, and management products for the telecommunications industry. The 30-year-old firm serves a highly specialized customer base comprised of a large array of telecommunication service providers. For more information about Dantel, visit the corporate web site at http://www.dantel.com/.

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Website:	www.Dantel.com

ECI Telecom—NGTS

BOOTH #403

ECI Telecom—NGTS Ltd., the Next Generation Telephony Solutions provider, develops trunking and access gateways bringing carrier-class, toll-quality solutions to packet telephony.

Over 700 carrier customers in 140 countries trust ECI Telecom—NGTS to provide telephony networking solutions and business applications, bridging classic and IP telephony domains. We at NGTS have deployed over 12,000 telephony bandwidth optimizers (DCME terminals) worldwide, supporting 21 billion minutes per month of telephony traffic.

Now, we bring our innovative technologies, expertise and reputation for reliability to media gateways, serving global and domestic players. Our media gateways are standards-based with a flexible, scalable architecture delivering unparalleled speech quality and unmatched call completion for voice and fax-over-packet networks.

Our I-Gate 4000, a carrier-class trunking media gateway, interoperates with market-leading softswitches creating integrated solutions for next-generation networks.

ECI Telecom—NGTS
8160 Baymeadows Way West
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Website:	www.ecingts.com

Enavis Networks

BOOTH #401

Enavis Networks reliably navigates carriers to multi-service bandwidth management solutions with their flagship product the T::DAX. The T::DAX provides a unique combination of wideband, narrowband and broadband digital cross-connect functions in a single economical platform. It is unmatched for international gateway applications to accept, convert and cross-connect all levels of North American and International signals. Enavis also offers its T::MSA Multi-service convergence platform for evolution to data-centric service networks. T::MSA is a scalable system which provides the functions of frame relay, switches, access routers, ATM edge switches, 4/3/1 cross-connects and superband optical devices.

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ePHONE Telecom, Inc.
BOOTH #400

ePHONE Telecom, Inc. is a next generation, facilities based, marketing and sales oriented telecommunications company providing domestic and international voice and data services using VOIP protocols. The company holds an FCC 214 carrier-to-carrier and retail services license. ePHONE's strategy is to utilize management's breadth of experience in information technology, telecommunications and marketing to integrate the latest in data (IP) and VOIP technologies for our customers. This expertise enables ePHONE to deploy a robust and scalable tier-1 grade international telecommunications network capable of supporting virtually every telephony protocol and existing or emerging IP global standard at a fraction of the cost of a traditional network.

The ePHONE Competitive Advantage

- Built an efficient, low cost network providing a reliable, high quality transmission facility
- Deployed a network capable of interfacing to legacy networks and the variety of VOIP networks
- Innovative high margin retail products such as ePHONE's Unlimited Calling Program, prepaid calling cards and 1+ dialing services
- Wholesaling minutes to other carriers
- Aggregating traffic to certain geographic destinations at low cost
- Inexpensively deploying nodes in new markets domestically and internationally, decreasing the cost of terminating traffic as well as generating traffic out of those locations

ePHONE's strategy is to capitalize on each element decreasing costs while increasing market penetration. ePHONE is a technology and sales driven organization. The company philosophy is the catalyst for innovative marketing and sales approaches, the development of relationships and a commitment to customer service. ePHONE is meeting the demand partners and sales channels are placing on the company for increased network coverage, innovative products and new technologies. ePHONE is poised to meet the challenges of the 21st century telecommunications market; technically and commercially.

ePHONE Telecom
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Website:	www.ephonetelecom.com

Epoch Internet
BOOTH #303

Epoch Internet is a new generation of Internet Service Provider. As the United States largest privately held ISP, we're dedicated to supporting the demand for high-performance access and hosting solutions in the International markets.

Epoch Internet's high-speed US network delivers dedicated backbone access in over 40 metropolitan areas, 10 international (fiber and satellite) exchange points, and remote access from over 1,000 locations. Its world-class data centers provide secure, reliable hosting or co-location for Web site or e-business solutions. And its state-of-the-art systems and industry-leading provisioning and customer support capabilities are second to none.

Epoch provides the fundamental building blocks for e-business, including:

- Dedicated, high-speed backbone access: A full range of access solutions (up to Full STM1) including turn key transit offerings over satellite and fiber networks.
- Web Hosting: Choose dedicated or shared Web site hosting, or secure server co-location—our world-class data centers offer the level of service our customers need.
- Security services: Including firewalls and Virtual Private Networks (VPNs).

Epoch Internet's customers receive world-class customer care, including around-the-clock support from highly trained engineers and technicians, and Service Level agreements that give them the highest guaranteed levels of service.

Epoch Internet
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Website:	www.epoch.net

France Telecom
BOOTH #513–514

France Telecom provides a full range solutions for carriers, ISPs and switch-based resellers through its quality Open Transit® brand, including mobile, Internet, bandwidth and voice. To ensure quality seamless service, Open Transit® packages are supported by France Telecom's own worldwide network: TheBackbone, satellites, IP connections and 160 direct switched routes.

France Telecom is one of the world's leading telecommunications carriers, with over 86 million customers in more than 75 countries and consolidated operating revenues of 20.4 billion euros for the first six months of 2001. Through its major international brands, including Orange, Wanadoo, Equant and GlobeCast, France Telecom provides businesses, consumers and other carriers with a complete portfolio of solutions that spans local, long-distance and international telephony, wireless, Internet, multimedia, data, broadcast and cable TV services. France Telecom (NYSE: FTE) is listed on the Paris and New York stock exchanges.

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Website:	www.carriers.francetelecom.fr

General Telecom—A Verestar Company
BOOTH #313

General Telecom—Fast, Flexible Carrier-Grade Gateway Switching Solutions

General Telecom is the world's first and leading independent provider of outsourced carrier-grade switch partitioning and advance network management services and billing tools. With General Telecom, you'll be up and running in 30 days with T1/ E1 leased ports on our advanced Tier One network. The General Telecom switching infrastructure interconnects with more than 250 carrier networks, serving over 110 countries —all powered by Nortel DMS switches in New York, Los Angeles, and Miami with full SS7/C7 capacity. We are carrier-independent, so within your gateway partition, you are in control. For more information, visit www.gentel.net.

