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ABSTRACT

Six papers from the 1990 CAUSE conference's Track V, Managing Telecommunications and Networking are presented. Topics address such subjects as network funding, support services, access to networks, improvement of instruction through networks, and image transmission. Papers and their authors are as follows: "What's New in Telecommunication?" (Gene T. Sherron); "Computer to Computer Communications: When E-Mail Is Not Enough" (Daniel J. Oberst); "Marketing Principles Extended: Creating a Statewide Network" (Robert E. Zimmerman and Sandra M. Statham); "Networks Beget Networks" (Gene A. Kemper); "Networking in Residence Halls: Participation and Impact" (Mary Simoni and Elaine M. Hockman); and "The Integration of Voice, Data, and Video Services via a Wide Area Network: Technical and Organizational Issues" (Jan A. Blatzer). (GLR)

ED 305 ###

Challenges and Opportunities of Information Technology in the 90s

Proceedings of the 1990 CAUSE National Conference

TRACK V
MANAGING TELECOMMUNICATIONS AND NETWORKING

November 27 - 30, 1990
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MIAMI BEACH
NOVEMBER 27-30, 1990

TRACK V
MANAGING TELECOMMUNICATIONS AND NETWORKING

Coordinator: Con Dietz, Illinois State University

Communication may be replacing computation as the most critical service within our higher education institutions. Papers in this track address such subjects as network funding, support services, access to networks, improvement of instruction through networks, and image transmission.

WHAT'S NEW IN TELECOMMUNICATIONS?

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ABSTRACT

PBXs, LANs, CSMA/CD, ISDN, FO, FDDI, and the list goes on. How's a person suppose to keep up with all the advances in computing, much less telecommunications? The fact is we don't! But, this layman's terms presentation is designed to provide you with an update on the typical issues and technologies facing us in telecommunications today.

The data for this presentation was collected from a survey of 128 college and university telecommunications departments which makes it "real world" and current. Highlights include: How does a fiber optic backbone fit the campus networking strategy? What does ISDN means to me? Which LAN configuration is most popular on campuses?

In addition to the national data, case briefs of Florida State's will be interspersed in the presentation.

INTRODUCTION

The year is 1984. The place is the U.S. District Court in Washington, D.C. The judge is the Honorable Harold H. Greene. The decision is to deregulate the telecommunications industry and AT&T consented to divest. Since that date, life on the campus has not been the same. Slowly at first, but now like a locomotive, colleges and universities across this land are taking control of telecommunications.

Most of us in the technology business have realized that it is a lonely world in which we live. We see opportunities. We try to sell "management" on them. Yet these are expensive decisions that we are trying to get them to buy into. And the technology changes so fast that they worry whether it will be obsolete before we get it installed.

Yes, bless their hearts, our bosses are uneasy about technology decisions because they simply did not grow up in the electronic age. And I am one of them. Think on us kindly. We, those of us who are in management positions in colleges and universities today, grew up with the following handicaps -- our phone numbers were something like "39W" and we reached parties through an operator on our dial-less black phones; when we visited Grandpa's Kentucky farm, we answered "two longs rings and a short" on the oak-cased, party-line phone; and the most sophisticated technology in the home was a vacuum tube radio and we didn't even think about it being AM only.

Is it any wonder that you young "whipper-snappers" have trouble selling new telecommunications systems on campus?

THE SURVEY METHODOLOGY

The First Survey

Realizing that our managers respond well to peer information, I decided to ask our ACUTA colleagues for some hard evidence to advance our cause. And, since most of us want to progress as broad a front as is feasible, I developed a survey that would collect data that could be used to demonstrate to my boss that we should do these wonderful, new, innovative things. Thus, in the Summer of 1988, I conducted my first survey of twenty-four ACUTA members.

The 1990 Survey

The response to the first survey was so encouraging that I decided to seek another level of management data about campus telecommunications operations.

A seven-page survey instrument was developed in Spring 1990 and sent out somewhat randomly to 151 ACUTA members. It achieved an outstanding reply rate of 60 percent, or 90 respondents, and generated the data for a presentation at a recent ACUTA national conference, results of which CAUSE published as a Professional Paper. (1)

The Enhanced 1990 Survey

Happily, I can report that the survey data was well received at the annual ACUTA conference. However, the bad news is that some of the attendees felt that the data might have been skewed by the responses from larger universities. To correct the flaw, a copy of the survey was sent to each college and university attending the ACUTA conference that had not been previously surveyed. Ninety-two of these additional surveys went out in July. By Labor Day, 38 more responses (a 40% response rate) were added to the previous data base to make a total of 128 colleges and universities.

The Survey Instrument and Findings

So, what follows is not so much "What's New in Telecommunications?" but WHAT'S NORMAL? From the paper, you will be able to pull together a picture of campus telecommunication activities and get a feel for normal or average activities.

SWITCHING CAPABILITY

Getting into the Campus Phone Business

The deregulation of the telephone industry gives colleges and universities freedom of choice. But, it also poses one of the biggest dilemmas -- whether to subscribe or continue to subscribe to Centrex service or acquire a private branch exchange (PBX). In other words, should the campus use its local telephone company to provide phone service or acquire a switch (PBX) and become its own "mini-telephone company." Thus, in simple words, we are looking at "Centrex" versus "PBX."

The Trend Toward PBXs

Little data exists as to the number of campuses with Centrex service versus those with their own PBX at the time of divestiture. A good guess would be that ten percent or lower had PBXs.

One thing that we do know is that in 1990 a majority of the larger institutions opted to have their own switch. The survey indicated that 6[illegible] percent owned their PBX, while 31 percent used Centrex service. It does not seem to matter whether the institution is small or large, a ratio of two to one seems to prevail.

The Vendor of Preference

There are two giants battling it out to be the dominant switch vendor. AT&T is the name most of us recognize and the other is a Canadian firm called Northern Telecom, Inc (NTI). In terms of providing Centrex service, the Northern Telecom DMS-100 digital switch is the clear leader with the campuses surveyed. When it comes to picking a PBX for the campus, the preference is one of AT&T's models. But, as seen by the percentages below, no particular switch turns out to be the dominant choice.

CENTREX		CAMPUS PBX	
49%	Northern's DMS-100	34%	AT&T's 25, 75, 85, & Dimension PBXs
46%	AT&T's SESS	29%	Others: NEC, InteCom, GTE, Ericsson
5%	Others: Nova & "other"	27%	Northern's SL-1 & SL-100
		10%	Rolm's CBX & Model 9751

However, based on these percentages of campus market share, a safe choice would have to be Northern Telecom or AT&T. And both have been in the bushiness long enough to give confidence to the notion that they will be around for years to come.

The Integration of Voice and Data

Whether it is Centrex service or an owned PBX, it is safe to say that the overwhelming number of them are digital switches. This means that all of the internal circuitry is handling signals in binary, just like another computer. Further, it can be said that they were designed to handle data as well as voice communicating. And, this has been so for a decade and a half. The sales pitch has been to buy one switch that handles both.

But in fact, vendors have had few takers. In the early years, campuses acquired data switches for data communicating and a PBX for voice needs. Even today vendors still talk about how easy it is to run voice and data through the same PBX, but those who do exploit integrated voice/data (IVD) are few in number.

During the Fall '88 survey process, it was learned that Northern Telecom tried to sell customers on integration but in practice less than 2 percent of it's customers actually acquired the IVD instruments (make that "phones"). The universities reported an even lower number. The twelve universities with Northern Telecom PBXs reported that only about 1 percent of the proprietary phones which they acquired were the IVD type.

So, how do we handle data?

It seems that we can generalize our data options into three categories --modems, data switches, or voice/data PBX. For decades, campuses have used modems (modulator/demodulator) to connect workstations to computers via telephone lines. We have them that range in speed from 300 bits per second (bps) on up to 19,200 or 19.2K bps.

In the late '70s, the data switches, such as those made by Gandalf and Micom, gave rise to the establishment of separate data networks. These systems use twisted-pair cabling and achieved data rates of 9.6K bps to 19.2K bps.

Finally, the "digitation" of the switch/PBX brought an important capability to users. With a digital PBX, users gained the ability to be connected simultaneously to data signals and voice or a voice/data PBX.

Now, against this background, we can see what campuses are doing.

Low-speed Data via Modems	44%
Separate Voice & Data Networks	39%
Integrated Voice & Data via PBX	19%
Low- to Hi-Speed Data via PBX	14%
Low-speed Data via PBX	9%

Note that these percentages total to more than 100 percent. This occurs because many of the campuses report several different ways of handling their voice and data needs. From these data, two things leap to our attention. First, there is still a considerable amount of low-speed modem use on campuses today -- 44 percent. And, secondly, the data switches that were so popular fifteen years ago are still very much present on the campus -- 39 percent. The big hope is that more and more campuses will move to the integrated voice/data switch, which is a capability that is moving up into third place, or 19 percent.

NETWORKING

Networking. Whatever that is!

Doing some networking? Whether we call it networking or local area networks (LAN), selecting the scheme for your campus is no simple task. Today's networking/LAN marketplace is crowded with at least fifty different vendors, all claiming that their product is the one you need. Further, confusion occurs because there are few fixed standards, de facto or otherwise. Nonetheless, you may be sure that the simple, small LAN you install today will turn into a large multifloor, multibuilding, or multicampus network at some time in the future.

The Campus Communications Picture

Not sure of how to ask the LAN question in order to get a definitive and clear picture of campus networking, the question was posed, "What best describes your campus?" Note the frequency of responses to the left of the following descriptions.

80 A campus backbone
60 A loose confederation of LANs w/ computer center data circuits
48 Administrative and academic computing on separate networks
3 A data switch
16 Integrated voice and data network

As mentioned earlier, the most curious response is that the vast majority of the campuses see themselves with a "campus backbone." Yet, from the responses about data rate and the use of different media, these are most likely coaxial networks or maybe even some using twisted pairs. Probably less than a dozen of the campuses surveyed are using fiber backbone.

The Typical Data Rate on Campus

The most popularly reported data speed is 9.6K bps at 56 institutions. Add that to the lower speeds reported and we find 97 out of 128 campuses at 9.6 and slower, 13 at 4800 bps, 21 at 2400 bps, and 7 at 1200 bps. Of those campuses which reported high data rates, it is encouraging that 11 are at the 1OM bps speed.

Optical Fiber -- The Ultimate Transmission Technology!

Although fiber is making its mark, copper, as in twisted pairs, will continue to be the basic method for delivering services in the office during this decade. With our campus buildings full of twisted copper telephone cables, it represents a valuable resource for networking that is cheap, light weight, flexible, and easy to install. More importantly, it will support most of the popular networking protocols and configurations. Coaxial cabling, which is 14 times more expensive than twisted pair, provides a far broader transmission bandwidth, but it is less flexible and heavier. (2)

Here's the FDDI Scoop!

It's a little early to get excited about FDDI, but it won't hurt to know enough about it to ask a few good questions. FDDI (Fiber Distributed Data Interface) is a developing standard for large backbone LANs that is configured as a counter-rotating ring operating a 1OOM bits per second. It is intended to support up to 1,000 connections and support a total fiber length of 200 kilometers. This is now a "developing standard" but expect it to play a role in campus networking plans in the '90s. (3)

ISDN! "Do I have to know?"

Put simply, ISDN (Integrated Services Digital Network) is a modest set of broad technical recombinations for a common user interface to digital networks. The "integration" part applies to the goal of combining separate networks into a single, high-speed common facility--like your local telephone company's system. The concept envisions breaking out 64K bps channels for all types of transmission from voice to slow-scan television. Again, this is a standard, in the making, that will play a role in our campus communications plans.

For some of us, there isn't room in the old think box for many more acronyms, so do I need to know about ISDN, too? If you need a more detailed understanding, you can read 1,000 word articles in CAUSE/EFFECT and Procomm, written just for the layman. (4)

LAN Topologies

Increasing the difficultly in understanding LANs, we select the LAN components and mix them with several topologies and protocols, in various combination, to implement a LAN.

Here is a quick summary about LAN topologies. The basic topologies are: bus, ring, and star. However, in practice, we find a number of hybrid topologies. Networks with the bus topology sometimes are called backbone networks because they connect each device to a central cable called the backbone. A ring topology network connects each station to those on its left or right. Regardless of the topology -- ring, bus, star, or hybrid -- every message contains a designation address and each station on the network "listens" for its address in each message.

LAN Protocols

A LAN protocol is the set of rules, procedures or conventions that relate to the format and timing so that two or more points can communicate with one another. Associated with the protocol decision is one concerning whether the system will be baseband (one message at a time) or broadband (multiple message passing).

To ascertain what was being used by campuses to control their networks, the survey question was, "What protocols were used most prevalently on campus?" And, we must confessed that not all possible protocol options were listed, in an effort to keep things simple.

The most commonly reported protocol is TCP/IP (Transmission Control Protocol/Internet Protocol), with a frequency of 60 campuses. It is probably the oldest networking standard and allows reasonably efficient and error-free data transmissions. Recall that it comes to us through development at the Department of Defense's Advanced Research Project Agency network project known as ARPANet.

With an abundance of IBM hardware on campuses, it should not surprise you that IBM's Systems Network Architecture (SNA) has a significant presence. The IBM protocol used under this Architecture is Synchronous Data Link Control (SDLC) protocol. Yet, when one asks about campus LAN protocols, it is common to refer to it as SNA rather than SDLC. Recognizing that option, SNA was reported as the second most popular option with 38 campuses reporting its use.

Again, considering the amount of Digital Equipment Corporation (DEC) hardware on college campuses, it should not come as a shock that DECnet is the third most popular protocol with 8 campuses reporting.

LAN Operating Systems

As mentioned earlier, the techies who work on our LAN systems do not have a common vision of the hierarchy associated with LANs. So, when we asked about the most prevalent LAN "Operating Systems" on campus, we were really asking about the "LAN software" or "LAN application software." One of these days, we may be able to use architecture, protocols, and software as distinct categories and people will know what we mean. In the meantime, let's report the findings on "operating systems."

Novell's NetWare is the clear choice of LAN Operating Systems with 94 out of 128 campuses reporting that it is the most prevalent one used.

Apple Talk is in second place with 62 votes. Again, Digital is in third place with VMS/DECNet (45). The others include: DOS LAN Manager (18), 3 COM Plus (13), and Banyan VINES (10).

ORGANIZATIONAL AND MANAGEMENT ISSUES

A New Function--Telecommunications

Prior to deregulation/divestiture (1984), campus telephone service was typically a small operation down at the Physical Plant Department that coordinated the phone and data circuit requests with the local phone company. A telephone administrator and a few clerks ran the show.

During the past six years, a majority of our campuses have taken advantage of deregulation's freedom of choice to create Telecommunication Departments, establish Director of Telecommunications positions, and develop communications operations that represent the fastest growing organization on the campus.

Organizational Generalizations

The last page of the survey instrument contained a request for a copy of the organizational chart for the campus department of telecommunications. The most challenging part of the data analysis has been drawing conclusions and making generalizations from these hundred or so charts. An indicator of the newness of telecommunications on our campuses is the fact that less than half provide a "printed" organizational chart. The others used the multi-purpose form provided and filled-in the blanks.

