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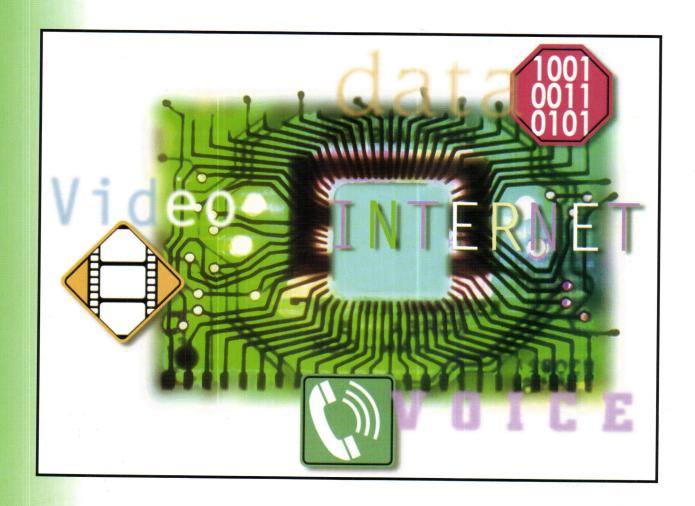
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Fall Seminars

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Marriott City Center
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Track II: New Telecom Technologies

Winter Seminars

January 9-12, 2000
Newport Beach, California
Marriott-Newport Beach
Track I: Legislative and Regulatory Update
Track II: Telemanagement Issues

Spring Seminars

April 9–12, 2000 Miami, Florida Wyndham Miami Beach Resort Track I: Wireless and Other Emerging Technologies Track II: Leading the Technology Organization



...[T]here seems little doubt that communications and data will be delivered over the same network. What remains to be determined is what those services look like, sound like, and how they will perform.

> -Mick McKellar Michigan Technological University pg. 4

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President's Message

Buck Bayliff, Wake Forest University ACUTA President 1998–99

Great Expectations: Convergence for the Uninitiated

For my message this quarter, I think you'll find the following perspec-

tive on delivering technologies to our campuses very interesting. Thanks to Mick McKellar, who works in Information Technologies at Michigan Technological University, for putting these thoughts together.

For the next few months, most of us will be watching closely for the approach of the Y2K monster. Assuming we're still in business after 12/31/99, most computer users will start looking toward the future again. They will remember hearing about voice over IP, desktop videoconferencing, portals, intranets, Webbased tools, information management, knowledge management, etc., and will be expecting these services from their desktop. What can we do to manage these expectations, what can we deliver, and how do we deliver it?

If you have tried desktop videoconferencing, you know that the quality leaves much to be desired and that the software requires fairly powerful workstations. Not all users have these powerful machines on their desks. Internet telephony is not quite like picking up your telephone and dialing a friend's number—at least not yet. To the user, it's more complicated than the desktop phone and not as portable as a cellular phone. Most users are familiar with e-mail, but few have ever tried sending an attachment. Even fewer have had success sending an attachment. No faculty or staff member wants to spend a great deal of time learning to do these things, and most expect it all to come through a single jack in the wall.

Anyone who even casually glances at television or print media is aware of the pervasive marketing hype about the promise of future technology. Most users really have no concept of what it takes to put together an infrastructure to support such a wide variety of demanding services through a single pipeline to their desktop. It does little good to explain about the campus backbone, or switching technology, or PBXs, because these technologies are invisible to the users. Our customers need both visible demonstrations of the current state-of-the-art of these technologies and reasonable predictions regarding future enhancements.

The Dog and Pony Show

Ironically, one of the oldest forms of communication, the one-to-many presentation (the old dog and pony show), is perhaps the best vehicle for helping to shape user expectations. (Not to say that the presentation wouldn't include demonstrations of some fairly sophisticated technologies.) The true art of the presenter—engaging, entertaining, and enlightening dialog—is needed to enable users to visualize using these technologies in their teaching, research, collaboration, correspondence, and communication.

We must begin discussing future use of technology in terms that are reasonable, given our current infrastructure and plans for the future. For example, we are preparing a conference for Michigan Technological University faculty called "Technology and the Academy of the Future," a grand tour of a future both awesome and reassuring. We also are publishing a series of online vignettes describing what the future may look like ten years from now. These vignettes will be on the university Website, and faculty, staff, and students will have opportunities to post their own comments regarding these snapshots of the future. Such events and activities help define future technology in realistic terms, reducing both wonder and anxiety.