General Telecom—A Verestar Company
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Website:	www.gentel.net

Globecomm Systems Inc.
BOOTH #205

Globecomm Systems Inc. (NASDAQ: GCOM) was founded in 1994 with the vision of becoming a world leading Satellite-Based Solutions Provider. We achieve this vision by providing high quality engineering, systems and services to our customers.

From our foundation as a turnkey satellite network and earth station infrastructure provider, we have expanded our proven capabilities into three main business areas:

1. **End-to-End Communications and Broadcast Solutions**—We provide the infrastructure and services required to implement and operate end-to-end communications and broadcast solutions.
   - Network of teleports.
   - Satellite space segment.
   - Fiber connections.
   - Leased terrestrial services.
   - 24x7 Network Operations Center.
   - Custom engineer solutions and services for any requirement.
   - Ongoing monitoring and maintenance.
2. **Communications and Broadcast Infrastructure**—We design, implement and install communications and broadcast infrastructure required by customers who operate their own facilities.

Professional Engineering Services— We offer our network analysis and design engineering services for customers who are planning communications or broadcast facilities and networks. We have over 100 engineers in specialties ranging from Satellite Communications Systems and Networks, Broadcast Studio design, Facilities design, Network Management Systems, Internet Networks, Internet Service Provider infrastructure, and Information Technology System and Application engineering.

Globecomm Systems Inc.
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Website:	www.globecommsystems.com

1308

Guam Telephone Authority
BOOTH #505

Guam Telephone Authority (GTA) is an established local telephone company owned and operated by the Government of Guam. Currently, GTA provides local and cellular telephone services. Due to restrictions inherent in GTA's charter, GTA is limited in its ability to effectively compete with the private sector. After numerous studies and evaluations performed in conjunction with the GTA's Special Task Force, it has been concluded that privatization is the best solution to protect the interests of the Government of Guam and its citizens.

The Government of Guam is offering a turnkey acquisition of the GTA. With a strategic partner, GTA becomes the ideal vehicle to provide high-return enhanced services, with offshore flexibility and U.S. stability. The strategic partner will be able to capitalize on this unique opportunity due to GTA's gateway location, state-of-the-art infrastructure, skilled employees, and tax incentives supported by the Government of Guam.

It is anticipated that the strategic partner will expand GTA to provide high quality, state-of-art telecommunication enhancements and Internet services. The expected result shall be a premiere U.S.-based Internet hub serving the Western Pacific and the Pacific Rim nations of Asia.

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Henkels & McCoy, Inc.
BOOTH #613

Henkels & McCoy is one of the largest privately held engineering and construction companies in the United States.

Our Business is designing, building and maintaining infrastructure that provides society with economical and reliable sources of energy and communications in a wide range of applications.

Our lines of work include engineering, communications, gas work, electric work, training, industrial construction and more.

When Hurricane Iniki devastated the island of Kauai in 1992, literally destroying its telephone system. Within hours, Henkels & McCoy began mobilizing its crews to help the Hawaiian Telephone Company and the people of Kauai. By day three, Henkels & McCoy had flown in 150 skilled craftsmen and was airlifting in heavy equipment and tools on a Boeing 747. Today we're a permanent resident in Hawaii.

We employ over 5,000 full-time personnel in more than 50 permanent offices located throughout the United States and abroad.

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InfoVista (Asia-Pacific) Pte Ltd
BOOTH #212

InfoVista is the Leading Provider of Real-Time, QoS Performance Management Software Solutions.

InfoVista designs, develops and markets technologically advanced software which monitors, analyzes and reports on the performance, availability and quality of service of information technology infrastructure ("IT"), including networks, servers and applications.

Our products are part of the software market segment known as Service Level Management ("SLM"). We market our products primarily to telecommunications companies and Internet service providers ("ISPs"), as well as to other IT-intensive organizations such as financial services companies, outsourcers of IT services, application service providers and other multinationals. Our products' easy-to-use interface enables IT managers and non-technical users alike to proactively manage their IT resources, analyze Internet network resource activity and trends, anticipate future demands and prepare customized quality of service reports.

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Intele-CardNews
BOOTH #708

Since the inaugural issue in June 1995, Intele-CardNews has become the definitive resource within the $4 billion + prepaid and smart card industry. By delivering vital information and timely news, we have become the leader in the market*and the only monthly publication devoted to the prepaid and smart card industries.

More than just a magazine, Intele-CardNews serves every need in the marketplace. The debut of our quarterly international edition, Intele-CardNews International marked the first expansion of a U.S. prepaid telecom publication into the global marketplace. With the rapidly changing landscape of prepaid, Intele-CardNews responded with our web site at www.intelecard.com and our bi-weekly e-mail news source, ICNwire*immediate, vital information that captures the attention of decision-makers daily.

A vital resource for readers in the retail and promotional markets alike, Intele-CardNews delivers your marketing message into the hands of marketing managers, brand managers, buyers, business executives, advertising and promotional agencies, premium and incentive purchasers and entrepreneurs.

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Intelsat
BOOTH #601-602

Intelsat is a privately held international company offering Internet, broadcast, telephony and corporate network solutions around the globe. In July, Intelsat became a private company after 37 years as an international cooperative. The move is enhancing the company's ability to continue providing customers access to affordable, reliable and innovative communications solutions that include Internet access, broadcast services, corporate networks and voice communications.

This is being done via Intelsat's fleet of 20 satellites, located in prime geostationary orbital locations, connecting more than 200 countries and territories at a service reliability rate of 99.996 percent. Plans call for nine more high-powered satellites to be launched over the next two years.