Next, it was necessary to separate the campuses into those with their own switch/PBX versus those served by Centrex (the local telephone company). Rather than comment on each observation, please note these generalizations.

As indicated earlier, the size of the campuses and in turn, the size of the telecom operation followed the often cited "bell shaped Curve." Given this diversity, the data falls into fairly neat groups. Thus, the following generalizations represent statements that you can bank on as being the norm.

Telecommunications Departments with Centrex Service

--Staff size ranged from 2 to 85 people (an average of 19)
--Span of Control averaged 3
--Staffs of 5 and larger had an average of 5 Operators
--20 and larger staffs also had an average of 5 Installers -
--Most department heads were "Director" Smaller ones were "Manager"
--75 were named "Department of Telecommunications"
--No consistency of technical titles
--Typical organization was "Business/Finance," "Customer Service," and "Installation & Maintenance"

Telecommunications Departments with its own Switch/PBX

--Small Departments -- Staff from 2 to 11
-Typically organized in 2 to 3 groups Operator, Accounting, & Technical
-Average of 2 Operators
-Director is called "Manager"

--Medium-sized Departments -- Staff from 13 to 16
- -Span of Control was typically 3
- -Usually 3 or more Operators
- -Included Telecommunications Technicians (PBX caretakers)
- -Or PBX Maintenance was "Contracted out"
- -Operators Function aligned under Accounting/Billing
- -One or more Programmer Analysts present

--Large-scale Departments -- Staff from 19 to 25
- -Span of Control was typically 3
  Customer Service, Finance & Billing, and Plant/Facilities
- -Usually 5 or more Operators -
- -The PBX was of "Central Office" size -A full technical staff to include: cable plant, installation & maintenance, and switch operations
- -Often a "Data Communications" group -Department head was called "Director"

Since these two sets of summaries truly highlight observations concerning over 100 organizations, making a recap of them would be the height of redundancy. So, about the best thing that can be said here is that if one wanted more specific groupings of data it is available. In fact, all of the data groupings will be written-up and published next year.

CLOSING THOUGHTS

"What's new in telecommunications?" Campuses are growing their own mini-telephone companies. But more than that, they are tending to be more of a full-service offering than their counterparts "down town" (the local phone company). Universities have always done a better job in data communications and they will continue to push the technology frontier in this regard. Additionally, colleges and universities are and will continue growing in the delivery of student services such as: long-distance resale, cable TV, voice mail, alternate operator service, and the like. The sky is the limit!

And that, my friend, is **WHAT'S NEW IN TELECOMMUNICATIONS**

FOOTNOTES

(1) Gene T. Sherron, "An Information Technology Manager's Guide to Campus Phone Operations," CAUSE Processional Paper #3, January 1990, pp. 26.

(2) Alan Simpson, "The State of the Optical Art,"Telephony, August 27, 1990, p. 40.

(3) Jerry FitzGerald, Business Data Communications, 3rd ed, (New York: John Wiley & Sons, 1990), p. 347.

(4) Gene T. Sherron, "ISDN--Take Another Look,"CAUSE/EFFECT, Summer 1990, pp. 3-4 and "The Scope of ISDN," Procomm, October 1990, pp. 41-42.

Computer to Computer Communications: When E-Mail is Not Enough

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Computers today function as information processors, not large calculators. Computing on desktops and in dorms, with world-wide campus network interconnections, permits communications on an unprecedented scale. But the most widely-available messaging tools will soon be inadequate to the task. Princeton University is investigating how computer-based messaging systems can cope with this flow of information and aid internal communications for strategic planning and consensus building. The paper reviews the history of these systems and mail distribution lists, examines the strengths and weaknesses of each, and outlines the roles that personal computers and centralized computing resources can play in meeting this need.

When the history of the computer revolution is written, two images will be recalled: the room-sized ENIAC that ushered in the age of computers and the thumb-nail sized microprocessor chip that brought computing to office and home desktops. Accompanying this miniaturization in size, and growth in power has been an equally dramatic shift in function. Whereas the ENIAC's function was numeric processing and calculation, the microchip's main application is in the areas of word and information processing.

The application of computers to the communication of information, or computer mediated communications systems (CMCS), began in the 1970's. As computing applications have shifted increasingly towards information rather than strictly numeric processing, the potential for CMCS use has grown. Second-order effects of the personal computer revolution are now appearing. Users who took to the personal computer for word processing and spreadsheets now look for ways to organize, share, and communicate their ideas and work with others. Industry pundits have coined a new buzzword, "groupware," for this as yet vaguely-described but nonetheless highly-desired capability.

Princeton University, along with many other universities, has experienced these changes. Whereas once users trekked off to a computing center to punch cards or sit at hard-wired terminals to "do computing," today we see first year students, computers in tow, setting up their own computer centers in their dormitories. From their rooms, students can write papers, work on lab reports, run simulations, as well as connect to information resources on the campus internet and beyond. Faculty and staff now make use of desk-top and departmental computing resources for a host of critical functions, from basic research and experimentation to managing grants and departmental finances.

Users are increasingly aware of the role of the local campus network, along with the regional and national networks that interconnect it with other campuses, as a conduit of information and vehicle for communication and collaboration. Use of electronic mail for local and remote communications is growing, university purchasing and financial on-line information systems are now routinely accessed by departments, and regular transfers and sharing of information between local and centralized networked computers is becoming commonplace.

With a campus backbone network and localized computing infrastructure in place, Princeton has begun to look at how internal communication, discussions, consensus building, and information dissemination might be assisted through the use of networking and computer resources. An *ad hoc* committee has been set up within Computing and Information Technology to explore the current state of computer mediated communications systems as they might apply to fulfilling these perceived needs of the university community. The groups has just begun its evaluation of several systems, and is hoping to have preliminary recommendations ready by early 1991.

CMCS's: A Brief History

Computer mediated communications systems began in the early 1970's. Pioneering efforts included SRI's Augmented Knowledge Workshop (AKW), the Institute for the Future (IFF)'s PLANET, and several commercial systems like the Computer Development Corporation (CDC)'s PLATO NOTES system and Scientific Time Sharing Corporation (STSC)'s MAILBOX.[1]

[1]John S. Quarterman, The Matrix: Computer Networks and Conferencing Systems Worldwide (New Bedford: Digital Press, 1990) p. 158.

The first important practical use of a CMCS was EMISARI (the Emergency Management Information System and Reference Index) developed by Murray Turoff for the U.S. Office of Emergency Preparedness under the Nixon administration in 1971. This system allowed the government to monitor wages and prices around the country, rapidly disseminate wage and price freezes to regional offices, and electronically discuss issues related to economic policy.[2]

EMISARI formed the basis for the Electronic Information Exchange System (EIES) that Turoff went on to develop at the New Jersey Institute of Technology. The system originally ran on a Perkin Elmer mini-computer located at NJIT, and was made available nationwide through EDUCOM's EDUNET, an educational resource-sharing network using public data networks for remote access. Educational and research organizations and individuals made effective use of the system for everything from distance learning and distributed collaboration to work by industry standards bodies.

The EIES system proved to be a rich development environment for other CMCS's. Participate was prototyped on the EIES system, using its powerful INTERACT programming and development environment, by C. H. "Harry" Stevens. It was later made available on the commercial information utility, The Source, and also as a stand-alone system for use locally by organization on their own computers. Its features included a very rich branching structure for its conferences.

At Wayne State University, CONFER was designed by Dr. Robert Parnes in 1975. It is now widely used at the University of Michigan where it has grown to become an integral part of the university experience for many of the students, staff, and faculty as a forum for discussion and information. Development of a unix port of CONFER is under way, but it currently only runs under the MTS (Michigan Timesharing System) mainframe operating system.

In 1977, at the University of Stockholm's QZ Computing Centre, Jacob Palme created the COM system, a powerful messaging and conferencing system that has been used in that country and internationally for university and commercial applications. Originally designed to run on DECsystem 10/20 computers, COM was rewritten in a portable version called PortaCOM to run on a variety of operating systems.

Caucus was developed by Charles Roth as a very portable conferencing system modeled largely on the Confer system. It runs on a wide range of machines from small PC's to mainframes and powerful unix servers. The user interface is dictionary-driven making foreign language adaptations of the system easy to implement.

At the University of Guelph, Alastair Mayer worked on the CoSy system in 1983. The resulting system was used extensively there and later adapted for use in BYTE Computer's on-line BIX system. It is now a commercially marketed product running on unix and other machines.

Mailing Distribution Lists and CMCS

About the same time these CMCS's were under development, the United States Department of Defence's Advanced Research Projects Agency (ARPA, now called DARPA) was experimenting with a wide-area data communications network. Computers at universities and military sites were connected to what became the ARPANET. Electronic mail systems on each computer allowed researchers to address messages to colleagues at any of the other interconnected computer systems.

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[2]Brock N. Meeks, "An Overview of Conferencing Systems," BYTE, December 1985, p.169.

They did not need to login to the colleague's computer, and thus did not need to request an account or learn how to use the remote system in order to communicate with users there. Electronic mail soon became a dominant use of the network, more so than the originally-expected services such as remote login.

Most electronic mail systems allow users to create personalized lists of frequently-addressed recipients that can be called up instead of having to type in the individual addresses. A CMCS-like "mailing distribution list" facility can be set up by centralizing these lists of addresses. Researchers who wish to keep each other informed of their work can create a centralized list to which all the members direct relevant mail. Users send mail to an address that looks like a userid at the list-maintaining host computer (e.g. "fusion-list@ppl.princeton.edu"). When the host receives the mail it "explodes" it out to each of the remote recipients on that particular list.

Today's descendant of the ARPANET, the Internet, consists of interconnected networks, such as the National Science Foundation sponsored NSFNET and its member networks, which use the Transmission Control Protocol and Internet Protocols (TCP/IP). Electronic mail, much of it from such mailing distribution lists, remains an active part of the network. Some 250 lists are widely advertised on the Internet, and many more private ones exist. Some are technical, like the "unix-wizzards" list that dates back to 1977. Other topics range from the practical (a recipies list) to the frivolous (a science fiction lovers list). Interconnections with BITNET and UUCP networks (see below) provide access to similar facilities on those networks.

In 1985, the author, then director of the BITNET Network Information Center (BITNIC), and Ira Fuchs, who headed the BITNET Development and Operations Center (BITDOC), proposed a mechanism for adding mailing list capabilities to BITNET. The resulting software, LISTSERV, was developed by Ricardo Hernandez, and distributed to several dozen BITNET sites. Its success was such that LISTSERV traffic soon began to swamp the more congested BITNET links. In response, a revised LISTSERV was created by Eric Thomas of the Ecole Centrale de Paris in France. Whereas the initial LISTSERV used a simple mail "exploder" (one in, many out) mechanism, Thomas's improved version made use of a set of peer LISTSERV computers, which communicated among each other to more efficiently distribute the traffic. A message going from the US to several dozen users in France, for example, would transit the Atlantic once, and be "exploded" only after arriving at a French peer LISTSERV. Thomas's version also added features such as automated list signup and retrieval of archived postings, information files, and programs. The combined BITNET/NetNorth/-EARN networks on which LISTSERV operates have nearly 1,700 lists world-wide in active use today.

These network-based "distribution list" systems developed in parallel with centralized CMCS systems. Functionally, both types of systems provide for one-to-many (and by extension many-to-many) communications. CMCS's provide specialized tools and facilities to deal with this sort of communication. Distribution lists, on the other hand, are handled by programs designed primarily for electronic mail, which is predominantly one-to-one communications.

Both provide the ability for users at different, and often geographically dispersed, locations to form groups based on common interests. CMCS's usually require remote access to a centralized CMCS. Mailing distribution lists allow users to do this within a familiar environment (their local computing environment) using the same tools (electronic mail) used to support communication with individuals at their own or other universities.

Because of its simplicity of installation and setup, mailing lists usage has grown dramatically, especially as the penetration of networks has grown to virtually all the major institutions of higher education. An individual or group wishing to set up a mailing lists need only set up the mailing address that will do the mail exploding. As stand-alone multi-user workstations have dropped in price, it is now possible for individuals to do this. In other cases, the administrator of a centralized mainframe or mini-computer needs to be involved. Setting up such lists (using LISTSERV or other mailing distribution list exploders) is relatively straight forward.

Publicizing a mailing distribution list involves advertising the network addresses for list signup and postings. After signing up, users continue to use the standard mail interface to send, receive, or reply to items posted to the mailing list. As a result, list members are instantly connected to a set of colleagues with similar interests .

Many of the advantages of mailing distribution lists contribute to their disadvantages as a means of group communications. Since most subscribers use their standard mail systems to read and organize mail that comes from lists, they often do not have tools to deal with the volume of information that can come from lists. Sorting, searching, and following threads can be difficult, especially when the volume of messages is large. Cross postings to several lists show up multiple times in the mail system. Worst of all, one's personal and often urgent mail can get intermixed and buried in distribution list mail. In addition, since mail is sent to each subscriber's mailbox, multiple copies of the list mail items often exist on a campus or even on a single machine.

Hybrid Systems

There are several examples of systems that have the characteristics of both a conferencing system and a mailing distribution list. These systems work in a distributed fashion among a number of geographically dispersed computers but provide local access and a single common local copy of the information for users at each site.

In UUCP, a facility for posting information to interest groups, called netnews, functions similarly to a mailing distribution list. Users post items to netnews groups, instead of to a distribution list. When an item or message is posted to a "newsgroup," however, the netnews mechanism employs a flooding algorithm to distribute the item to other sites that have indicated an interest in (subscribed to) that particular newsgroup. New items thus transit the network until each subscriber site has received it[3].

Thus, on a machine-specific basis, it is decided whether or not users of that computer will have access to certain netnews groups. For each group, there is also an associated expiration period. Articles only remain on the system for users to read for the duration of that time period, and are then removed. If a specific department (or user with a netnews-capable machine) wishes, they in turn can subscribe to a group, and then keep the items for a longer expiration time.

Netnews reader programs provide tools for viewing these posting, and in some cases provide end-user functionality approaching that of a conferencing system. In all cases, the netnews items are not a part of the user's personal mail, and pointers, rather than individual copies of each messages, keep track of what groups a user is following and which items are read and unread.

[3]Mark R. Horton, Standard for Interchange of USENET Messages, issued as Request for Comments (RFC) 850, DDN Network Information Center, June 1983.

An implementations of netnews for the IBM VM/CMS operating system, developed by Irwin Tillman at Princeton University, provided both a netnews reader for the end user as well as a mechanism for receiving and sending netnews postings. Tillman also made it possible for LISTSERV lists to be posted to netnews. This allowed users of LISTSERV distribution lists, whose personal electronic mail boxes had become inundated by LISTSERV mailing list items, to monitor the lists through netnews.

EIES2, the current implementation of the EIES system, has been designed to operate within a distributed environment as well. Its so-called User and Group Agents can run within the same physical computer or the User Agent can interact with a remote Group Agent on another computer, which in turn can interact with other Group Agents over TCP/IP or X.25 (international public data network standard) networks.