Delivering the Goods

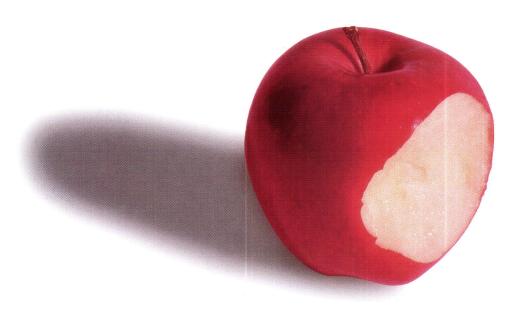
Still, there seems little doubt that communications and data will be delivered over the same network. What remains to be determined is what those services look like, sound like, and how they will perform. Quality of Service is a major consideration for delivering these services and must be addressed in infrastructure planning. However, most users will not understand nor will they care about the network infrastructure except as it pertains to their costs and the quality of service. If it is too expensive, difficult to use, slow, or not dependable, they won't use it.

The customers' needs—cost avoidance, savings, and performance—will converge at a single point of contact with the IT provider. For the customer this means integrated one-stop shopping. For the service provider it means brushing up on your 3Rs:

- revise management concepts,
- reevaluate services, and
- reorganize to meet new challenges and stay flexible.

For most of us, the IT organization of today will not meet the needs of tomorrow without communication, planning, quality service, and reorganization to remain flexible and dynamic. Keeping customers involved in each of these projects helps manage both their fears and their expectations.

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Meeting Bandwidth Challenges on Campus

by Curt Harler

Colleges always have been bandwidth hogs. But with the spreading of network environments and the proliferation of remote-access demands, concerns over bandwidth availability have reached near crisis proportions. With those concerns comes a need to develop an effective plan for handling the demand. Schools like Penn State, Texas A&M, and the Rancho

Santiago Community College District have made great strides in that direction.

Penn State got into the hub business 14 years ago. Back then, recalls Steve Schroeder, director of network planning and integration, networking meant having a bisync printer at each location. The original WAN soon became known as the data backbone and became a production OTC service in late 1986. That data backbone supported interconnectivity of 170 LANs and 35,000 hosts at Penn State and provided worldwide access to other computer resources and information available on the Internet. The hubs were set up at regional campuses across Pennsylvania, the system closely following the state's LATA map.

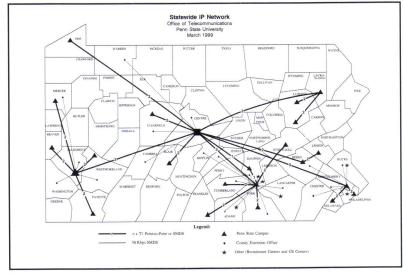


Figure 1. Penn State network map.

"We've followed that model for 14

years," Schroeder says, "increasing bandwidth whenever money allowed." Currently, the Great Valley location (near Philadelphia) is linked with three T1s to University Park, and a pair of T1s link nearby Delaware and Ogontz locations. All of the T1s terminate at an ATM switch. Similar setups link other regional centers. Schroeder knows he needs T3 or OC-3 links to

replace the T1s. "The big problem is getting beyond the T1s to each campus," he says.

OC-3 for Internet2

Penn State currently is using OC-3 connections to Internet2 and will be going to OC-12. Their network is based on IP running over ATM. In Schroeder's outlook, "The transport protocol is less important than getting the raw bandwidth." The first broad deployment of the schedule to upgrade and increase non-University Park campus bandwidth took place early in 1998. The Inter-Campus Network map (Figure 1) depicts the network as it looks with the completion of the upgrade.

Upon completion, Penn State's four-year colleges (Abington, Altoona, Erie/Behrend, Harrisburg, and Berks) will have a direct link to University Park. In addition, the Capital College (comprising the

Harrisburg and Schuylkill locations) will benefit by having a direct link between its two locations. The Berks—Lehigh Valley College (comprising the Berks and Lehigh Valley sites) will have a direct link between its two locations.