Intelsat's history is a history of firsts and in its new incarnation, the company expects to continue to break new ground, helping its customers achieve and hold leadership within their own industries.

For more information please visit our website at: www.intelsat.com

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InternetSpeech
BOOTH #215

InternetSpeech, the leader in Voice Internet, develops and markets netECHO™ to business and consumers. It is the only software available that provides voice access to the entire Internet using any telephone. netECHO's patent pending technology allows surfing, searching, email, news and other portal features in English, Chinese, Japanese and Spanish. For more information, visit us at www.internetspeech.com.

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Website:	www.internetspeech.com

Interoute Telecommunications
BOOTH # 502-503

Interoute's i-21 network is the largest in Europe today, offering unparalleled homogeneity, reach and capacity. It connects 45 cities in 9 countries across 11,250 cable miles. From the ducts (minimum 3, maximum 12) to the two Network Operating Centres (two for resilience), we own and control the entire network. 48 fibre pairs have been deployed throughout the network, which means it has the capacity to carry over a petabit (a billion megabits per second) of traffic. Services include:

Bandwidth
fibre, wavelengths, SDH, co-location, metro services

Virtual Private Networks
MPLS VPNs

Internet Services
high speed access, transit, managed application hosting

Communications
carrier services, business communications, video streaming

Contact: +44 7000 835883 or i-21sales@interoute.com

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interWAVE Communications International, Ltd.
BOOTH #402

interWAVE Communications International, Ltd. is a global provider of end-to-end compact cellular systems and broadband wireless data networks that offer the most innovative, cost effective and scaleable network solutions in the industry, enabling today's operators to "reach the unreached." interWAVE's economical, distributed networks minimize capital expenditures while accelerating customer revenue generation due to its rapid and simple deployment of scalable IP and ATM broadband networks. interWAVE's highly portable mobile, cellular networks and broadband wireless solutions provide vital and reliable wireless communications capabilities for customers in over 50 countries. interWAVE's U.S. subsidiary is headquartered at 312 Constitution Drive, Menlo Park, California, and can be contacted at www.iwv.com or at (650) 838-2000.

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IP Access International
BOOTH #302

IP Access International, (IPA) is the leading independent "Best of Breed" solutions provider of voice, video and data over satellite. With the assistance of Advanced Projects International (API), our sister company and world-renowned consulting, integration and testing lab, IPA is able to test, certify and recommend the best available options for a customer's particular application.

As numerous Teleports, Telco's, and ISP's have discovered, strategic IPA/API solutions can save thousands of dollars and ensure an open architecture with the ability to leverage not only the technologies of today but the technologies of the future.

Through very open relationships with all of the leading DVB manufactures, our companies are able to test products while they are still in the beta stage. So stop by booth 302 and allow us to show you what's hot, what's not and what's coming next.

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Japan Asia Network Consulting Co., Ltd.
BOOTH #215

We are providing global carriers with our expert services for market study, license, recruiting partners and others in Japan, China and South East Asia. More information is available through our Web site http://www.asianet.co.jp

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JSAT Corporation
BOOTH # 616-617

JSAT is a leading satellite operator in Asia with the largest fleet, and it has been an innovator of satellite based multimedia business ever since the company was founded in 1985.

To offer high-quality superior service and excellent reliability, JSAT operates eight satellites in seven geosyncronous orbits, one being a fully equipped back up satellite. Onboard Ku and C-band transponders have coverage of most of Asian region.

JSAT made available two highly advanced satellites, JCSAT-3 and JCSAT-4 for the first Japanese communication satellite (CS) digital broadcasting system. Began operation in October 1996, SKY PerfecTV!, provides the multichannel age with variety-filled programming that can be selected from 300 channels. In April 1998, JSAT established NTT Satellite Communications Inc. in conjunction with telecommunication career NTT to provide internet access service and intranet service via satellite. Internet service subscribers can receive information at high speed from JCSAT-4 satellite.

As the pioneering firm in the Japanese satellite business field, JSAT is pledged to utilize its know-how and continue its efforts toward realization of the satellite infrastructure of the 21st century.

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Kapolei Hawaii
BOOTH #608

Kapolei: Hawaii's e-City Technologically Smart. Globally Connected.

Kapolei, Hawaii on the island of Oahu. It's a city for people with prospects. Totally wired for global commerce. Connecting companies to major markets anywhere in the world. Time zones that span the Americas and Asia for same-day communications. Business-friendly with aggressive new tax incentives. Good jobs for forward-thinking people. A lifestyle second to none. A city like no other. Kapolei, Hawaii's e-city.

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LYNX Technologies, Inc.
BOOTH #702

LYNX Technologies, Inc. (LYNX) is a telecommunications professional services company that focuses on the value of telecommunications services. LYNX's Information Services Group has produced the LYNX Global Telecommunications Database (GTD) every month for over 20 years. The GTD provides rate and tariff information on more than 450 carriers in over 200 countries. The Professional Services include Global IP Demand Modeling, Benchmarking, RFP Development and Telecom Service Procurement. LYNX's Research and Studies group offers valuable and insightful reports on new trends in telecommunications, the latest technology, and customer studies.

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MediaRing.com Ltd
BOOTH #500

MediaRing is a leading IP Telephony technology and solutions company specializing in providing VoIP interconnect and value added IP telephony solutions to carriers and service provider world wide.

MediaRing is headquartered in Singapore and has sales offices in San Jose, California, London, Tokyo, Taipei, Beijing, Shanghai, and Hong Kong. MediaRing is listed on the main board of the Singapore Exchange Ltd and is traded under the symbol "MRNG.SI".

MediaRing operates VoizNet, a global interconnected voice network infrastructure over the Internet. Powered by patent-pending technology, VoizNet brings high quality Internet Telephony services to carriers, service providers, enterprises and consumer worldwide.