At IBM, two researchers, Robert Flavin and Jack Williford, developed an internal distributed conferencing system called GRAND (its predecessor was called PALTRY). The system was built to be distributed, and have a highly tailorable user front end.[4] Like netnews and EIES2, GRAND is a distributed system, and provides a means for cooperating GRAND systems to keep each other informed of new articles submitted to a local system. The GRAND system was based on IBM's Network Job Entry /Remote Spooling Communications Subsystem (NJE/RSCS), the same protocol that underlies BITNET host to host communications.

GRAND allowed several "notification styles" for end users that ranged from an interface to local or remote copies of GRAND conference entries, to delivery of items as personal mail. GRAND thus functioned as both a mailing distribution list exploder as well as a conferencing system.

PortaCOM, a portable implementation of the COM conferencing system, has a Network InterfaCE (NICE) that allows it to both send and receive mail from external mail systems. In this way, external mailing distribution lists can be directed to a PortaCOM conferences, or users can have items from lists sent to their own mailbox. PortaCOM attempts to minimize duplication of items by attaching unique identifiers to each message handled by the system. PortaCOM conferences can also have external "members," so that remote users or mailing distribution lists can participate in PortaCOM conferences.

Role of Personal Workstations in CMCS

The dominant model of a CMCS is a central computer on which the data and user profiles reside. Users are required to login to interact with the system. This style of time-shared computing predominated when most computer conferencing systems were developed, and most systems have retained this model. Users of such systems were often limited to printing or simple video terminals at slow (300 bits per second) speeds. The user-interfaces and text editors available had to conform to, or at least take into account, such a user environment.

Many CMCS's use menus that constantly repeat the choices (some video terminals had only 24 lines that scrolled irretrievably off the screen), or command interfaces that require users to remember (or call up a menu first) and then type to navigate around the conferencing system. Editors in most CMCS's are the line-oriented style of editor associated with printing terminals that require users to

[4]Robert A. Flavin and Jack D. Williford, "The Network Application Manager," BYTE, December 1985, p.203.

memorize commands for changing text, inserting text, etc. Reflowing of text (adjusting line lengths after text insertions and deletions) can be difficult if possible at all.

As long as this was the only way to access computing, such interfaces were at best tolerable. Since users had to access centralized computers for other applications (such as statistical analysis, on-line administrative systems, etc.) they needed to become familiar with some of the access procedures and editors anyway. The learning curve for the systems, while steep, was at least useful for other computing activities. Today however, most users have access to personal computers that provide far more flexible editing environments and user interfaces. On many, bitmap graphics and mouse-driven menus provide a far more intuitive means to access programs and data.

Some CMC's developed ways to make use of the growing power and intelligence of personal computers that were beginning to be used as terminals to access these systems. On the EIES system, a program was written for the AppleII that attempted to locally mimic the EIES system, and then build a set of batched commands that could in turn be executed on the EIES system. The results were then returned for local perusal on the microcomputer. This was viewed both as a cost-saver (since both system and telecommunications costs were time-based) and an aid to the user (since some of the features of the local micro, its editors, etc. could be used in preparing the text to be submitted, as well as in processing it later.)

A later version of EIES called TEIES (Tailorable EIES) allowed personal computers to locally create items for use in the system, including pictures, graphics, and formatted text[5]. Other "Personal-TEIES" users could then view these items, or create their own for submission to the TEIES system. Access and navigation was accomplished through PF-keys on the PC. The PortaCOM system has both a Macintosh (MacKOM) and PC (VIDAKOM) interface to its system that provides a localized environment in which to interact with PortaCOM.

Another approach, taken by the University of Michigan's InfoDisk, is to build a front end to host systems that in turn communicate with a remote workstations using a defined protocol. In Michigan's case, mail and a calendar of events were front-ended with a MacWorkstation program that translated system commands and structures into pull-down menus and "dialog boxes" on a Macintosh. The complexity of the system was masked behind a series of menus and fill-in boxes that allow the user to intuitively explore and make use of the power of the system. To the end user, the system appeared like a Macintosh application running locally.

In each of these systems, the user is able to use a local word processor to prepare text for submission to the system. Some of the interfaces include their own WYSIWYG ("What You See Is What You Get") editors, or are integrated with existing text editors. Windowed personal computer environments (such as Microsoft Windows on PC's, the Macintosh interface, or X-Windows on unix workstations), with "cut and paste" capability can simplify the use of systems even with simple "dumb-terminal" interfaces.

A local front-end to a CMCS allows a logical split of responsibility. The centralized computer does what it does best, centrally store and manage the data of the conferences as well as the information about the participants. The user's personal computer does what it does best, provide a better, more

[5]Starr Roxanne Hiltz and Murray Turoff, "Teaching Computers and Society in a Virtual Classroom[TM]," Proceedings of the Conference on Computers and the Quality of Life, Association for Computing Machinery SIGCAS, Volume 20, Number 3, October, 1990, p. 70.

intuitive interface to the system and permit the use of local familiar tools, such as editors and spell-checkers.

Another way to divide responsibility between the central computer and the workstation is through a client-server model. The user's personal computer or workstation is the client or user of a set of services, and the central computer is the provider or server for the set of services. In a true client-server model, the functions and the split of responsibility are well-defined and incorporated into the client-server interface and protocol. An abstract model for a set of client-server functions can form the basis for a standard that operates independently of the implementations of the client and server.[6] Some of the first adaptations of personal computers and workstations to computer conferencing systems were merely grafted on to existing terminal-based applications. Thus there was not a redesign of the interface and protocol, but rather an attempt to develop an interface based on the existing computer-terminal interface.

The GILT project[7] was a multi-year effort at defining a protocol for communications between large centralized computerized conferencing systems. Conceptually, a number of conferencing systems, each with a localized set of users, would transfer information among themselves, and provide the appearance, of a single conferencing system spanning all the systems hat were participating. Funding for the project ended before it was implemented, however.

Netnews, as described earlier, normally employs a flooding algorithm to pass along locally-submitted news group items to other netnews sites. Delivery is deterministic, with sites accepting whatever "new" items have been submitted to groups they subscribe to. A variation on this is the Network Netnews Transfer Protocol (NNTP)[8]. This provides a mechanism for sites to request items in specific newsgroups (based on as the dates of their submission, or message id numbers, etc.). Sites can thus take a more active role in accessing netnews items. It also means that a site can decide to keep a much more limited (recent) local "store" of netnews items (based on the most frequently or likely to be accessed items). If a user requests an unavailable item, the system can use the NNTP protocol to retrieve it from some centralized (perhaps even remote) system with a larger archival store of items.

While envisioned as a protocol for communications among larger multi-users netnews machines, NNTP can also be used with personal computers or workstations to access netnews articles. For unix workstations, the windowing protocol called X-Window provides a graphical interface that allows mouse-driven cutting and pasting, as well as button and pull-down menu access to applications. An X-Window interface to netnews, called xrn, allows users to view, sort, and access newsgroup lists, subject headings, and posted articles in netnews. Powerful system features, such as subject or text searching, following and leaving discussion subject threads, and submitting follow-up items can be done with just the click of a mouse.

Several NNTP-based netnews readers exist for the Macintosh. As with xrn, the user is presented with a visual interface to the lists of groups, subject headings, and contents of the newsgroups that makes it easy to navigate and manipulate the items in the groups.

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[6]Jacob Palme, "Conferencing Standards," BYTE, December 1985, p. 197.

[7]GILT-Interconnection of Computer Based Message and Conference Systems, Green Version, (Duesseldorf: University of Duesseldorf Computing Center, Universitätsstrasse 1, 1983).

[8]Brian Kantor and Phil Lapsley, Network News Transfer Protocol, issued as Request for Comments (RFC) 977, DDN Network Information Center, February, 1986.

In both cases, the user's computer acts as an NNTP agent (client) accessing information from an NNTP server via the protocol. Because of the way the protocol operates, it is possible to have a number of different user implementations (interfaces) for netnews. The protocol deals strictly with the requests for information about items, and not with how the items are presented to or how information is requested of the user.

Evaluation of CMCS

Early reviews of CMCS's attempted to create a framework for evaluation of these systems. Among the items considered were design features, user acceptance determinants, and impacts on the users and groups. While there was disagreement about the relative importance of many of the specific features of CMCS's, there was agreement among systems designers that accessibility, humanization, responsiveness, and text-editing capabilities were extremely important.[9] In a subsequent study of productivity enhancement from CMCS's, system acceptance was seen as largely determined by external factors, such as initial user expectations. A combination of factors, including group, individual, and task characteristics, combine with the particular system software to produce (or not) a gain in productivity.[10] While these studies have provided a good theoretical framework for evaluation, they have not produced any definitive recommendations.

The *ad hoc* evaluation committee at Princeton set a number of criteria for its investigation of a CMCS. Ease of use for first time users, from navigating in the system and following discussion threads to inputting information, was viewed as extremely important. The groups felt it was important that the system be able to interact well with existing mail systems for both on and off-campus electronic mail. Searching and archival/retrieval capabilities were felt to be important as the system and its contents grew. Of lesser importance were the exact feature set (beyond those functions mentioned above), administrative and maintenance issues, and direct interaction with other conferencing systems.

Several base criteria were established for the first set of evaluations. Any system without a responsiveness comparable to the current mail systems would not be acceptable. Since it is anticipated that one of the first uses of the system will be as a tool for strategic planning and discussions, the system must support private or close conferences. The initial platform considered for the system was a SUN SPARC-based machine running the unix operating system. This avoided concerns about load on an existing and increasingly administratively-oriented VM/CMS system, allowed testing of the system on a small, locally administered SPARC workstation, and provided the potential for moving the software to a recently-acquired more powerful SPARC-based compute server.

After an initial investigation of a number of systems, three were chosen for further use and evaluation by the evaluation committee. Face-to-face meetings and the CMCS's themselves are to be used in evaluating the systems and further refining evaluation criteria as the group proceeds. Several individuals outside Computing and Information Technology will be brought in to the evaluation process after an initial several weeks and feedback on each of the systems.

The CMCS's

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[9]Elaine B. Kerr and Starr Roxanne Hiltz, Computer-Mediated Communications Systems. New York: Academic Press,1982.

[10]Starr Roxanne Hiltz, "Productivity Enhancements From Computer-Mediated Communications: A Systems Contingency Approach." Communications of the ACM, December 1988, p. 1438.

EIES2 — EIES2 is a rich, full-featured conferencing system whose interface makes some use of a VT-100 (cursor-addressable) full screen for command selection and explanation, using a Lotus123-like menu interface. The system editor is still line oriented, although some on-screen help is provided. It is possible to interact directly with the underlying unix operating system and move files, mail, etc. in and and out of EIES2 with unix-style command. An X-Windows-based interface is under development. EIES2 permits the addition of personal key words to items, provides for following conversational threads and backward-chaining for earlier items. Because of its design, the system is extremely flexible and tailorable, although programming effort would be required for system changes.

PortaCOM — Development and marketing of PortaCOM has been taken over by a spin-off group from the University of Stockholm called KOMunity. PortaCOM is a feature-rich conferencing system with well-developed tools for integrating external mail and distribution lists (both sending and receiving) into its structure. It also has powerful organizing and threading capabilities. It features both a command- and menu-based interface. A "friendly" iconic Macintosh (MacKOM) and PC-based pop-up menu front-end (VIDAKOM) are available for asynchronous connections.

Caucus — Caucus appears to be the most scaleable of the true conferencing systems. It runs efficiently on everything from a 80286-based unix personal computer to a SUN SPARC server. Several types of interfaces (abbreviated menus, full menus, and commands) provide flexibility. The system does not directly make use of full-screen terminals, although the use of any unix-based editor (including full-screen) is easily supported. With a scrollable cut and paste terminal windowing system, the system is more useable.

Following newly entered conference items and responses is easy. Finding new responses to items previously read is not as intuitive, nor is back-chaining. Conferences must be explicitly entered (and then left to enter a new conference) to find awaiting new items.

The task force is hoping to find a CMCS that adequately meets the criteria outlined earlier, and to begin to use it with a controlled test group before releasing it to administrative policy makers and to the community as a whole. We have been encouraged by developments in local personal workstation front-ends and front-end tools which can facilitate usage of these systems. We are investigating both system-specific as well as more generic abstract-model based interfaces to work with these systems. CMCS access is viewed as part of a more general goal of providing universal and seamless access to all computing resources from any platform supported on campus.

The introduction of a CMCS has the potential to have high a visibility payoff for the university computing infrastructure. Initial rejection of the system on the other hand could set back general acceptance of such a tool. It is important therefore, that the system, its interface, and its introduction to the community all be appropriate to its intended tasks and users.

Marketing Principles Extended: Creating a Statewide Network

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Fayetteville
Arkansas

The prognosticators were right! Campuses moved from islands of computing (centralized computing with star networks) to distributed computing resources. And then, the whole bunch wanted to get back together again as a network. This sequence of events has occurred on numerous campuses including the University of Arkansas. We created our University network, UARKnet, and connected to the outside world by BITNET and NSFNET. Subsequently, we discovered that we could communicate almost anywhere but within our own State! So, we did the logical thing, we decided to create a statewide higher education network in Arkansas, ARKnet!

In the summer of 1989, we started the marketing effort by recruiting computing services directors from within the University of Arkansas System to be our partners. We soon found that the marketing effort could not succeed by emphasizing the elegance of the technology. We decided ARKnet had to be done without requiring new dollars, had to add significant value to the resources of each campus, and had to include all participants as "first-class" members. Now we have formed a confederation of 19 institutions and submitted a proposal to fund ARKnet to the National Science Foundation (NSF). About half of the schools have decided to form the network core with or without NSF support because it "has to be done." In order to share the financial load, partner networks for ARKnet have been found in the research community, university extension services, and State government offices. By applying marketing principles to a network development project, we have come up with a winner! This presentation provides the details.

Marketing Principles Extended: Creating a Statewide Network

Robert E. Zimmerman, Ph.D.
Sandra M. Statham, M.B.A., C.D.P.
University of Arkansas

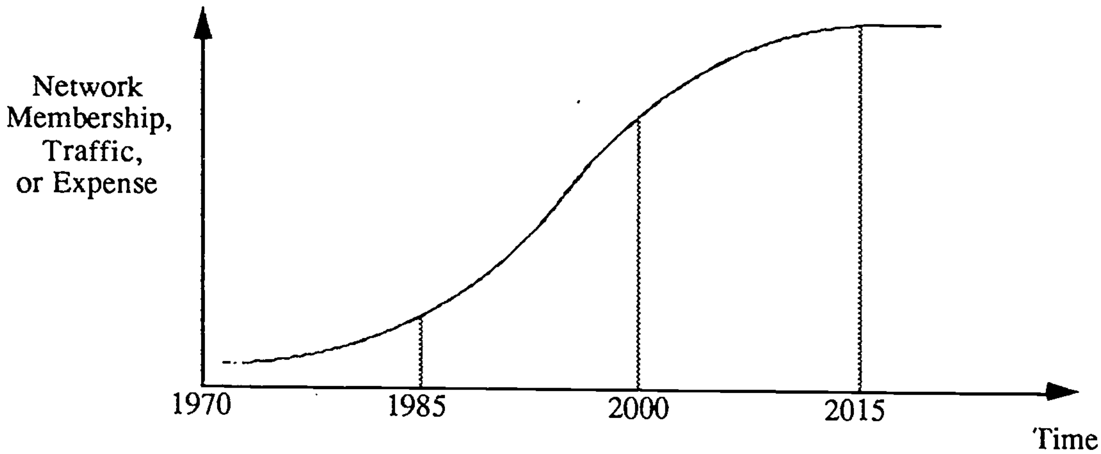
The University of Arkansas is an example of the classic model of a university. It is the State's flagship university, located in a small city, and isolated by the Ozark Mountains from the rest of the State. Our university is like many others—short on cash and long on opportunities for change through technology. Almost everyone is familiar with the Razorbacks' athletic programs. They are awesome! One of our objectives is to have an academic program that is a source of pride for the athletic program!