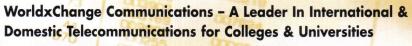
The intercampus upgrade also increased the bandwidth to each campus to a minimum of 3 MBps, added ATM to manage the multiple circuits used to each campus and some measure of quality of service (QoS), added an on-demand dialup backup capability for all but one campus, and upgraded each campus's router. In recognition of the new features it supports, the new network has been given the name "integrated backbone." By adding ATM capabilities and upgrading the routed core, the new network can support more sophisticated applications that were not possible on the old data backbone.

IP has been Penn State's bearer service for years. "We fought the battles of AppleTalk, IPX, and NetBEUI," Schroeder recalls. They put ATM in since they wanted to integrate their extensive voice, data, and video applications. Video came first, since it showed the most promise for benefiting from the QoS the new architecture could provide. Within the University Park campus, the video is handled over IP, but elsewhere they still lack the bandwidth to pull it off.

Voice will be added over the coming year. Will it necessarily be over IP? "I don't know," Schroeder says. "We are using ATM as a core since it gives us a Layer 2 network we can control and get QoS." But he is open to alternatives should they prove effective in providing end-to-end services.

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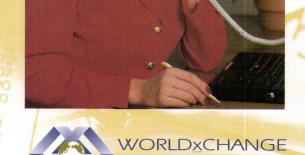
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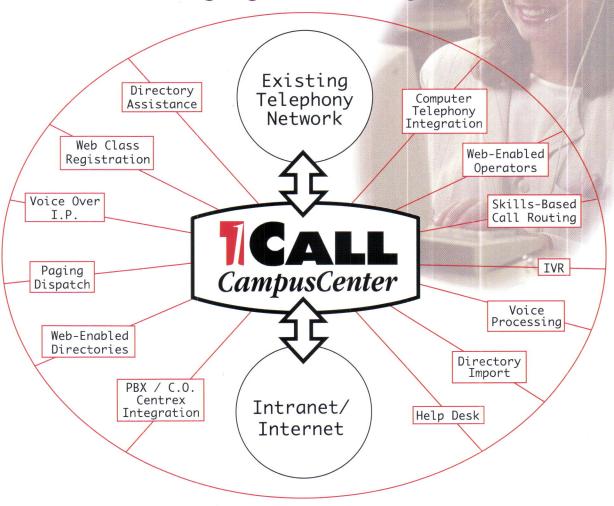
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A&M Goes ATM

Texas A&M, on the other hand, is sold on ATM. "We are trying to talk to other universities with extensive ATM campus infrastructures," says Willis Marti, director of the computing and facility services group in the Computer Science Department at Texas A&M. He sees ATM going way beyond A&M's network and even far beyond state boundaries.

"Some people are not interested in a nationwide ATM infrastructure," he continues. "But there are those of us who think that ATM is a great environment. We'd like to share ideas and share experiences." A&M is in the process of bringing two 40-GBps ATM switches up for its production network. "The idea was to take an opportunity as we transition from production FDDI to ATM to put in something that is not going to be overloaded for a long time," Marti explains. They are using the ASX-4000 switches from Fore Systems, Pittsburgh, Pennsylvania. "They were the best we can get and still stay cost-effective," Marti says.

The campus at Texas A&M is roughly divided into two parts by a railroad track. Each campus will be served by one of the switches. Although the railroad limits the amount of cable that can be run between campuses, there will be OC-48c linking the two. In spite of the fact that the main campus is larger, the West campus has the agricultural, biological science, and health services facilities, so they are major users of integrated services.

A&M got into ATM back in 1993 as a research networking tool. A small start continued to expand. Soon the researchers were demanding an expansion in the scale of the network. Over a couple of years' time, a respectable research network was developed, and soon it became apparent that it would be profitable to move the entire campus backbone to ATM. Before that time, the production network was based on two FDDI rings with routers in each of the buildings on campus. A&M overlaid a parallel ATM infrastructure, consisting of 20 to 30 switches, on the FDDI rings. By 1998, the decision to make ATM the core of the production network was reached.

"We wanted boxes big enough to handle both the campus production network and the research traffic on the same box," Marti

"We realized that if we truly wanted to expand our students' horizons, we would need to expand our network's capabilities first."