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Minerva Networks
BOOTH# 501

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Mockingbird Networks
BOOTH #506

Mockingbird Networks the Voice Services Infrastructure (VSI) Company, delivers a complete voice services solution that allows wireline and wireless carriers and service providers to rapidly deploy new, revenue-generating voice and web-driven services across PSTN and IP networks. Mockingbird's Voice Services Infrastructure architecture is an overlaying solution that features PSTN and IP interoperability (including SS7, H.323, and SIP), standards-based design, and UNIX operating system, making it the platform of choice of forward-thinking wireless and wireline carriers and service providers. The Mockingbird Networks VSI solution is comprised of several integrated hardware and software products; the NuvoStream Media Services Gateway, Mockingbird SIP Server, Enhanced Services Softswitch, Nuvo AIN SS7 Signaling Gateway and Impresaria Customer Card and Billing platform. Silicon Valley-based Mockingbird Networks is a privately-held company with top-tier venture funding from Alcatel Ventures, Technology Crossover Ventures, Robertson Stephens BayView Investors, Ltd., Wasserstein-Perella, and others.

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NACT

BOOTH #203

With two decades of telecom industry experience, NACT (a division of Verso Technologies) provides the most cost-effective and scalable VoIP solution in the industry today. With unique architectural features including end-to-end SS7 signaling, NACT's line of IPAX Gateways meet the needs of service providers who want to deploy low cost IP-based voice services with PSTN-like scalability and QoS. NACT's complete business solutions include state-of-the-art hardware and software, OSS integration, field-proven applications and technical training and support.

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NECA

BOOTH #417

Formed in 1983 by the Federal Communications Commission (FCC) as a not-for-profit membership corporation, NECA plays an important role in administering the FCC's access charge plan—a plan that helps ensure that telephone service remains available and affordable in all parts of the country. Through its corporate family, NECA administers numerous nationwide programs. The Universal Service Administrative Company (USAC) administers programs that provide support for telephone companies with inordinately high costs, and assistance for low-income subscribers by reducing or waiving fees necessary to get on the phone network and stay connected.

NECA Services, Inc. was formed in 2000 to pursue new business opportunities, drawing on the skills and experience of the NECA professional staff. The lines of business they have engaged in to date are Billing and Collection Services, Call Routing and Rating Services (AOCN), Central Office Mapping Data, Company Codes, DSL CPE Services, Ordering and Billing Database, and State Fund Administration.

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NetEnterprise, Inc.

BOOTH #305

NetEnterprise provides a one-stop solution to selecting, implementing, and supporting corporate IT networks, including Internet connectivity, hosting, and network integration, as well as network management through our full-service data center.

The NetEnterprise team takes the time to understand each customer's businesses and tailor end-to-end, customized solutions that are appropriate to each company's IT needs and operations. Microsoft, Cisco, and Oracle are among the technology leaders that depend on NetEnterprise to implement and support their leading-edge products and systems in Hawai'i. So our customers know the solutions we provide represent the best practices available.

The NetEnterprise Global Gateway improves the Internet experience for end users by delivering fast, scalable and reliable Internet connections. Let NetEnterprise demonstrate how to reduce your company's IT costs, gain efficiencies, and improve your company's competitive position.

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New Skies Satellites NV
BOOTH #407-408

New Skies Satellites NV is a global satellite communications company providing video, Internet, voice and data communications services to a range of broadcasters, Internet service providers and telecommunications carriers around the world. New Skies is headquartered in The Hague, The Netherlands and has offices in Singapore, Washington D.C, Sydney, London, New Delhi and São Paulo.

New Skies operates a fleet of five satellites in the Pacific, Atlantic and Indian Ocean regions, providing a complete global coverage at C-band, and high powered Ku-band spot beams over most of the world's principal population centres. These are established and reliable satellites operating at excellent orbital locations. NSS-513 is one of the few satellites that can connect North America with all major destinations in the Asia Pacific in one single hop. NSS-6, a high-powered Ku-band and Ka-band broadband multimedia satellite designed for intra-regional networking is planned for launch during 2002 to augment existing coverage of Asia.

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NTT Communications, Inc.
BOOTH #609-610, 700-701

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Website:	www.ntt.com/world

Nuera Communications, Inc.
BOOTH #508

Nuera Communications, Inc. is a top-rated provider of Voice-over-Internet Protocol (VoIP) infrastructure solutions that work over any medium (cable, wireless, copper and fiber). The company's Open, Reliable Communications Architecture (ORCA®) product portfolio helps carriers worldwide migrate from legacy networks to next-generation VoIP networks.

Nuera continually wins awards for its superior products and services and is respected throughout the industry for driving the adoption of interoperability and open, standards-based platforms. For more information, please visit www.nuera.com.

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OTL Software Limited
BOOTH #412

OTL Software Limited is a New Zealand based company specializing in the development, implementation and support of software products that are targeted at the Telecommunications and Enterprise Systems Management marketplaces. The company has over 150 customers in 20 countries spread across Europe, North America, New Zealand, Australia and the South Pacific. Over a number of years the processes and infrastructure required to manufacture, implement and support their products across a global marketplace have been well established and proven.

In the area of Telecommunications the company's flagship product TelStream has long been the leading solution in the New Zealand, Australian and South Pacific marketplaces. This product has evolved as a powerful, fully featured and scalable solution to assist organisations to meet their telephony management, billing, service order and customer care requirements. A raft of services are offered in conjunction with TelStream including solution design, implementation, training, project management and maintenance & support.

In the area of Enterprise Systems Management OTL Software focuses on Backup, Scheduling and High Availability (Veritas) Knowledge Modules for PATROL.

For more information on OTL Software, it's products and services, please refer to the company website at www.otl.co.nz.

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Website:	www.otl.co.nz/Products/default.asp?Target=telstrea

PacAmTel, LLC
BOOTH #511

PacAmTel is the leading force in the satellite communications industry. Offering cutting edge connectivity solutions for voice, Internet, and video, PacAmTel has developed a reputation for providing high quality services with unbeatable response times.