Several years ago, Computing Services did a painfully honest appraisal of the quality of resources offered to our clients for academic, research, and administrative applications. We really did not have much to offer, and the computer users were telling us that in numerous ways. In earlier presentations at CAUSE (Zimmerman, 1988; Statham, 1989), and in other forums, we have reported dramatic changes that occurred as a result of redirecting resources, establishing partnerships, and marketing services. In short, we installed a high-speed computer network throughout the campus and upgraded mainframe, minicomputer, and microcomputer platforms. More and better computer resources will always be needed, but we are approaching the ability to deliver appropriate resources to the site of a client's choice.

Academic and administrative computer users responded to the enhanced facilities with enthusiasm and requests for more. Use of facilities increased dramatically for computing and communications on our campus and across the nation via the Internet. There was one significant area within the United States though where we could not share resources—Arkansas! The University of Arkansas was the only National Science Foundation Network (NSFNET) connection in the State. We were isolated from the rest of Arkansas, and the rest of the State was isolated from the nation! Computing Services' managers discussed the in-state communications void, and among solutions proposed, we found an "ace that we could play." We decided to extend MIDnet, our NSFNET regional network, into Arkansas and named that project MIDARK.

Now, that might have been just a little presumptuous! We had a few barriers that we would have to get over to create a statewide network. No funding was available for the MIDARK Project. A few months earlier, University Chancellor Ferritor had told the Director of Computing Services that a statewide network was a low priority project. Other universities in Arkansas did not have campus networks and were generally not interested in a statewide network. If the other campuses had been interested in a statewide network, most would have preferred to work with almost anyone but our university! In fact, there were few examples of successful cooperative projects of any kind among universities in Arkansas! Did such a project have any chance of success? Can elephants fly? We decided to go for the MIDARK Project, and Computing Services' representatives began discussing statewide networks in informal contacts with other universities in Fall 1988. After a year of these low-profile, low-interest, and low-awareness activities, we had made little noticeable progress toward our objective. We decided to escalate our efforts and formalized our MIDARK Project to get the job done.

In order to take advantage of the work of others, our first step in getting the job done was research. We found one paradigm, shown in Figure 1, at a Coalition for Networked Information (CNI) Task Force meeting. Our MIDARK Project evolved from NSFNET, the precursor of the National Research and Education Network (NREN), and its growth fit the growth pattern projected for NREN, as a lag variable. The first stage of the paradigm was initiation which required an entrepreneurial style of management. For MIDARK, the interest and awareness activities of the first year represented that stage. Although the first year's accomplishments of MIDARK had been modest, we had found interested researchers, school districts, universities, and State or University agencies. Unfortunately, most had little if any money for statewide networking. Fortunately, Computing Services had been able to get authorization to reach out into Arkansas with a T1 connection to Little Rock. With or without partners outside the University, we made a commitment to extend our network based on only University of Arkansas needs.



STAGE	INITIATION	GROWTH	CONTROL	MATURITY
Management Style Required	Entrepreneurial	Marketing	Utility	Full Service

Figure 1. Predicting NREN Growth (Hall, 1990)

Funding the extension of UARKnet, the University of Arkansas campus network, into the middle of the State took a little creative financing and negotiation, but we got the "green light." Now, if we could get the participation of the interested parties found in stage one, the initiation period, with accompanying funding sources, we could propel MIDARK into stage two, the growth period. A "marketing" style was needed for the growth stage so we looked to marketing literature to develop appropriate strategies.

Those of you who may have had exposure to marketing concepts in the past may remember the "Four Ps": Product, Place, Price, and Promotion. In the last decade, however, marketing management has taken a new twist, emphasizing the customer or client (Neidell, 1983, p. 4). Today's marketing strategies are characterized by:

- Well-defined processes rather than random acts.
- Management process of analysis, planning, product/service development, and controlled delivery.
- Packaging products/services for targeted clients.
- Designing products for market needs/wants.

Although we now had an understanding of the modern definition of marketing, there was still some reluctance to become "sales persons," particularly considering all of the exposure each of us has had to such individuals. A little more research provided a ready answer to the question, "Why marketing now and not before?"

Many of us who have been in information technology for a number of years recognize the proliferation of the microcomputer as the starting point for having to take a new look at how we performed our day-to-day activities. While the microcomputer had a revolutionary effect on the options available to the users of information technology, larger changes were taking place in the work place which dictated a new approach for the whole service sector of our economy. Figure 2 shows the growth of the service sector in terms of United States employment since 1920. The number of people employed in the production and distribution of services has been steadily increasing since the turn of the century. Furthermore, the growth in this sector during the past 20 years has been greater than the total growth for the forty years prior to that time. Obviously, such growth should result in changes in the way we do business, and the new recognition of the role of marketing could be considered a natural change. It has been said that the recent recognition of the discipline of services marketing can be explained by the fact that marketing was not needed when "demand exceed supply and competitive pressures were few" (Bateson, 1989, p. 4). This concept describes us service providers in the field of information technology perfectly. It also answered our question.

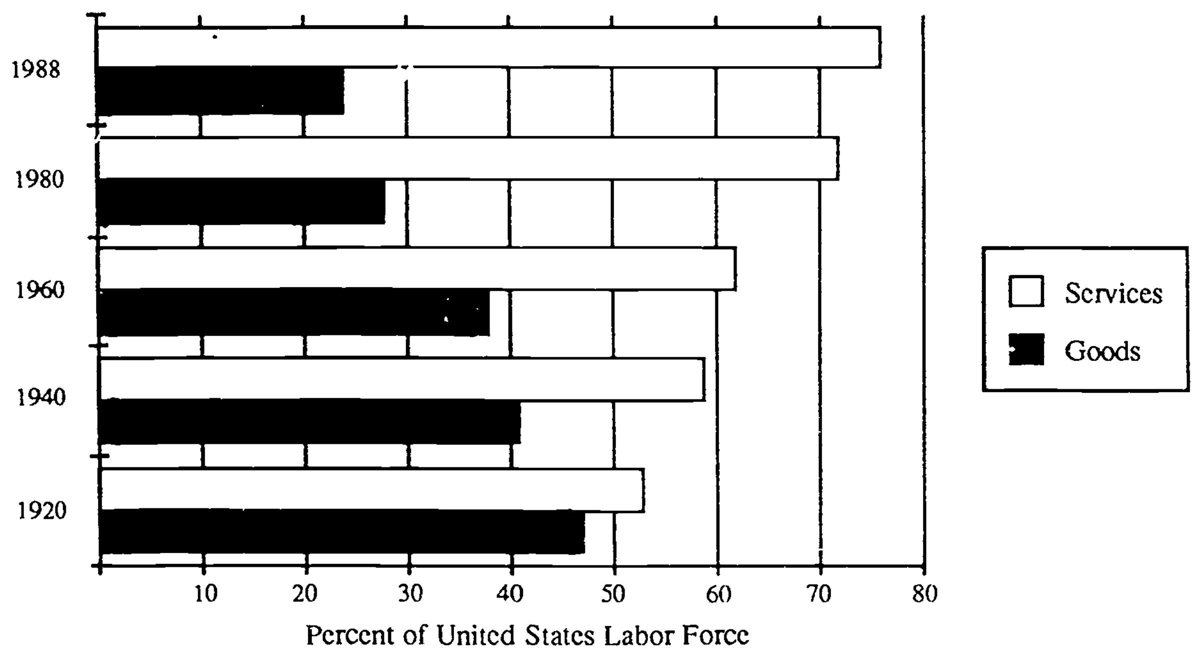


Figure 2. Growth of the United States Service Sector (Adapted from Bateson, 1989, p. 25)

Now that we appreciated the need for marketing, the next step was to find a workable model to assist us in organizing our process. Although many, often complex, models can be found in the literature, we settled on the relatively simple "Five-Stage Model for the Consumer Buying Process" shown in Figure 3. As a well-known expert in the field of marketing, Philip Kotler was telling us to put ourselves in the shoes of those on our target campuses who would be making the necessary decisions. He further helped us by defining the consumer as "the person or organization that is the target of the marketing effort" (Kotler and Fox, 1985, p. 197).

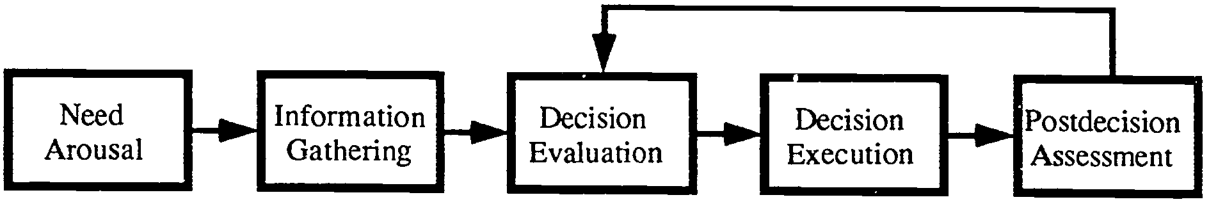


Figure 3. Five-Stage Model of the Consumer Buying Process (Kotler and Fox, 1985, p. 198)

As the marketer works his or her way through the model, the following questions must be answered:

1. What needs and wants give rise [to the consumer] to the interest in buying or consuming the program or product?
2. What does the consumer do to gather information relevant to the felt need?
3. How does the consumer evaluate the decision alternatives?
4. How does the consumer carry out the purchase?
5. How does the consumer's postpurchase experience with the program or product affect his or her subsequent attitude and behavior toward it? (Kotler and Fox, 1985, p. 198)

Since we were viewing the model as "marketers" who wanted to get our "consumers" (Arkansas's colleges and universities) involved in our "program or product" (developing a statewide network), we decided it would be easier to modify the model slightly to reflect the marketer perspective. Our result is shown in Figure 4. We needed to get the attention of Arkansas's colleges and universities so that we could educate them as to the need for access to national and international networks. Then we needed them to make a positive decision to join with us to create a statewide academic/research network. After they decided to work with us, we had to obtain the necessary funding so that we could implement the network. Finally, we would then need to evaluate the results to see if we needed to add new partners to our working group (confederation).

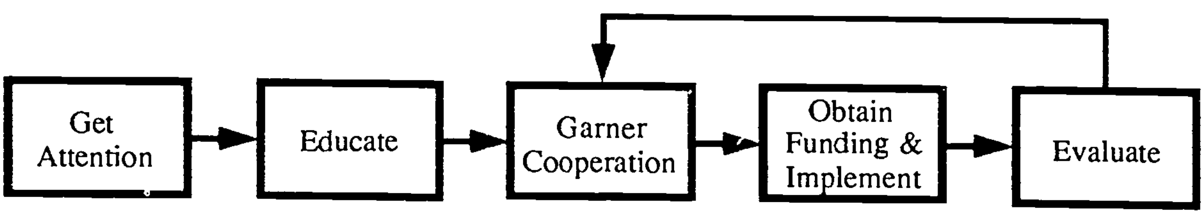


Figure 4. Modified Five-Stage Model

For our model to work, we had to have a full understanding of our potential clients. According to the experts, in order to arouse the consumer's need, the marketer must know the consumer well enough to know how to trigger his or her interest while reducing his or her feelings of risk. During the "education" stage in particular, the consumer must view the information source as creditable, yet he or she generally does not want to exert significant effort to obtain the information necessary to make the decision (Kotler and Fox, 1985, p. 211). Since our clients were also educational institutions, we were aware of some basic characteristics. An especially important consideration was the fact that many of our potential clients had had previous relationships with the University of Arkansas. Based on these experiences, our consumers desired autonomy, felt competitive (e.g., Who always got the biggest share of State appropriations?), and were suspicious of our intentions. In addition, most were not familiar with network concepts and funding was scarce everywhere.

In order to get commitments to participate in a statewide networking effort, we were also going to have tc be sensitive to the organizational structures of our potential clients. As you know, one generally does not get fast decisions in a highly bureaucratic environment where institutional governance is the watch word. Mix in a few political concerns and the acknowledged competition among institutions, and a decision could take years. We decided that funding was going to be a key issue if we were going to succeed. We would have to offer a "no cost" means of participation. When we looked at potential funding mechanisms, we realized that state appropriations would take several years to obtain due to Arkansas's budgetary cycle. Although federal funas and endowments were a possibility, we did not have ready access to the right resources to make these a reality. We finally decided that a grant would be the most accessible source of funding, and we started pursuing possible granting agencies. You can probably imagine our enthusiastic response to the NSFNET Program, "Connections to NSFNET," announced in February 1990, that allowed NSFNET to fund connections for institutions whose mission was primarily undergraduate instruction. We finally felt that we knew enough to begin to pull the whole project together.

Having sized-up our potential clients and potential strategies, we started our marketing blitz with a free seminar. We followed this with on-site visits, attendance or presentations at professional meetings, and letters to potential decision makers inviting them to more free seminars. You know—all of the strategies that we see vendors using on us! We were even devious enough to have our Vice Chancellor for Academic Affairs invite all of his peers to attend a free seminar *with* their computing center directors. Our first exposure to using the media took the form of articles in various newsletters. A natural start was our own Computing Services' newsletter, *ARKive*. Then we were able to take advantage of one of our faculty member's involvement in the Arkansas Society for Computer and Information Technology (ASCIT). This allowed us to get coverage in the *Arkansas Computer Bulletin*, a statewide newsletter. Our first opportunity for national exposure came in the form of an article in CAUSE's *Manage IT* newsletter. We eventually promoted media opportunities successfully enough to attain coverage on many of the major television stations and daily newspapers throughout Arkansas. We knew we finally had a success when the telephone started ringing off the hook with questions about "ARKnet." Before long, we even needed our own brochure!

Our marketing strategies included use of "pitches" developed to enlist client support. We adopted a slogan from an area shoe store's commercials and announced that we could "save you more than you pay" with a statewide network. We tried to work in an open atmosphere that was inclusive instead of exclusive. After a few meetings, our peer institutions recognized that we were *really* talking about a cooperative partnership that could improve productivity at each of our partner schools. We were finally able to lure 18 of Arkansas's 32 institutions of higher education to participate with us in the ARKnet Confederation and to develop a joint funding proposal for NSF.

Although we were hoping for external funding for ARKnet, we knew first hand that there would also be real costs associated with each school's participation. We also needed to be prepared to support the network after external funding expired. Based on our own experiences, we were able to document several areas where savings could be generated in order to be able to redirect funds into supporting ARKnet. Most of our participants intuitively accepted savings related to inter-library loan and communications but were skeptical of savings that might be available through a software distribution plan or through group purchase agreements.