With the capabilities to provide satellite services throughout the world PacAmTel offers numerous broadcasting, data and Telephony services.

With its own Teleport located 60 miles from downtown Los Angeles, PacAmTel is able to offer very competitive pricing. With extensive experience from qualified staff, PacAmTel can provide turnkey solutions for almost any project.

PacAmTel has a point of presence (POP) in the One Wilshire Building, the major Telecom hub in Los Angeles. One Wilshire houses the world's largest International carriers. PacAmTel is the only teleport to have its own microwave tower on the roof of One Wilshire to back-up its fiber connectivity, providing exceptional redundancy.

As PacAmTel is independently owned and operated, flexibility, speed of implementation and meeting clients needs at all levels are easily achieved. Call at the booth and find out why more and more customers are utilizing PacAmTel as their worldwide connectivity partner.

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Pacific LightNet, Inc.
BOOTH #517

Pacific LightNet, Inc. (PLNI) is a Hawaii-based company offering a full range of integrated telecommunication products and services including local dial tone, high speed Internet, long distance, collocation, special access and enhanced data services. PLNI has more than 10,000 submarine and terrestrial fiber miles connecting the six major Hawaiian Islands. We are interconnected with major carriers to provide cost-saving solutions. Whether your telecom service needs are statewide or global, contact PLNI at 808-791-1000 to find out how we can put our people and our emerging technologies to work for your business.

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Pacific Resources for Education and Learning (PREL)
BOOTH #307

At Pacific Resources for Education and Learning (PREL), our business is education. PREL's mission is to strengthen culture, increase literacy, and improve the quality of life locally, regionally, and globally. PREL serves 10 island entities spread across the Pacific Ocean, making distance learning a necessity. With funding from two Star Schools federal grants, PREL has developed infrastructure and programs to bring distance learning to Pacific island entities.

The Star Schools Program is one of the largest and most successful public and private partnerships for delivering distance education in the U.S. and around the world. Since 1988, the Star Schools grants have provided access to technology, telecommunications equipment, and instructional programs for more than 10 million learners in thousands of schools across the U.S. and abroad. Information on all 23 Star Schools programs is available through the Distance Learning Resource Network (DLRN) and PREL.

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Pacific Star Communications
BOOTH #411

Pacific Star Communications, delivers and supports advanced telecommunications equipment worldwide. We carry over 200 lines of the world's best telecommunications equipment. This ranges from the most prominent providers, such as PairGain/ADC Telecom, Enterasys/Cabletron, Alcatel and P-COM, to new and exciting providers such as LightPointe, Jetstream and Redback.

While we carry equipment for all applications, we specialize in supporting customers that are:

- Making the transition from analog to digital (such as DSL)
- Expanding their local loop capabilities through terrestrial or wireless networks
- Migrating to IP services and capabilities

  Our service credo is "Serve the Customer."

To us, this has four key elements:

- Respond immediately
- Always be dependable
- Be friendly and easy to work with
- Provide knowledgeable support

There is nothing high-tech about these qualities, but they are the key to our success and growth. We pledge that these qualities will be the center of our relationship with you.

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PBI Media Ltd.
BOOTH #304

At PBI Media Ltd, we deliver essential analysis and business intelligence to help winning communications companies across the world stay competitive. We are one of the leading professional services, research, conference and publishing firms serving an extensive blue-chip client base in the global telecommunications, cable, satellite and Internet marketplace. For our clients, we deliver business-critical intelligence, analysis and services tailored to each of their specific requirements.

TARIFICA is the London-based communications, media and pricing consultancy and a leading brand of PBI Media. The group has evolved from a tariff data and publishing service to a fully integrated practice with research and consultancy conducted in Bandwidth, Wholesale and Metro Markets, Colocation and Managed Solutions, Billing and CRM, Internet Services and Infrastructure, including IP VPNs and Retail Pricing. The consultancy group delivers researched and customised services and products including white papers, focused reports, multiclient studies, workshops and seminars.

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PHONE+ International
BOOTH #306

PHONE+ International, now in its third year, has established itself as the leading supplier of news analysis for network service providers who have a stake in global telecommunications. Through this period of rapid deregulation and uneven growth, P+I has served as a beacon of clarity across the multitude of developments that comprise the world telecom scene, from wholesale transport to retail channel sales, from long-distance services to local market opportunities, from fixed broadband to 3G mobile, from major enterprise customer demand to opportunities in residential. The magazine has been there to describe the players and their strategies, to interpret the regulatory issues and trends and to illuminate the technological and operations management solutions that service providers need to achieve their goals.

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Pihana Pacific
BOOTH #603

Pihana Pacific is the leading provider of managed e-infrastructure services and the first company to build, brand and manage neutral Internet exchange data centers in Asia/Pacific. Pihana's extensive footprint in the region is unmatched and includes world-class facilities in Los Angeles, Honolulu, Tokyo, Seoul, Singapore, Hong Kong and Sydney.

Founded in January 2000, Pihana's core service offerings are colocation within a secure best-of-breed data center environment; carrier-neutral Internet exchange (IX); storage services (NAS, SAN, Backup and Recovery); remote hands and a suite of managed services—all backed by stringent 99.999% SLA-based support and commitment to service excellence. Pihana's unique neutral model attracts a broad range of communication service providers and enterprise customers, creating communities of interest that flourish within Pihana's environment. Pihana is a Hawaiian word meaning a state of "completion" or "fullness" associated with a gathering. For more information please visit us at Booth #603 or www.pihana.com.

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Pulsecom
BOOTH #612

Pulsecom (www.pulse.com) is a leading manufacturer of telecommunications transmission and access equipment. From the Central Office to the desktop, Pulsecom supplies Network Access Providers with a full range of communications solutions including Optical Access Systems, Power Systems, Integrated Access Devices, DSL tool kits that enable seamless DSL deployment in existing carrier equipment, D4 Central Office systems, and high performance and cost-effective Digital Loop Carrier Systems. An ISO 9001-registered firm with over 30 years experience and an installed base of over 9,000,000 voice and data circuits, Pulsecom is headquartered in Herndon, Virginia, with regional offices throughout the U.S.

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Qwest Communications International Inc.
BOOTH #600

Qwest Communications International Inc. (NYSE: Q) is a leader in reliable, scalable and secure broadband Internet-based data, voice and image communications for businesses and consumers. The Qwest Macro Capacity® Fiber Network, designed with the newest optical networking equipment for speed and efficiency, spans more than 104,000 miles globally.

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REDCOM Laboratories, Inc.
BOOTH #409-410

REDCOM designs and manufactures digital telecommunications systems based on its patented distributed control architecture.

The International Gateway Access Transit Exchange (IGATE®) combines end office, tandem, and international gateway functions in one convenient package. IGATE® reconciles differences in transmission, signaling protocols, and numbering plans between networks.

The Modular Digital Exchange with ISDN (MDX•I) is a public switching platform with ISDN, Caller ID, CLASS features, CALEA, SS7/C7, and flexible dialing plans. The version without ISDN is the **MDX**.

The **ISDN Gateway Exchange (IGX)**, with PRI and BRI, serves many private network applications (CLEC, command center, rapid response, etc.). ClusterNet™ technology, several operator consoles, a GUI console, and an optional CTI link are available for special applications.

The **Tactical Communications Package (TCP)** is a portable, deployable communications system designed with quick cable connectors and support for a variety of domestic, international and government interfaces.

The **Modular Switching Peripheral (MSP)** is a programmable switch controlled by a Host Computer. The MSP Host Toolkit (provided in ANSI C source code) increases productivity of developers.

The **Small Business Exchange (SBX)** Family includes office systems, tandem repeaters **(TRX)**, power line systems **(PSX)**, and command centers **(DCCX)**.

The **TeleTraffic Generator® (TTG®)** is a call generating device which simulates traffic on a telecommunications switching system.

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SatNews Publishers
BOOTH #216

Satnews Publishers is the leading multimedia information provider on the worldwide satellite industry and its convergence with the broadband, cable, telecommunication, broadcasting and internet businesses. Satnews publishes the annual International Satellite Directory, Satfinder CD-ROM database, Satnews Online, Satnews Asia, SateProfiles, among others.

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SED Systems
BOOTH #405

SED provides the satellite industry with dependable, flexible systems and services that fully satisfy customers' needs in testing, operating and managing satellite systems.

Serving satellite manufacturers, satellite operators, service providers and teleport operators, our products include: Monitor and Control Systems, In-Orbit Test Systems, Carrier/Spectrum Monitoring Systems, Network Management Systems for centralized operations, Telemetry, Tracking and Command Systems, Uplink Systems, Satellite Gateways, and custom Test Solutions, as well as Contract Manufacturing and Satellite Operations Services.

Established in 1965, SED serves customers around the world. We offer a flexible approach and an eagerness to work with our customers to devise the most cost-effective and practical solutions.

We are a turnkey supplier, working with our customers to tailor systems to their operational requirements. We design, build, install and test the system, assist in developing operating scenarios and procedures, provide expert support to system commissioning and service rollout, and offer long-term maintenance support.

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Website: www.sedsystems.ca

Sinotel Ltd.
BOOTH #201

Sinotel Ltd provides wholesale voice and data transmissions services between Australia, China and United States. The company has since expanded these services into all of Asia. The company offices are located in Sydney, Shanghai and Seattle. Shanghai Sinotel Guangtong Information Technology Company, a China joint-venture company, was established recently with Shanghai Guangtong Land Network & Communication Company who exclusively operates, manages, and markets the second largest and newest fiber optic network in China. This network covers 72% of all cities and 79% of the entire population in China. This network is a point to point open system, and can be billed at one point. The purpose of this joint-venture company is to market bandwidth to international companies operating in China. As China becomes a full member of the World Trade Organization it is important for the growth of these international businesses to have access to cost efficient high quality communications/technology solutions provided by Shanghai Sinotel Guangtong network.

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Smit-Oceaneering Cable Systems, LLC
BOOTH# 312

Smit-Oceaneering Cable Systems L.L.C. (SOCS) provides a full range of services to the telecommunications industry for the installation, repair and maintenance of fiber-optic submarine cable systems.

A joint venture between Smit International and Oceaneering International, SOCS capitalizes on Smit's 150 years' experience of worldwide ship operations, combined with Oceaneering's extensive track record in underwater technology and cable installation. The combined ability to maintain expertise, equipment and vessels in strategic locations across the globe enables SOCS to provide the most cost-effective installation and repair solutions for customers.

A primary asset is the dedicated telecommunications installation vessel Ocean Hercules, which is permanently equipped with a Phoenix cable repair and burial ROV, cable plough and burial assessment platform. The dynamically positioned vessel has a sheltered cable deck, with storage and handling equipment for the deployment of submarine telecommunications cable. Ocean Hercules is available in alternative configurations.

Latest addition to the company's assets is the MD3-JK plough, rated to 1500m for burial, with jetting capability to 1000m. Burial depth is up to 3 m.

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Space Foundation
BOOTH #211

The Space Foundation is one of the world's premier organizations supporting space activities, space professionals and space education through a wide range of programs and activities.

As the global space community has evolved, so has the Space Foundation - addressing all sectors of space - civil, commercial and national security. In fact, the Space Foundation is one of the few space-related organizations that embraces the totality of this community rather than focusing on a narrowly defined niche.

The Space Foundation conducts programs designed to serve the space industry and to increase the public's appreciation and understanding of the importance of space in their daily lives. As the leading non-profit organization advancing all segments of space, the Space Foundation maintains effective and coordinated partnerships and affiliations with numerous space advocacy, trade and professional organizations.