Fortunately, one of the participating universities had already explored DEC's Campus-wide Software License Grant (CSLG) Program offered under the DEC Education Initiative and was willing to report directly to the confederation. Another university was able to attest to the group that real dollar savings were available through confederation purchase agreements. Finally, resource sharing meant that a campus' resources, whether equipment or expertise, could be expanded without actual dollar outlays.

As mentioned earlier, one of our pitches was that productivity improvements could be realized at each participating school. Most of these improvements would be based on the idea of resource sharing. Consulting services would provide valuable expertise in a timely manner through electronic mail and other forums. Although we were proposing an electronic network, a valuable by-product was the "people" network that developed first. Even our confederation meetings became an excellent mechanism for sharing knowledge. Although participants may have first considered consulting services to have come primarily from the University of Arkansas's networking expertise, it became apparent almost from the start that other campuses had valuable experience with products and architectures not available at the University. This reinforced the idea that we were really peer institutions. Training took on a similar complexion. Although the University would be providing the bulk of the training related to national connectivity, other institutions had valuable experiences that could be used to extend computing knowledge in Arkansas.

Technology sharing was a special area where productivity enhancements could be realized. Several schools in the State were in the formative stages of planning major hardware and/or software acquisitions. Many of the resources under consideration were already available elsewhere in the State. ARKnet could provide a mechanism for checking out these resources without having to invest significant scarce dollars in site visits. On a lark, we started pursuing computer vendors with ideas for how they could allow 19 schools to experiment first hand with their products. It did not take them long to realize the potential sales that might result from such an arrangement. In due time, it is expected that each ARKnet node will provide exploratory access to its unique set of resources and a world of options will be available to us all.

We convinced ourselves of the value of ARKnet and apparently quite a few others too, because we ended up with an ARKnet configuration that spans the state. We are still waiting for formal notification on our NSF grant proposal. All indications are favorable at this time, and we expect good news soon. If the NSF proposal is selected for funding, the "save you more than you pay" pitch would become reality, at least for a while. With or without NSF funding, half of the ARKnet schools have indicated their willingness to participate. Earlier in this paper, we asked the question, "Can elephants fly?" The answer appears to be "yes."

However, if ARKnet is going to be a truly successful academic/research network, we will need additional partners in the future. We have already identified, and are pursuing, a number of potential extensions for ARKnet. The Arkansas Library Association is interested in expanding their cooperative efforts through ARKnet. The University of Arkansas was recently awarded a grant to establish the National Center for Resource Innovation/Southwest, one of four such centers in the nation. This will provide us an excellent opportunity to make a contribution to the national networks via the implementation of a "GISnet." Another potential client that could enhance national resources is the National Center for Toxicological Research (NCTR) located in Jefferson, Arkansas. The University's Cooperative Extension Service, Agricultural Experiment Stations, and Engineering Research Center are all anxious to become part of ARKnet in order to solve current communication's difficulties. We have even been contacted by interested individuals, and have does some exploratory work, to investigate providing secondary (public) schools, vocational education schools, and rehabilitation services centers network access. Yes, elephants can fly! And with all of the interest that we have found in Arkansas, how about a flock of flying elephants?

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Networks Beget Networks

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The development of the North Dakota Higher Education Computer Network (NDHECN) in the mid 1970's was in response to the rapidly growing computing needs of the public post-secondary educational institutions. Because of the involvement of all these institutions, the NDHECN has contributed much more than computing services. It has promoted a sense of understanding among the campuses which has enhanced system-wide cooperative efforts including a library automation network and an interactive video network. The successful management structure of the NDHECN has been used as a role model for these other networks.

INTRODUCTION: The development of the North Dakota Higher Education Computer Network (NDHECN) in the mid 1970's was in response to the rapidly growing computing needs of the public post-secondary educational institutions. The intent was to provide equal access to mainframe services from all institutions and to develop a uniform management system for financial and student records common to all institutions. As originally planned, the network has developed to include centralized mainframe academic services. Distributed mini and micro computer services are primarily provided by the institutions. The NDHECN services include a statewide data communications network. This facilitates connections, for all institutions, to external networks such as BITNET and NorthWestNet (NWNet), a regional network connected to NSFNet.

However, because of the involvement of all institutions, the NDHECN has contributed much more than computing services. It has promoted a sense of understanding among the campuses which has enhanced system-wide cooperative efforts including a library automation network and an interactive video network. The successful management structure of the NDHECN has been used as a role model for these other networks.

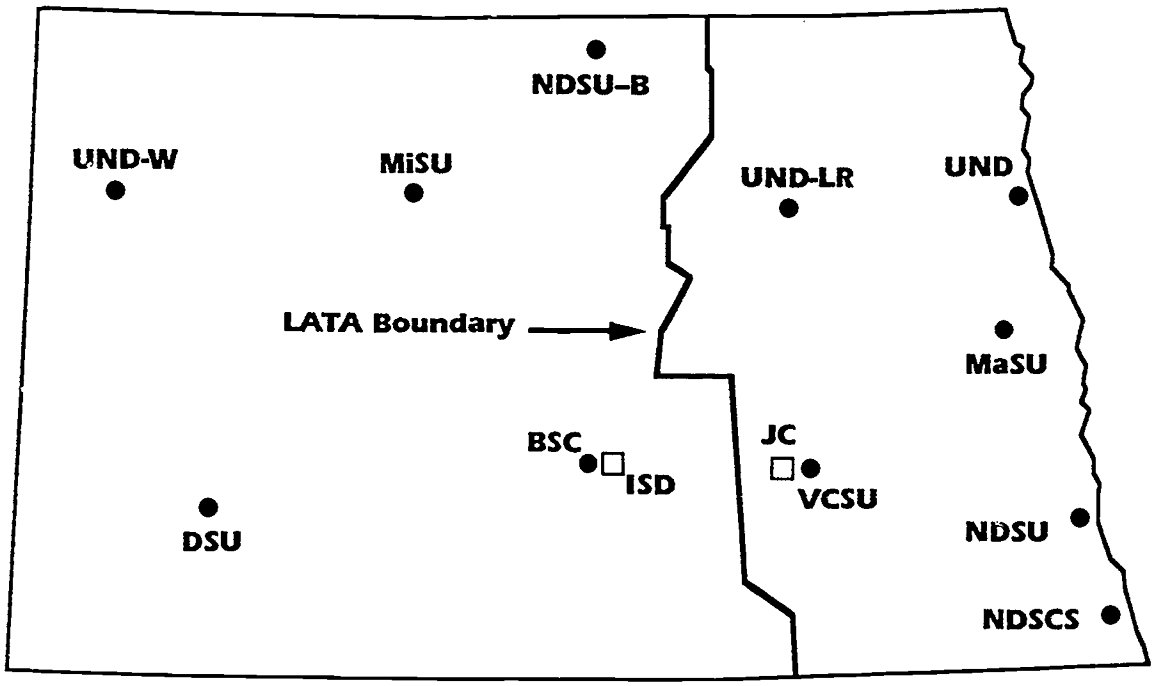
Finally, of considerable importance, the NDHECN staff includes programmer/analysts to provide software development and support for uniform financial and student records systems. These systems not only serve the individual institutions but provide a uniform reporting system to the higher education governing board, the North Dakota State Board of Higher Education (NDSBHE). The uniform systems report comparable institutional data which assists this board's involvement in the legislative process.

OVERVIEW: The activities and services described herein will be more meaningful with a brief description of the setting in which they take place.

North Dakota is a very rural state. Its 653,000 inhabitants occupy a geographical area approximately 350 miles east-to-west by 200 miles north-to-south. State public higher education services are centered on the eleven campuses of eight institutions. There are five two-year campuses, three four-year campuses, one masters level campus, and two doctoral level campuses. Both doctoral level campuses, North Dakota State University and the University of North Dakota, are located on the eastern border. These eleven campuses form the North Dakota University System (NDUS). The locations of the campuses are shown in Figure 1. Also included are two other nodal sites serving the NDHECN.

Total enrollment in the NDUS is 33,754 ranging from 450 at North Dakota State University - Bottineau to 11,885 at the University of North Dakota. The NDUS has 2,060 FTE faculty and research professionals. Grant/contract activity at the doctoral institutions totals in excess of $50 million annually.

NODAL Sites Serving the NDHECN



● NDUS Institutions		Level	Location
BSC	Bismarck State College	2 year	Bismarck
DSU	Dickinson State University	4 year	Dickinson
MaSU	Mayville State University	4 year	Mayville
MiSU	Minot State University	masters	Minot
NDSCS	North Dakota State College of Science	2 year	Wahpeton
NDSU	North Dakota State University	doctoral	Fargo
NDSU-B	NDSU - Bottineau	2 year	Bottineau
UND	University of North Dakota	doctoral	Grand Forks
UND-LR	UND - Lake Region	2 year	Devils Lake
UND-W	UND - Williston	2 year	Williston
VCSU	Valley City State University	4 year	Valley City

□ Other Facilities/Institutions		Purpose	Location
ISD	Information Systems Division	State government computing and communications	Bismarck
JC	Jamestown College	4 year private college	Jamestown

FIGURE 1

THE COMPUTER NETWORK: The requirements for computing services grew rapidly following the installation of computers at NDSU and UND in 1961. This growth was accompanied by escalating funding requirements for the new service. As a result, the governing board, i.e. the NDSBHE, imposed a "freeze" on computer acquisitions to provide time for a thoughtful study. The freeze occurred in the later 1960's and early 1970's during which time there were several studies (with varying conclusions). There emerged a consensus for centralized computing services. Then, in 1973, the institutions at Dickinson and Valley City were networked to the UND computer. This was followed by a more specific plan to have two central sites. The University of North Dakota was to network with all institutions to provide administrative services and, on a temporary basis, academic services. North Dakota State University was to further develop the network and eventually provide statewide academic services.

By 1978 the project managers for the Uniform Accounting System (later to become the Uniform Financial System) and the Uniform Student Record System had been appointed as had the first NDSBHE designated Director of Computer Services. Thus emerged an identifiable NDHECN. The network became "whole" in 1979 when NDSU became the academic host site with UND retaining administrative host site responsibilities.

To this day the network remains co-hosted by NDSU and UND for communication and centralized mainframe services. This arrangement has provided each NDUS institution convenient access to BITNET (1985) and NWNet (1987). Also in 1987 the NDHECN together with the state government communications/computer Information Systems Division (ISD) developed an in-state communications network linking all eleven campuses, ISD, and numerous state, county, and local government offices. This cooperative effort resulted in a network called the North Dakota Information Network (NDIN). NDIN node cities which also service the NDHECN are shown in Figure 1. NDIN made possible more convenient electronic data transfer between the NDUS institutions and ISD. Current planning efforts are directed toward enhancing NDIN with TCP/IP. Because ISD is also responsible for state government voice communications it is anticipated that within a year or two both NDUS data and voice communications will be a part of NDIN.

A Fall 1989 snapshot of the NDHECN would reveal the following statistics: 2 mainframe computers (IBM 3090-200Es, one with one vector facility), 50 minicomputers and 4,775 microcomputers (3,115 academic, 1,468 administrative, and 192 combined). Combined mainframe usage was 28.8% administrative, 21.8% instruction, 49.0% research, and .4% other.

The management structure for the NDHECN is shown in Figure 2. Descriptive functional titles of advisory committees are used in place of actual titles to more clearly indicate the responsibilities to the NDHECN. As illustrated in Figure 2, the NDHECN is the responsibility of the system Vice Chancellor for Administration who also serves as Director of the NDHECN. Not illustrated is the dual reporting responsibility of the computer center directors at the two co-hosts. Both directors are responsible to the Director of the NDHECN and each reports to a vice president at their respective institution. This dual role has significantly contributed to the success of the network.

Both co-host computer center directors are members of the Executive Committee as are the project directors for the uniform financial and student record systems, and the manager of NDHECN academic user services. The committee is chaired by the Director of the NDHECN. In addition to on going management responsibility for the NDHECN, this committee forms the core of a larger, more diverse, statewide committee which is formed by the Director of the NDHECN every two years to recommend a biennial plan for network services and the related budget. It is this plan which is used by the NDSBHE to form and support the legislative funding request for the NDHECN.

THE LIBRARY NETWORK: Campus library automation services were recommended in a 1983 UND strategic academic computing plan developed at the request of the university president. Upon acceptance of the plan, campus planning activity for library automation increased significantly with a focus to determine the most appropriate automation system and to identify the required funding.

Simultaneous efforts, largely initiated by the North Dakota State Library, were underway to plan for library automation to potentially serve all libraries in North Dakota. The North Dakota State Director of Institutions, to whom the State Library is responsible, and the UND Vice President for Academic Affairs were Executive Sponsors for an IBM Application Transfer Team which assisted a select statewide committee to study library automation needs in North Dakota. This team interviewed over 50 librarians from 40 libraries of various types (academic, public, school, and special). In November, 1985, the team issued an extensive report which was used as a basis for a funding request from the legislature. Economic conditions within the state were a major factor in unsuccessful attempts to obtain the required funding from the 1987 and 1989 Legislatures.

In addition to the aforementioned planning efforts, the NDHECN strategic planning documents of 1986 and 1988 identified the need for the NDHECN to enhance its statewide communications network to prepare for network communication services supporting library automation.

NDHECN ORGANIZATION

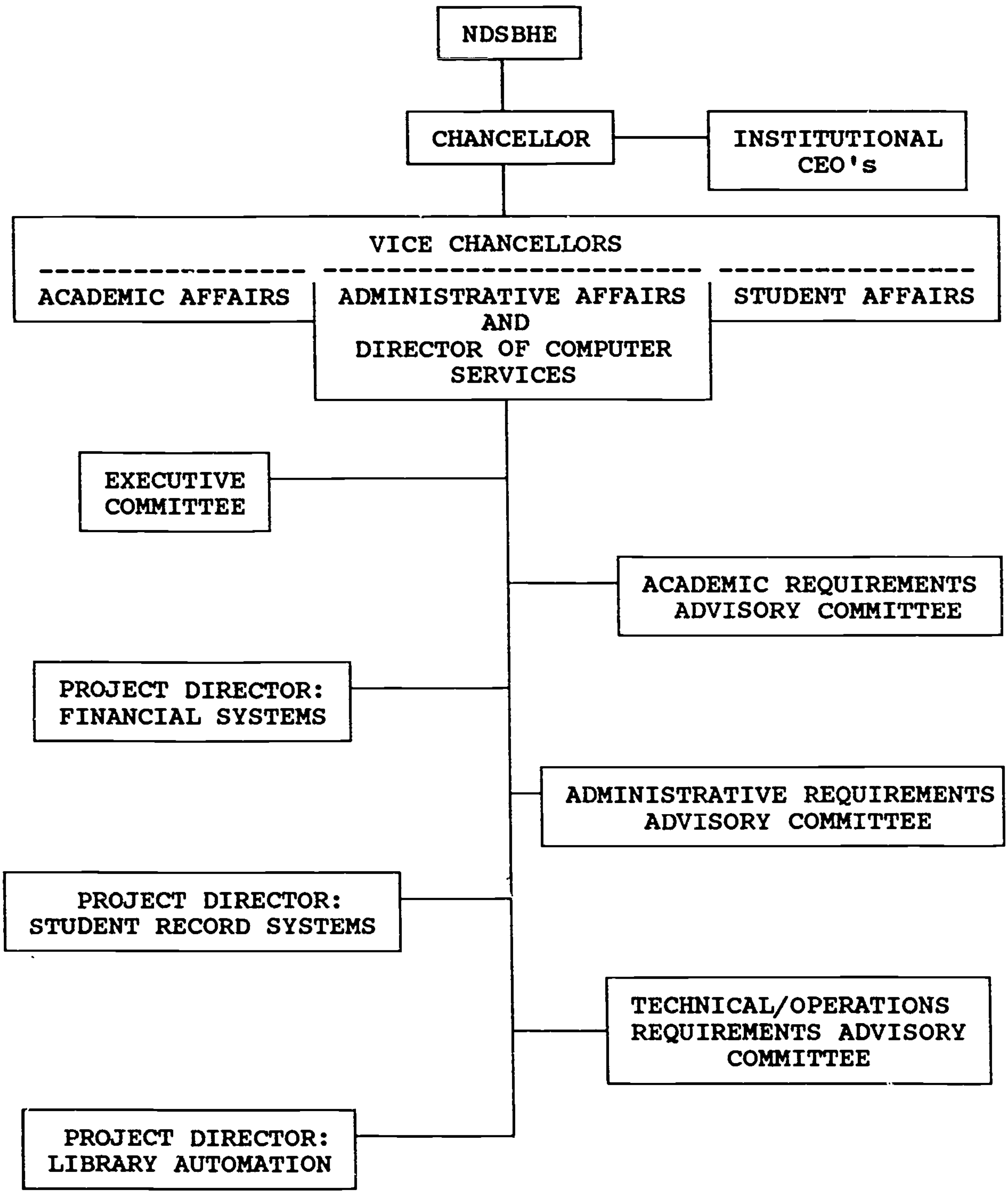


FIGURE 2

With these extensive planning efforts it was inevitable that once funding was available implementation of a library automation system would rapidly follow. So it was! The determination in early 1988 that gift funds recently received by UND could be used for a library automation project was rapidly followed by the preparation of a request-for-proposal for an automation system. During preparation of the RFP the Director of the NDHECN requested UND to include in the RFP, as an option, an automation system configuration that would eventually serve all the system institutions except NDSU and its branch campus NDSU-B. The exclusion of NDSU was because NDSU already received library automation support from the Minnesota State University System (MSUS) by virtue of membership in the Tri-College University. The Tri-College University is a consortium consisting of NDSU in Fargo, ND and two institutions, Moorhead State University and Concordia College, located in adjacent Moorhead, MN. The MSUS uses the PALS (Project for Automated Library Services) software developed at one of the MSUS institutions, Mankato State University.

In June, 1988 the NDUS decided to implement a library automation network. The fact that PALS was being used by MSUS to serve a forty-seven member library consortium and was being installed to support the South Dakota Library Network was a significant factor in the NDUS choice of the PALS software. With this choice it became technically possible to link the library networks in Minnesota, and North and South Dakota. Because of this possibility (presently becoming a reality), NDSU chose to remain a member of the MSUS library network.

Installation of a UNISYS 2200/202 computer system occurred in early 1989 at the UND Computer Center. Initially, the network was to support all libraries at seven of the eleven NDUS institutions. NDSU and its branch NDSU-B and the UND branches UND-LR and UND-W were not included. Eventually UND-LR and UND-W will become participants.

The seven founding institutions had collective holdings of 844,000 records, 1,006,000 titles, 1,272,000 volumes, and an annual circulation of 411,000. To serve these libraries, the initial configuration costs were $670,000 for host site hardware/software and site preparation, $264,000 for workstations/terminals/printers and $120,000 at the remote campuses for communication equipment. These costs do not include data transmission which, because of NDHECN strategic planning efforts, is provided by the NDHECN.

At the time of installation, there were twenty-one OCLC libraries in North Dakota that were not utilizing the type of services being provided by the UNISYS 2200/202 installation. As the library network developed it became attractive to libraries in addition to those at the founding seven institutions. All but two of the twenty-one OCLC libraries are located in a city in which there is also located a public higher education institution. Fortunately, the NDHECN though its NDIN affiliation has data/voice access to numerous cities not served by the NDHECN. One such city, Jamestown, is the home of a private college. Jamestown College together with public libraries in Fargo and Grand Forks, the North Dakota State Library in Bismarck, and the founding seven institutions presently form the library automation network. In recognition of the centrality of a library to the purposes of educational institutions, the network has been named ODIN after the chief and wisest god of Norse mythology.

Convenient access to a state-based data communication system is a primary asset permitting the UND-based PALS system to provide an affordable service to more libraries than the founding seven. For this reason, and the service commitments of public higher education institutions, the NDHECN governance structure of the library automation project has established guidelines to provide automation services to other categories of libraries (private academic, public, state agency, etc.). The governance structure fits within the NDHECN by having a project director reporting to the Director of the NDHECN as shown in Figure 2. The project director in turn has an advisory council consisting of one member from each NDUS participating institution, one member from the NDSU library, one member from the ND State Library, and two representatives from the non-NDSBHE participating libraries. The rationale for the organizational structure is the recognition that the project is a NDHECN service which will also provide "service bureau" type contractual services to those libraries interested in participation. The service bureau activity has thus far required an upgrade to a UNISYS 2200/401 including an increase of approximately fifty percent disk storage. It is a goal of the automation project to utilize networks and dial-in services to provide direct citizen access to the library databases.

THE INTERACTIVE VIDEO NETWORK: The NDUS implemented an interactive video network (two-way audio, two-way video) on six campuses for the Fall 1990 term. By January 1, 1991 ten of the campuses will be serviced by this network. At present NDSU-B is not planning a connection to this network.

Although the North Dakota Interactive Video Network (NDIVN) is not a part of the NDHECN, the management structure of NDIVN is similar to that of the NDHECN. In fact, initially NDIVN was the responsibility of the NDUS Vice Chancellor for Administration, i.e., the same person who is Director of the NDHECN. However, once the network was technologically configured and installed, the primary concerns of NDIVN changed from technology to academic programming. As a result, NDIVN became the responsibility of the Vice Chancellor for Academic Affairs.

The development of NDIVN was partially enabled when the 1989 State Legislature appropriated $700,000 to the NDUS for the establishment of a video network. There were also other groups interested in video networks to serve their needs. One such state agency, the Department of Public Instruction, also received funding to continue the development of video networks for K-12 schools. To insure the various interest groups developed compatible networks the legislature established an eleven member Educational Telecommunications Council (ETC) with its own funding and a charge to encourage and direct the creation of educational telecommunications programs and systems within the state. The ETC contracted for professional engineering and consulting services to develop a statewide plan for needed telecommunications services.

The consultant's report of April, 1990 included a far-reaching recommendation that a statewide telecommunication network should include both computing and video services for K-12, postsecondary and lifelong learning activities. The suggested computing services would preferably be delivered by an extended NDHECN. Toward that end, the NDHECN and NDIN are presently planning an enhancement which would begin to address the needs identified in the consultant's report. Similarly, the NDUS and local consortia of school districts are implementing and planning for interactive video networks.

The implementation of NDIVN will connect the campuses in the west lata shown in Figure 1 to a Digital Access Cross-connect Switch (DACS) and Multipoint Control Unit (MCU) located in Bismarck. The campuses in the east lata are similarly connected to a DACS/MCU in Fargo. The two DACS/MCU units are then connected with two T1 lines. With the installation of a "cascading" feature, which enables the two MCU's to act as one, up to seven of the eastern sites (both NDSU and UND have two video classrooms making eight eastern sites) and all four western sites (NDSU-B excluded) can be connected in one interactive conference using only one of the T1 lines connecting the DACS/MCU units.

The equipment to implement the NDIVN double star network totals approximately $1.1 million. In addition to legislative appropriations, a portion of this expenditure and related operating expenditures will come from a United States Department of Agriculture grant to NDSU and UND. The grant to the NDSU Extension Service Center for Rural Revitalization and the UND Center for Rural Health Services, Policy and Research is for the development of a model program to utilize telecommunications to expand health and social science education outreach programs in a rural area. The governing board of the rural health project worked cooperatively with the governance structure of NDIVN to plan, implement, and now operate NDIVN.

As a result of the rural health project, in the Fall 1990 term UND began to deliver undergraduate course work in medical technology, nursing, and social work to video classrooms at DSU, VCSU, UND-LR, and UND-W. To do this required the NDUS to consider not only technological issues but other complex financial and academic issues such as student financial aid, which institution (the sending or the receiving campus) retains tuition, and which institution maintains the students' academic records. The fact that the NDUS has uniform financial and student record systems will facilitate the resolution of these issues.

SUMMARY: The development of the NDHECN has been accompanied by an increased sense of understanding and cooperation among the eleven NDUS campuses. The existence, experience, and strategic planning activities of the NDHECN have facilitated membership in NorthWestNet and guided and enabled ODIN. Presently ODIN has three modules operational (on-line public access catalog, circulation, and interlibrary loan) and is on schedule for implementation of the other modules and for connection to other states. The management structure is now reviewing the operational guidelines to better serve additional libraries. NDIVN, the newest network, is yet evolving both technologically and policywise.

An extensive multiyear statewide study has identified needs to be addressed for North Dakota to better support economic development efforts and to secure the economy of the state. A statewide telecommunications network is one of the identified needs. The North Dakota University System through the NDHECN, ODIN, and NDIVN is a major contributor to such a network.

Networking in Residence Halls: Participation and Impact

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Abstract

The Residence Halls Computing Program (ResComp), jointly funded by the Housing Division and the Information Technology Division at The University of Michigan, loans Apple Macintosh computers to all student resident staff. Being connected to the campus computing network, these approximately 300 staff in 16 residence halls are required to use electronic mail and conferencing in their jobs and are encouraged to use these networking resources in their academic work and personal tasks. A pilot computer loan program in 1985-86 and extensive monitoring during the past three years of the program have demonstrated the validity of the assumption that electronic communication facilitates the work of resident staff. This paper shares experiences and findings from this program and provides insight into a) how resident staff use networking and b) the academic and personal impacts of networking on resident staff and the students living in their residence halls.

Networking in Residence Halls: Participation and Impact

Philosophy and Assumptions

The University of Michigan is committed to ensuring that students have a firm understanding of the application of technology to levels that guarantee both academic and professional success. To this end, the Residence Halls Computing Program, ResComp, was created in 1985 through the collaboration of the Information Technology and Housing Divisions. The primary goal of ResComp is to provide computer education and consulting services to approximately 10,000 students living in the residence halls. Non-credit computing classes, taught by paraprofessional staff, allow for flexibility in the implementation of a wide-ranging curriculum that closely reflects the changing technology and the academic demands of the students. In addition, the use of paraprofessional staff provides excellent leadership opportunities for students interested in pursuing such careers as teaching and management.

A comprehensive research program operates in parallel with these services. The research program regularly evaluates the delivery of service; monitors changing skill levels, needs and expectations of the students; and studies the influence of electronic communication on a subsample of the residence hall community: the resident staff.

The purpose of this paper is to summarize the findings regarding the impact and influence of networking in general, and electronic communication in particular, on how the resident staff fulfill the responsibilities of their position and how networking has enhanced the development of the living-learning environment of the residence halls.

Setting and Resources

The resident staff are a group of over 300 graduate and undergraduate paraprofessionals, whose major responsibility is to foster an environment that facilitates the social, academic and cultural development of residence hall students. Resident staff work in such capacities as Resident Advisors, Resident Fellows, Resident Directors, Minority Peer Advisors, ResComp Trainers and Head Librarians.

Since September, 1987, the University of Michigan and Apple Computer, Inc. have been in a partnership that provides each resident staff room with a networked Macintosh and communications software. Each Macintosh is connected to the campus network, UMnet, which gateways not only to Merit, a network consisting of several colleges and universities in the state of Michigan, but also the Internet, the international computer network. In addition, resident staff have access to additional software including word processing, graphics, spreadsheets and HyperCard™. Since January, 1990, the resident staff of one particular residence hall, South Quadrangle, have had access to an AppleShare™ server.

The reason for placing networked Macintoshes in resident staff rooms is rooted in the philosophy that in general, resident staff are critical role models to students as they pursue an undergraduate degree. By equipping each resident staff member with a networked computer, residence hall students have an opportunity to interact with resident staff and learn the importance of using networks as an aid in academic efforts by accessing databases, as a way to develop projects through collaboration over networks, and as a means of communication with faculty, staff and other students. In addition, students observe resident staff actively engaging in electronic communication as a means of fulfilling the responsibilities of their position.

Electronic communication over UMnet occurs by use of 1) an electronic mail application known as the MTS (Michigan Terminal System) $Messagesystem, and 2) conferencing software entitled Confer II™ by Advertel Communications. The $Messagesystem, like many electronic mail applications, is used to send a message to one or more recipients with an option to reply to one or more individuals. The responses to a message are private in that only the designated recipients may see the message. The $Messagesystem is generally used in non-real time but some options allow for real-time exchange of private communication. Confer II™ allows for non-real time electronic communication that may be viewed and responded to by any participating member of the electronic conference. Thus, electronic conferencing is best-suited for discussions involving a group of participants. Conferences may be designated as private (restricted membership) or public (open membership). In addition to electronic messaging and conferencing, resident staff have access to databases such as MIRLYN, an online library research tool that allows searches for books and periodicals by title, author and keywords; UM-CIC, a database that provides information regarding special events on campus and throughout the Ann Arbor area; and UM-CRISPINFO, an online course guide that features the current status of course availability.

In order to guarantee consistent implementation of the resident staff Macintosh loan program, each resident staff member is contractually obligated to fulfill several requirements. These requirements include 1) signing on once a day to send and retrieve messages, 2) participating in private staff conferences for their designated staff group, 3) completing research and evaluation questionnaires, and, in some cases, 4) participating in interviews and completing communication logs. During the summer preceding their term of employment, each resident staff member completes a questionnaire, entitled "Computer Experiences Questionnaire," that is designed to assess their interests and skill in using technology. From this questionnaire, a wide range of classes is designed and corresponding documentation is created to meet the needs of the incoming staff. These classes occur during the week preceding the start of the academic year and oftentimes continue throughout the year at the request of the staff group. In special cases such as the AppleShare™ network in South Quadrangle, resident staff receive additional training in accessing the network to share graphics used to advertise residence hall programs and to prepare monthly reports that summarize programmatic activity in the residence hall.

Evaluation of the Impact of Computer Networking

Data Collection

The research and evaluation component of ResComp has been systematically assessing computing experiences, expectations, and attitudes of entering freshmen and resident staff since the 1985 fall term. Since that time three entering freshmen classes (85, 86, and 87) have responded to a paper-pencil questionnaire, entitle "the Freshman Questionnaire," and three entering freshmen classes (88, 89, and 90) have responded to the same questionnaire in an online form. The first four freshmen classes to experience ResComp were again surveyed, with a paper-pencil questionnaire, entitled "the Freshman Follow-Up Questionnaire," at the end of the 1989 winter term, when the first four classes were, respectively, freshmen, sophomores, juniors, and seniors. Data from Resident Staff are more extensive. In the first two years of the loan program (87-88 and 88-89), staff responded to two online questionnaires, one in November and one in March. In the third year of the loan program, the online questionnaire was administered only in January (1990). At the end of the 1990 winter term, interviews with staff from six buildings were conducted to maximize qualitative information about the efficacy of the program. Table 1 presents a summary of the ResComp data sets.