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Space News
BOOTH #606

Space News is the global publication of record for the space community. Space News plays an essential role in worldwide space, providing fresh news, critical insight and a common communications forum for the world's space leadership. *Space News* is the only weekly dedicated to global space activities, technologies, trends, business, environment and major programs. We cover space policies, political & legislation, NASA, ESA & space agency programs, satellite communications, new products & advanced technologies, interviews with worldwide space leaders, satellite manufacturing, operation & applications, remote sensing and space exploration activities. Please visit the *Space News* booth and sign up for a free subscription!

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Strategic Service Alliance, Inc.
BOOTH #611

Strategic Service Alliance, Inc. (SSA) is the leading source for communication platform solutions, providing the most advanced call transaction processing systems for the telephony and Internet industries worldwide.

SSA's prepaid Internet platform provides prepaid & metered Internet with no software install, download or reconfiguring of the end user's PC.

Our prepaid telephony platforms support, prepaid calling cards, wireless and wireline applications.

SSA brings their technology to market through joint ventures, currently covering 13 countries.

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Switch Management Corporation
BOOTH #311

Switch Management Corporation supplies OSS software to international circuit-switched and VoIP carriers. Its award-winning WebCDR carrier-billing ASP allows carriers to fully outsource their billing operations, and realize significant cost savings over traditional in-house billing. Switch Management also publishes Switch Watchdog, a real-time switch monitor and QoS alarm management program designed to replace 24/7 operations staff in small to mid-sized carriers. For more information, call 510.452.9200, or visit www.switchmanagement.com.

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Syracuse University School of Information Studies
BOOTH #703

Syracuse University School of Information Studies offers a dynamic Master of Science in Telecommunications and Network Management (TNM) in both distance learning and on campus formats. The TNM program offers students a comprehensive overview of networking technologies in data, voice, broadband multimedia and wireless, and an analysis of their applications in business and non-profit organizations. The TNM program prepares students as professionals who have the ability to combine knowledge of technology with an understanding of communication markets, management principles, and user behaviors. The School also offers nationally ranked master's degrees in Information Management and Library Science in distance learning and on campus formats. Please visit our website at http://istweb.syr.edu or contact us at 315-443-2911.

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Telemobile Inc.
BOOTH #509

Telemobile (www.telemobile.com) is a U.S. Wireless Rural Loop (WRL) manufacturer of digital and analog PHONELINK rural radiotelephony systems for point-to-point and point-to-multipoint applications.

You specify your requirements; we will design, produce and even install a complete "Turn-key" system including voice, fax and high-speed data transfer. Our systems can be used for wireless Internet access or private applications including multi-channel and multi-access systems in VHF, UHF (136 to 520 MHz), 1.4 and 2.4 GHz.

Telemobile also manufactures a complete line of full-duplex wireless Callbox RET (Roadside Emergency Telephone) systems, two way radio equipment and portable repeater systems.

Wireless village Community Telephony Centers (CTC's) can help provide universal access in remote regions.

Telemobile's TDMA Fixed Wireless Access (FWA) systems deliver rural telephony service.

Custom options are available as well as extra capacity with pair gain and line concentrators for wireless and wire line systems.

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The Aerospace Corporation
BOOTH #202

The Aerospace Corporation is an independent, nonprofit corporation whose principal mission is applying the full potential of science and technology to the advancement of space systems. Aerospace provides support in all fields and disciplines of research, development, engineering, acquisition, operations, and program management for space and space-related programs.

Aerospace operates a federally funded research and development center (FFRDC) for the U.S. Department of Defense, while also providing research, engineering support, and consulting services for other public and private agencies, organizations, consortia, and commercial companies involved in space technology and its applications.

Some areas of expertise include launch vehicles, propulsion, satellite design and orbital systems, remote sensing, ground systems, telecommunications, and signal processing. Examples of engineering support and direct consulting services include reliability analysis, risk analysis and lifecycle cost modeling, systems engineering, test and evaluation, launch and on-orbit failure analysis, and independent readiness reviews.

As an independent and unbiased resource, Aerospace adheres to the highest standards of objectivity and nonadvocacy, providing services of only the highest technical caliber.

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Time Warner Telecom
BOOTH #607

TIME WARNER TELECOM—WEST COAST FACTS

- 1300 Local Route Miles within the Time Warner Telecom West Coast Metropolitan West City Locations
- 3560 Route Miles along the Time Warner Telecom Fiber Optic WestCoast Longhaul Backbone.

- CO and Hub Locations (Longhaul and Local Services Available) - Los Angeles, CA; Bakersfield, CA; Orange County, CA; San Diego, CA; Boise, ID; Oakland, CA; San Francisco, CA: Fresno, CA; Phoenix, AZ; Seattle, WA; Portland, OR; Tucson, AZ.

TIME WARNER TELECOM—TRANSPACIFIC CABLE SYSTEM BACKHAUL SERVICES

- STM-1 and OC-3c Backhaul Services
- STM-4 and OC-12c Backhaul Services
- STM-16 and 2.5 Gbps Direct Wavelength Access Backhaul Services
- SDH to North American Protocol (e.g., STM-1 to 3xDS-3) Conversion Services Available

OTHER TIME WARNER TELECOM SERVICES

- Local and Longhaul Transport Services (DS-1 through OC-n)
- Native LAN Services (10 Mbps, 100 Mbps, Gigabit Ethernet)
- Switched Services (Digital Trunks, ISDN PRI, Integrated Business Line)
- Internet Access Services (DS-1 through full OC-3)
- Dedicated Web Hosting
- Long Distance Services

For more information visit our website at www.twtelecom.com or call +1.808.441.8500.

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TransTeleCom Company

BOOTH #604-605

TransTeleCom was founded in 1997 to take advantage of the extensive railway infrastructure in Russia by building a high-speed telecommunications network along the existing roads, and to develop it for commercial purposes. In just three years TransTeleCom created Russia's first and only nationwide fiber optic network. The network passes through eleven time zones to connect 71 of the country's 89 regions, and effectively covers 1/8th of the Earth. The whole length of the network is more than 45000 km. Through its 17 affiliates, TransTeleCom can offer its services up to 90% of Russia's population. Within Russia, TransTeleCom has unparalleled reach, technology and reliability, making the company Russia's leading telecom services provider.

TTC services reliability and scalability is supported by the modern transcontinental SDH optical network infrastructure. The ring architecture of the network infrastructure, with a single center for network management ensures high fault-tolerance.

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USAsia Telecom

BOOTH #516

USAsia Telecom, LLC. was founded in 1997 as a FCC licensed 214 international carrier and began operations in 1998. The company is uniquely converging fiber optic and satellite communications (Hybrid Fiber Satellite or HFS) facilities at it's SuperPOP in Honolulu, Hawaii. Through USAT's Gateway Asia Teleport in Kapolei, Hawaii, the company currently transports carrier-class voice and data services to telephone companies and ISP's across the entire Asia continent from One Wilshire, New York and Hawaii. The company is also evolving to deliver Managed Network Services using Virtual Private Network (VPN) technologies for Fortune 1000 companies and Digital Cinema services in 2002.

USAsia Telecom is a subsidiary of Mitsubishi Corporation of Japan offering these carrier grade telecommunications services:

- Satellite/Fiber IP Transport
- Wholesale Voice and Data to all of Asia including Bangladesh, India and Vietnam
- Engineering, Design and Management Services
- VSAT Service for Primary and back-up solutions
- MPEG Video
- Secure Managed Network Services
- Disaster Recovery Services

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Verestar, Inc.
BOOTH #314

Verestar, Inc. provides international communications solutions that link business and the world. We seamlessly deliver and manage customers' mission-critical communications with end-to-end solutions, integrated technologies and flexible service options. Headquartered in Fairfax, Virginia, Verestar has over 40 locations around the globe, and owns 11 Satellite Network Access Points (SNAPs) or teleports. Our asset inventory includes more than 175 antennas accessing the world's largest satellite systems. Complementing our space segment inventory, we offer extensive local, regional and international fiber capacity and direct connectivity to major IP peering points, carrier hotels and hubs, and voice switching centers. Our Customer-Driven Communications Solutions include International Private Line Solutions; High-speed Internet Connectivity; Broadcast Services as well as Verestar Voice (International Origination and Termination) and Gateway Switching Solutions through General Telecom, Verestar's international voice gateway switching company.

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Via Satellite
BOOTH #515

Via Satellite, the industry's leading magazine, keeps its 22,000 subscribers "in the know" by providing essential news and analysis on the global commercial communications satellite industry, including current and evolving applications, infrastructure issues, technology, and business and regulatory developments around the world. Top satellite executives from 160 countries read *Via Satellite* to fully understand the industry and maximize their companies' profits. To qualify for a free subscription, please visit www.ViaSatellite.com or call 847-559-7314.

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ViaSat
BOOTH #413-414

ViaSat is the source for new ideas in satellite communications. Already the choice of three next generation Ka-band systems, we're using the technology advances and high-volumes in that business to bring more value to our Ku- and C-band products. Customers include Astrolink LLC for business broadband, WildBlue Communications for residential and small office / home office broadband, and Connexion by Boeing for mobile Internet access on airliners. A full range of VSATs fit applications ranging from thin route data to high-speed, bandwidth-efficient broadband for integrated voice, data and video. ViaSat also has more than 40 years of experience in integrating complete ground systems for Ku-, Ka-, C-, and X-band communications. Antenna systems include large gateways, remote sensing systems, and geostationary antennas.

Recently ViaSat acquired LINKWAY and LinkStar from Lockheed Martin. The new Comsat Laboratories division of ViaSat continues to offer these advanced VSAT products.

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Vision Accomplished Hawaii
BOOTH #706

Vision Accomplished Hawaii provides satellite uplink and downlink systems plus satellite service coordination for customers throughout Hawaii and the Pacific Rim.

Mobile and Fixed antenna and electronic systems are available to relay data, video and voice information to and from both US Domestic and international satellites.

Founded in 1984 and still privately held, Vision Accomplished Hawaii is part of Hawaii Overseas Teleport Communications, Inc., a Hawaii corporation. The company owns three mobile earth station systems and has antenna systems for fixed services in downtown Honolulu and Kapolei, Hawaii.

For more information about the company or a price quotation for services please contact us at the address below or by phone by visiting our website on the worldwide web at: www.visionaccomplished.com.

Whatever you vision for efficient cost-effective satellite services is, we believe we can accomplish and in many cases exceed your goals.

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Voiceware Systems, Inc.

BOOTH #707

Voiceware Systems specializes in call processing applications based on our own robust, fault-tolerant system architecture, and the most mature software in the industry. Our premier product, the Telephony Services Platform (TSP)is the industry's most powerful and versatile PC-based, tandem switch. Running on Windows NT, the TSP supports Prepaid and Postpaid Calling Cards, Prepaid Wireless, International Resale, Long Distance Resale, ISDN - Intelligent Call Routing, and Billing & Reporting. Enhanced Services include: Voice Mail, Fax Mail, Conference Calling, One Call, Internet Connectivity, VoIP—Voice over Internet Protocol, SS7 Networking, IVR—Interactive Voice Response, IP Agent Gateway, IP Customer Service, Watch Dog Trouble Detection, RAID Level 5, Credit Card Recharge, and Custom Scripting Languages.

Founded in January 1985 in West Palm Beach, Florida, Voiceware Systems has led the way as a turnkey provider of advanced switching platforms for the Prepaid Telecom Services Industry. Since our inception, we have been committed to delivering the most innovative, leading-edge technology available to keep our customers competitive in the world marketplace.

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WorldCom

BOOTH #317

WorldCom Group (NASDAQ: WCOM) is a preeminent global communications provider for the digital generation, operating in more than 65 countries with annualized revenues of more than $20 billion. WorldCom provides the innovative technologies and services that are the foundation for business in the 21st century. For more information go to http://www.worldcom.com

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