Table 1.--ResComp Data Sets

Academic Year	Student Data	Resident Staff Data
1985-86	Freshman Questionnaire	
1986-87	Freshman Questionnaire*	
1987-88	Freshman Questionnaire*	Computer Experiences Questionnaire November Online Questionnaire March Online Questionnaire
1988-89	Freshman Questionnaire	Computer Experiences Questionnaire November Online Questionnaire
	Freshman Follow-Up Questionnaire*	March Online Questionnaire
1989-90	Freshman Questionnaire	Computer Experiences Questionnaire January Online Questionnaire* March Interviews*

* Used in this report.

The data presented in this paper to assess the impact of networking on resident staff come from the following data collection points:

- the January, 1990, Resident Staff Online Questionnaire. This questionnaire included both structured and free-response questions about how the loan computers were being used and the effects of the program.
- the winter term, 1990, staff interviews. These data provide specific examples of how the loan computers were used and the effects of the program.
- the 1986 and 1987 freshman questionnaires. The majority of the January, 1990, staff were freshmen when these two questionnaires were administered. These responses, then, serve as baseline data to evaluate the staff responses in January, 1990.
- the winter, 1989, follow-up questionnaires. The responses from these questionnaires come from students who were not staff and thus provide a direct basis for assessing program effects.

Impact on Resident Staff Work

As part of the loan program, staff were required to access the $Messagesystem once each day. For the most part, the staff exceeded this requirement. As is evident in Table 2, about seventy percent of the staff used the loan computers at least one hour a day; nearly sixty percent signed on to the $Messagesystem at least twice a day. Only eight percent used the $Messagesystem less than required by the terms of the contract.

Table 2.--Daily Computer and $Messagesystem Use by Resident Staff in the 1989-90 Academic Year, N=290

Daily Computer Usage	Percentage	Daily Use of $Messagesystem	Percentage
More than 4 hours a day	4.1%	More than 2 times a day	20.3%
From 2 to 4 hours a day	18.3	Twice a day	38.3
From 1 to 2 hours a day	47.2	Once a day	33.1
Less than 1 hour a day	29.0	Less than once a day	8.3

Use of the $Messagesystem correlated significantly with attitude towards using computers for communication. The more frequently the $Messagesystem was used, the stronger the agreement with the statement, "Computers help me communicate with others." This relationship (chi square = 27.25, p = .0001) is illustrated in Table 3. Staff usage of the $Messagesystem went beyond minimum requirements of the computer loan program; usage was seen as having significant value.

Table 3.--Relationship between $Messagesystem Use and Attitude towards Communication by Computer, Resident Staff in the 1989-90 Academic Year

	"Computers Help Me Communicate with Others"		
Daily Use of $Messagesystem	Strongly Agree, N=95	Agree, N=133	Undecided, Disagree, Strongly Disagree, N=60
More than twice a day	31.6%	17.3%	10.0%
Twice a day	43.2	40.6	25.0
Once a day	20.0	33.8	51.7
Less than once a day	5.3	8.3	13.3

With respect to specifically work-related usage, the $Messagesystem and/or the conferencing system were used by a strong majority of resident staff to make appointments or plans with other staff (94%) and to communicate with their building directors (88%). Slightly less than half used computer communication to discuss confidential matters with staff (46%). The percentage distributions of computer communication for these three staff work usages are presented in Table 4. Almost no one used conferencing alone as a communication tool. The $Messagesystem alone was most frequently used to communicate with their supervisors, the Building Directors, generally a direct, one-to-one type of communication. Both conferencing and the $Messagesystem were used for making plans with other staff. These communications can be one-to-one or one-to-many, which suggests that small groups as well as large groups of staff may make plans via computer communications. The $Messagesystem was the method of choice for the minority who would use computer communication for discussing confidential matters.

In the interviews, the staff of one building presented a very vivid example of how the $Messagesystem was invaluable during a building-wide crisis. This particular hall experienced a "food poisoning" scare, which turned out to be a virus. During the crisis, the $Messagesystem was used to pass accurate information quickly between building director and staff without having to take precious time to type, copy, and distribute paper memos. Not only did the $Messagesystem provide immediate access to needed information, it also helped curb rumors and put misinformation into check. The value of being on a network was further emphasized by the fact that the epidemiologist assigned to the case was not part of the network. The staff felt that communication would have been even better had this person also been a participant on the network.

Table 4--Resident Staff Usage of the $Messagesystem and Confer for Work-related Tasks

Usage	Making Plans with Other Staff	Communicating with Building Director	Discussing Confidential Matters
Just $Messagesystem	39.2%	60.8%	33.7%
Both $Messagesystem and Confer	52.1	25.5	9.5
Just Confer	2.4	2.1	2.5
Neither	6.3	11.5	54.4

In residence halls other than South Quadrangle, the staff expressed a strong need for additional software, especially graphics and drawing programs, to help them in their work and suggested that this software be available on a network if it were too expensive to provide separate disks for each staff member. Thus the staff are showing a sophisticated knowledge of what computers should be able to do for them. This is in contrast to common findings in computing needs assessment that respondents are not sure of the value and use of a network.

Staff also would like to have all of the paper work required for the position available on the network. Staff groups have demonstrated a great deal of initiative in this area and are experimenting with this in terms of forms and schedules.

Impact on Academic Work

Because the majority of the resident staff are juniors and seniors, it is instructive to use the junior and senior responses from the Winter, 1989, follow-up study to compare $Messagesystem usage. Through the computer loan program, the resident staff had extremely convenient access to computing. Juniors and seniors from the student body at-large may or may not have such ready access to computers. Any differences between staff and students at-large may be attributed in part to improved computer access. There was indeed a very large difference between the two groups with respect to percentage using the $Messagesystem to communicate with faculty. Sixty-nine percent of the resident staff, while only thirty-two percent of the juniors and seniors in the follow-up study, used computers this way. Ready access to a network increases the probability that students will use its capabilities to communicate with faculty.

Another way to determine the impact of computer communication upon academic life is to compare freshman expectations with actual staff outcomes. Entering freshmen in 1986 and 1987, when the majority of the winter, 1990, resident staff were freshmen, responded to a series of questions that asked what was the likelihood that they would use electronic communication in various ways. The online questionnaire taken by staff in January, 1990, asked if the staff had used electronic communication in these same, or similar, ways. The freshman-staff academic usage comparisons are presented in Table 5.

About half of the freshmen respondents thought it was likely that they would use electronic communication to make appointments with faculty or to ask questions of faculty. Fifty-two percent thought they would use electronic communication to discuss course work with classmates. In the resident staff sample, seventy-two percent actually communicated with faculty on the computer, while fifty-five percent used the computer to discuss course work with classmates. Communication with faculty occurred more frequently than expected, while communication with classmates was just about as expected from freshman responses. The pattern of resident staff communication for academic reasons was similar to the pattern for employment reasons. The $Messagesystem was the method of choice for communicating with faculty and building directors. Communication with peers (classmates and other staff) was, however, also accomplished via the conferencing system. Faculty are more likely than students to have ready access to computers, which may account for higher than expected communication with faculty.

Table 5.--Resident Staff Usage of the $Messagesystem and Confer for Academic Purposes Compared with Freshman Expectations for Using Electronic Communication for Academic Purposes

Response Group	Percent Who Would/Did Communicate with Faculty	Percent Who Would/Did Discuss Course Work with Classmates
Freshmen Likelihood	50.5%	52.0%
Staff Using Just $Messagesystem	53.0%	25.8%
Staff Using Both $Messagesystem and Confer	15.5	25.1
Staff Using Just Confer	3.2	3.9
Staff Using Neither	28.3	45.2

UM-CRISPINFO, the University of Michigan online course guide, was new in the academic year 1989-90. It took little time for CRISP to become exceedingly popular with both resident staff and the students in their halls. CRISP was frequently mentioned during the staff interviews and in the free comments sections of the online questionnaire as being an exceptionally useful database. Staff indicated that student traffic in and out of their rooms during registration periods was heavy. Staff and their students even developed strategies for using CRISP to its best advantage to learn quickly when spaces in popular courses became available through "drops."

Staff also expressed a deep appreciation of having the card catalog available online (MIRLYN). This database was a great time saver as well as an aid to doing more thorough research.

Word processing was, as expected, the most widely used application for academic purposes. Although word processing software was not networked except at South Quadrangle, the staff expressed a strong need for networked printers for their staff groups. Having machines without hard drives also emphasized to the staff the strong need for networked software to eliminate the necessity of multiple disk-swapping in using some of the larger applications. The expression of these needs again shows the appreciation the resident staff have gained for the value of computer networking.

Impact on Personal Life

A parallel question dealing with communication with friends was included in the Winter, 1989, follow-up study as well as on the staff online questionnaire in January,

1990. Again a very large difference between the two groups with respect to percentage using the $Messagesystem was found. Eighty-seven percent of the resident staff, while only forty-eight percent of the juniors and seniors in the follow-up study, used computers to communicate with friends. Ready access to a network increases the probability that students will use its capabilities to communicate with friends.

The 1986 and 1987 freshman questionnaires contained several questions about using computers to communicate with friends. Similar questions were again asked in the January, 1990, online questionnaire. The comparisons between freshman and resident staff personal usage are presented in Table 6. More staff used electronic communication with friends that was expected from freshmen responses. The combination of the $Messagesystem and Confer was slightly more useful for making friends than for just communicating with them. Conferencing lends itself to personal expression which provides opportunity for getting to know one another.

Table 6.--Resident Staff Usage of the $Messagesystem and Confer for Personal Purposes Compared with Freshman Expectations for Using Electronic Communication for Personal Purposes

Response Group	Percent Who Would/Did Communicate with Friends	Percent Who Would/Did Make New Friends
Freshmen Likelihood	39.0%	44.0%
Staff Using Just $Messagesystem	58.2%	41.4%
Staff Using Both $Messagesystem and Confer	28.8	37.2
Staff Using Just Confer	2.5	7.7
Staff Using Neither	10.5	13.7

Tables 7 and 8 report the distributions for using electronic communication for giving and receiving advice. Personal advice is presented in Table 7, and computing advice is presented in Table 8. In the freshman questionnaires, giving/receiving was written into one item instead of two separate items as was done in the January, 1990, online questionnaire. The staff percentages for giving and receiving personal advice were much higher than expected. Incoming freshmen do not expect to use the computer for discussing personal matters, but, as resident staff, upperclassmen seem to be comfortable in using the computer to discuss personal matters. The uses of the $Messagesystem and Confer were very similar for both giving and receiving personal advice. As for computing, fewer gave than received advice, but the percentage who received computing advice was just about what would have been expected from the freshman responses.

Only thirty percent of the freshmen in 1986 and 1987 thought it was likely that they would use electronic communication to discuss political and other current issues. However, in January, 1990, eighty-seven percent of the resident staff had used electronic communication this way. The freshmen thought it was more likely that they would use electronic communication to learn about events on campus (76%) or about programs and services (83%). As for the resident staff in January, 1990, eighty-four percent had used their computers to learn about events, programs, and services, which is a very close match to freshman expectations.

Table 7.--Resident Staff Usage of the $Messagesystem and Confer for Giving/Receiving Personal Advice

Response Group	Percent Who Would/Did Give Personal Advice	Percent Who Would/Did Receive Personal Advice
Freshmen Likelihood	26.0%	26.0%
Staff Using Just $Messagesystem	42.1%	39.1%
Staff Using Both $Messagesystem and Confer	21.1	20.1
Staff Using Just Confer	3.9	3.2
Staff Using Neither	33.0	37.7

Table 8.--Resident Staff Usage of the $Messagesystem and Confer for Giving/Receiving Advice about Computing

Response Group	Percent Who Would/Did Give Computing Advice	Percent Who Would/Did Receive Computing Advice
Freshmen Likelihood	69.0%	69.0%
Staff Using Just $Messagesystem	17.7%	31.0%
Staff Using Both $Messagesystem and Confer	25.4	32.0
Staff Using Just Confer	3.9	5.6
Staff Using Neither	53.0	31.3

In discussion of the use of electronic communication during the staff interviews in March, 1990, the resident staff expressed how dependent they had become on the computer. Communication by computer became a way to keep up with friends especially since messages or confer entries could be made at any time, including times, such as 2:00 a.m. when one shouldn't be using the telephone. Checking messages had become a way of life. The interviewer would ask how they felt when they signed on and found that there were no messages waiting for them. The general reaction was: sad, unloved, let down. However, many said that never happened; there were sometimes too many messages to contend with. Staff felt that electronic communication made contacting someone not well known a lot easier than telephoning or visiting that person. As for conferencing, the general opinion was that conferencing allowed a venting of frustrations, stress relief, a chance to talk about frivolous things, as well as a chance to get to know staff better. In addition, the resident staff want to learn how to communicate with friends at other universities.

Summary and Conclusions

Staff expressed strong positive attitudes toward the computer loan program in general and toward electronic communication in particular. Staff rated their agreement with statements about the effects of the computer loan program on a five-point scale, where 1 = strong agree and 5 = strongly disagree. The means and standard deviations of these ratings are presented in Table 9. Staff do believe that the loan program had positive effects on their resident work. There was strong agreement that it made them more effective and helped them communicate. There was moderate agreement that they did not spend too much time using the computer and that the computer made their work easier. Reactions were more mixed but still positive in assessing whether using computers for communication made the staff closer or decreased the time the staff spends talking face to face.

Attitudes toward the loan program were correlated with network usage. Those who felt that computers helped to communicate with others, that the staff became closer because of computer communication, that computer use made the staff more effective, and that they did not spend too much time using the computer for the job were those who also used computer communication for a greater variety of purposes.

Table 9.--Resident Staff Assessment of the Computer Loan Program and the Use of Electronic Communication

Statement	Mean	SD
Using computers has made the staff more effective	2.0	.85
Computers help me communicate with others	2.0	1.01
I do not spend too much time using the computer for tasks for my job	2.3	.85
Using the computer has made my job as a staff member easier	2.3	1.24
Using computers for communication has made the staff closer	2.5	1.01
Electronic communication has decreased the time the resident staff spends talking face to face	2.7	1.19

One important outcome of this study is proof that the resident staff view electronic communication via computer networks as an additional resource, not a replacement for other modes of communication. Electronic communication minimizes paper work, assists with scheduling, and often increases the efficiency with which staff communicate with other students, staff, and faculty. Another important point contributing to the success of the computer loan program is that electronic communication allows staff to communicate at times that are convenient for them. Building Directors and resident staff alike unequivocally state that the most important effect of the computer loan program is that placing consistently reliable networked computers in staff rooms increases the availability of resident staff to students since the resident staff have ready access to academic and employment resources from their room through the network. As a result of the increased availability of the resident staff and the presence of network resources, resident staff use the technology as another venue for assessing the academic and social needs of their residents by observing how residents interact with the technology. In summary, networking resident staff has far-reaching benefits that include

- increasing the efficiency and productivity of the resident staff, both as staff and as students,
- localizing computer education on each residence hall floor,
- increasing the availability of resident staff, and
- providing another venue to interact with students.

The computer loan program has extended the concept of sustaining a living-learning environment in the residence halls through the successful integration of technology into the complex fabric of student life.

THE INTEGRATION OF VOICE, DATA AND VIDEO SERVICES VIA A WIDE AREA NETWORK: TECHNICAL AND ORGANIZATIONAL ISSUES

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Abstract: The Maricopa Community College District serves ten colleges, two educational centers and over 91,000 credit students per semester with a digital voice, data and video wide area network. The Maricopa wide area network also includes connections with local high schools, elementary schools and four year institutions for the transfer of electronic documents, shared files and electronic mail.

The planning and implementation of Maricopa's wide area network has been achieved through a conscious strategy of managing change and leveraging vendor partnerships. The information technologies organizational structure has evolved along with the evolution of the wide area network, creating new job functions and opening up new opportunities for retraining and staff development.

INTRODUCTION:

The Maricopa Community College District, located in the Phoenix metropolitan area, is the second largest community college district in the United States with eight (8) colleges and two (2) educational centers. With a service area of over 9,000 square miles, the Maricopa Community Colleges enroll more than 91,000 credit students and over 20,000 noncredit students each semester.

A major part of the Maricopa Community Colleges' mission over the past eight years has been to provide high quality services to faculty, staff and students through the use of state-of-the-art information technologies. This emphasis on the use of information technologies has led to the planning and implementation of a districtwide wide area network for the transmission of voice, data and video communications.

OVERVIEW OF THE MARICOPA WIDE AREA NETWORK

The Maricopa Community Colleges embarked on an ambitious computerization program in the early 1980's. The key feature of this plan was to decentralize computing with a distributed network of mini-computers along with a vast proliferation of personal computers. In the summer of 1982, there were approximately 150 personal computers or terminals available districtwide for students and staff for both academic and administrative uses. Eight years later, the Maricopa Community Colleges have over 8,000 terminals and personal computers in support of students and staff. Most faculty have workstations in their offices. Laboratories at the departmental level and large scale open labs also exist at individual colleges throughout the district. The large scale computing environment consists of eleven (11) VAX computers, all of the VAX 6000 family. The largest of these is a VAX 6440 and the smallest is a VAX 6410. These VAX computers are linked together at T1 transmission speeds via a districtwide digital microwave network which was completed in the spring of 1989. Over 2000 active ports are currently attached to the wide area network for data transmission.

In 1985, the Maricopa Community Colleges began planning and implementation of the Telecommunications Improvement Project. The overall goals of this project were to establish a universal wiring plan for voice, data and video communications, to upgrade or replace the college telephone systems and to construct the districtwide digital microwave network. By the spring of 1987, the project was completed. During this period, every workstation, classroom and conference room in the entire district was rewired for voice and data communications and every classroom and conference room was wired for video communications. The old, AT&T Dimension 400 telephone systems were replaced with new NEC NEAX 2400 digital PBXs with simultaneous voice and data capability. Voicemail systems and call accounting systems were also installed. Today, the Maricopa District operates ten (10) NEAX

2400 PBXs with over 4000 voice lines. Ninety-five percent of the instruments are digital instruments. There are over 3000 voicemail users within the district. The telephone systems are connected via the districtwide microwave network for five digit dialing.

Once the Telecommunications Improvement Project was completed and the districtwide digital microwave network was constructed, attention was focused on how the network might be used to transmit video among the colleges and the district office. With the help of NEC America, the Maricopa Community Colleges began the Video Demonstration Project in the spring of 1989. For one month, between the middle of April and the middle of May, shared instruction, meetings, staff development activities, and faculty discussions took place between Chandler-Gilbert Community College Center and Glendale Community College using the Maricopa digital microwave network and NEC's Visualink 3000 digital video codecs. During the one month period, over fifty separate events took place involving over 300 Maricopa faculty and staff.

The demonstration project was such a success that Maricopa moved immediately to equip four (4) colleges with this two-way video and two-way audio technology. At the present time, four colleges are using the system to share instruction and for video conferencing of meetings. A multi-point video switching device will be installed prior to the spring 1991 semester so that faculty can see and hear students at each site on the network.

STRATEGIES FOR THE IMPLEMENTATION OF INFORMATION TECHNOLOGIES

No institution can make the progress Maricopa has made in the implementation of information technologies without developing strategies to maximize the internal and external opportunities and to minimize or overcome the internal and external obstacles it may face. Three major strategies which have been identified by Maricopa are: (1) establishment of a centralized/decentralized technology environment, (2) use of the Concerns-Based Adoption Model (CBAM) for managing the change process, and (3) creation of partnerships with major technology providers.

Centralized/Decentralized Environment

The Maricopa Community College District consists of eight (8) semi-autonomous colleges. Each of these colleges is accredited separately by the North Central Accrediting Association; each has its own president and administration; each has its own faculty senate; each has its own curriculum and degrees; each has its own processes and procedures. The management direction for information technologies has, therefore, been to follow the overall management philosophy and give more and more technology power to the colleges. Thus, each college has its own dedicated VAX computer; each has its own NEAX 2400 PBX and voicemail system.

Not all aspects of information technology could be decentralized, however. Standards for the acquisition of hardware and software are established centrally with the advice and participation of the colleges. In addition, software and hardware systems that are centrally managed remain centrally located. The accounting system and human resource systems are managed by staff located at the district office. The hardware and software that support these systems, therefore, remain at the district office. The library system is also centralized so that each college can take advantage of the districtwide library holdings.

This centralized/decentralized environment is managed through the use of active user groups for each of the technologies and the Information Technologies Executive Council (ITEC). The user groups are composed of representatives from each college and from the appropriate segments of the district office. Directed by the management of Information Technologies Services, these user groups make recommendations regarding policies, procedures and acquisitions to the Information Technologies Executive Council. ITEC reports directly to the Chancellor and manages the information technology function for the entire district. ITEC is composed of the four vice chancellors for the district, one college president, a member of the Maricopa Governing Board, one faculty member, a vice president from Arizona State University, and the Director of Information Technologies at Phoenix Union High School District. The latter two members are non-voting, ex-officio members.

Concerns-Based Adoption Model

When any new technology is introduced into an organization, its chance of success is dependent upon the ability of the individuals introducing the technology to manage the change process. The change process model used within the Maricopa Community Colleges is the Concerns-Based Adoption Model (CBAM) developed at the University of Texas at Austin. This change model postulates that change may be effectively introduced into an organization only if the members of the organization understand the vocabulary of the change, understand how the change will affect their lives, adopt the change within their own individual work environments, and adapt their activities to accommodate the new approach.

This is the philosophy upon which Maricopa began the Telecommunications Improvement Project. It was the goal of the telecommunications team to spend adequate amounts of time before equipment specifications were developed and equipment was purchased, to insure that faculty, staff and administrators were taught how telecommunications, particularly voice communications, could be used as a strategic tool to complete their jobs. It was also important that these groups had input into the type of hardware that was to be purchased.

Toward this end, one-on-one and small group discussions were held at each college. Information was disseminated to all employees in both print and electronic formats. Audio teleconferencing sessions were held as "open hearings" to give anyone and everyone an opportunity to contribute to the planning and design effort.

Partnerships with Technology Providers

The creation of partnerships with major technology suppliers has been a deliberate strategy of Maricopa. The three-way partnership among Digital Equipment Corporation (DEC), Information Associates (IA), and Maricopa began in 1983. Prior to that, there were informal relationships with these same companies. This partnership brought to Maricopa millions of dollars in hardware procurement savings from DEC and broad resources from Information Associates to develop new software packages.

Because of the success of the DEC/IA/Maricopa partnership, Maricopa entered into another partnership in 1988 with NEC America, Inc. and NEC Home Electronics (USA) for telecommunications and video equipment. The goal of this partnership was to advance Maricopa's use of voice and video communications. The Maricopa/NEC partnership has resulted in the successful demonstration and implementation of digital video across the districtwide wide area network and the installation of new, state-of-the-art video equipment at each of the Maricopa Colleges. Between 1990 and 1993, this partnership will enable Maricopa to upgrade its current telephone and voicemail systems at considerable savings to the colleges.

The newest Maricopa partnership is with The Robinson Group, a newly formed information access company. The Robinson Group (TRG) and Maricopa are planning to jointly develop instructional and instructional support software along with information access tools and technology.

Maricopa believes that vendor partnerships are not only a form of creative financing, but also bring additional strength to developmental efforts. In addition, these partnerships provide some advance knowledge of future directions, pre-release of products, and a safety net to protect against possible failures.

EVOLUTION OF THE INFORMATION TECHNOLOGIES ORGANIZATION

For the past eight to ten years, technical and management journals have been filled with articles related to the evolving organizational structure for information technology organizations. The ongoing arguments regarding the pros and cons of separate or combined administrative and academic computing organizations have been joined with the arguments for and against combining telecommunications and computing into a single organizational structure. If combined, which receives "top billing"; if separate, how do the two relate?

Historically, these functions were separate entities within the Maricopa District. In the late 1970's, computing was all done in a batch mode and was the domain of Computer Services. There was no such thing as "data communications" in our vocabulary. Telephone service was monitored by the Purchasing Department under the careful eye of AT&T and Mountain Bell. Television activities belonged in the Media Services department at each college.

Beginning in 1983, with the installation of the initial VAX computers linked with 56 Kbps dedicated telephone lines, computing and the new area of data communications, became joined in a new department called Management Systems and Computer Services. Telephones were still not acknowledged as a technology that needed to be managed rather than simply "acquired"; and television was still seen as an extension of the old classroom film and, therefore, still managed by Media Services.

With the divestiture of AT&T and the Bell System in 1984, the organizational environment began to change again. The Maricopa Community Colleges, like so many other educational institutions across the country, awoke one morning to find that there were many new telephone service and equipment providers and that the number of new voice technologies being introduced had multiplied almost over night. To keep pace with these changes, a new department of telecommunications was formed. This department was combined with computing and data communications in 1985 and a new umbrella organization called Information Technologies Services was born.

Between 1985 and 1990 use of information technologies within the Maricopa Community Colleges have continued to grow and expand. With the completion of the districtwide microwave network, the lines between voice, data and video communications became even more blurred and districtwide planning for video communications was finally absorbed into the Information Technologies Services area.

The evolution of the information technologies organization has brought more than mere departmental name changes to Maricopa. Specifically, this evolution has brought about new job opportunities for individuals within the district and new challenges for retraining and staff development. Each of the new job opportunities and all of the retraining challenges focus on the strategy of integrating voice, data and video communications.

Key among the new job opportunities are:

Director of Computing & Communications: This position is responsible for all day-to-day operations of Information Technologies Services, including all voice, data and video communications along with all software development, applications programming and library automation.

Director of Technical Operations: This position is responsible for the maintenance and operation of the voice, data and video communications networks within the Maricopa District and oversees the technical staff in each of these areas.

Manager of Technology Planning: This position is responsible for the planing which must take place to integrate information technologies into new and ongoing facilities construction programs.

Manager of Network Operations: This position has primary responsibility for the maintenance and operation of the Maricopa wide area network, including fault isolation, fault resolution and capacity planning.

Manager of Research and Development: This position is responsible for researching new technologies and software applications for potential acquisition and implementation by the Maricopa Community Colleges.

The challenges of retraining and staff development are many as the roles of individuals within the organization are forced to change by the implementation and integration of new information technologies. First, the staff must be retrained to manage and operate the new technologies. This retraining can be both expensive and time consuming, particularly with the more advanced applications or hardware. Second, the staff must be retrained to work in self-managed teams rather than as individuals. The integration of technologies into one organizational structure means that teams must be used to approach and solve problems. Staff who are unable to work as team members cannot survive in this environment. Finally, staff must receive additional training in communication skills and customer service. Within Maricopa we have found that a majority of the "trouble calls" we receive in our Repair Services department are not really technology-related; they are people-related. In other words, there is often nothing wrong with the hardware or the software application. What is really wrong is the way in which the individual is using the hardware or software, the processes/procedures established by the individual's department, or the staffing in the individuals work area. Staff of the Information Technologies Services department must be trained to listen to the user, to probe to discover the true problems, and to communicate these issues in a nonthreatening and helpful manner.

PROJECTED AREAS OF GROWTH

The appetite for the acquisition and use of new technologies within Maricopa is horrendous. There are many more requests than can be accommodated within the resources available. This means that we have ambitious plans for expansion and growth for the upcoming five to ten year period.

In the area of computing and data communications, Maricopa plans to expand its use of local area networks and connection of these networks to the wide area network. This includes the use of multi-vendor hardware and software. We also plan to expand access to the network from homes and business locations through the use of laptop and home computers. We believe that the affordable laptop computer may be the next major breakthrough in computing, giving students an opportunity to complete course work at times and places convenient to them and then "dock" with the network to submit the course work, receive new assignments and communicate with instructors and other students. We also plan to expand the ability of faculty, students and staff to access information in district databases and in external databases. This will be done through the use of new types of databases, new graphical user interfaces, and other new access technologies.

In the area of voice communications, we plan to equip one new college and the newly acquired District Support Services Center with new digital PBXs and state-of-the-art voicemail systems. These new voicemail systems combine the traditional voice messaging technology with automated attendants, call processing and audio text capabilities. Through the use of NEC's Open Application Interface, which allows the PBX owner to customize certain PBX functions, Maricopa plans to enhance its voice communications services to faculty and students and to upgrade the telephone systems at each colleges. Also included in the voice communications plans are expanded integrated voice response (IVR) applications. Currently, the Maricopa Community Colleges are using a touchtone registration system based upon the technology of Perception Technology Corporation and Information Associates Student Information System (SIS) software. The new IVR technologies which are now available will enable Maricopa to give students and faculty touchtone access to many other types of information and other types of online processes.

In the area of video communications, Maricopa plans to expand its use of the NEC digital video codecs to all locations so that every college will have the capability of originating and receiving two-way video and two-way audio communications for shared instruction and meeting purposes. Additional C/Ku band satellite downlinks will be installed over the next few years to allow Maricopa to expand its use of satellite-based programming for ad hoc videoconferencing and instructional support. We believe we will also see a further integration of computing and video as personal computers expand their capability of handling video signals.

Finally, the Maricopa wide area network will continue to expand. Connectivity with local high schools, elementary schools and four year institutions will grow as will access to home and local business sites. Maricopa is heavily involved in statewide and regional efforts to connect educational institutions for voice, data and video communications, and is among the leaders nationally in the use of telecommunications to reach international audiences.

CONCLUSION

In many ways, the Maricopa Community Colleges have demonstrated exemplary uses of technology to meet the needs of students and staff. In many ways, we still have room for improvement. If there is one area, however, where Maricopa's faculty and staff have excelled, it is in their combined commitment to not just "do more," but to "be more." If we can "be more" effective; if we can "be more" productive; if we can "be more" as part of our community through the creative uses of technology, we are obligated to work together toward that end. Maricopa's wide area network is the primary vehicle through which these goals may be obtained.