> -Curt Childress RSCCD

says. In addition to on-campus ATM, they have ATM connectivity to Houston, to Waco, and to a GTE location in Bryan, 10 miles from the main College Station campus.

They are also working with other universities to establish a giga-POP in Houston, a pattern being followed by many private industry endusers as well. The demand for broadband services is being felt in all segments of the market, hitting both on- and offcampus operations. The Telecommunications Act of 1996 was expected to generate a flood of facilities-based competitors providing all manner of broadband and other services. It is fair to say that the anticipated flood has been more of a trickle, mainly because the CLECs (competitive local exchange carriers) are still developing their own facilities. It's way too soon to laugh at those who predicted a flood, however. Growth in the demand for high-bandwidth services, the continued convergence of voice and data networking, and the competitive threat represented by CLECs has lit a fire under broadband providers.

Boom in Fiber Miles

If a single statistic points out the growth in broadband, it is a study by the FCC which shows that the number of CLEC fiber miles has grown from 200,000 in 1993 to 1.3 million in 1996 and 2.5 million in 1998. The ILECs (incumbent local exchange carriers) had a similar, dramatic increase in fiber miles, growing from 7.5 million in 1993 to 12.3 in 1996 and 14.8 in 1998. But it is not statistics that are driving broadband demand. The obvious drivers on campus are the three-dimensional research projects conducted by the biology, chemistry, and physics departments. Social studies researchers are also eating more than their share of bandwidth.

However, in a broader sense, the entertainment industry is demanding its share of bandwidth. If you have not played games like Heretic (see the second or third editions) or Quake (again, look at the second edition), you cannot truly understand why the student body is demanding broadband connectivity. The graphics in those games are excellent. Played alone on a PC, they are fun. But played across a network, they are amazing. Add both application areas together and the result is an enormous and growing demand for broadband services. The answer at most locations seems to be installation of fiber-optic cable. Many colleges and college consortiums have been quick to take advantage of the broadband connectivity offered by the increasing fiber plant.

Rancho Santiago Network

At the Rancho Santiago Community College District (RSCCD) in California, the problem was user volume. RSCCD offers, as part of its curriculum, classes that incorporate multimedia applications, Internet access, videoconferencing, and video-on-demand. Santiago Canyon College (SCC) and Santa Ana College (SAC), two district schools, realized that the one main requirement for their networks was increased bandwidth. With the district's student body totaling more than 24,700, its IT staff knew it would need to ensure that the network could support high-speed, bandwidth-intensive applications. The sheer volume of users, as well as unbalanced traffic patterns, placed a severe burden on both the SAC and SCC networks continuously throughout the day. The existing shared Ethernet network simply could not handle the traffic.

"We realized that if we truly wanted to expand our students' horizons, we would need to expand our network's capabilities first," says Curt Childress, manager of technology services for RSCCD. "In technology-based education there is no such thing as a 'set curriculum.' Technology is constantly changing and, as educators, we need to be able to keep up. That's why we made the decision to implement a new network infrastructure."

Actually, what the network needed was a traffic cop for user volume. RSCCD partnered with Anixter Inc. of Skokie, Illinois, to implement a network based on

ATM technology. The key checkpoints in the network were to meet the district's needs for bandwidth, scalability, security, and reliability. In addition to multimedia applications and a strong focus on the Internet, the district also wanted to be sure that its Caesar Chavez Building—housing the computer labs and created specifically to provide central IT and business services to RSCCD-would be able to expand as needs changed. The solution included a physical cabling upgrade, redesigned infrastructure, and a heavy commitment to ATM.

ATM allows RSCCD to support voice, video, and data seamlessly across both its LANs and WANs. Where most existing networks are supported by frame-based technology with speeds of 10, 16, or 100 Mbps, RSCCD's cell-based ATM handles 622 MBps. The backbone is made up of ATM switches with fast Ethernet and 10-MB Ethernet switches at the department and workgroup level. T1 links are used to extend the backbone from the Chavez Building to other sites throughout the district.

"Our responsibility is not only to teach but also to create an atmosphere in which students can independently explore and develop the skills they need for success," Childress says. His current network allows him to meet those challenges.

Wrestling with Costs

One question ACUTA members need to wrestle with is where they will obtain both the infrastructure and transport for broadband services. They need to take a second look at how well they have prepared the administration to react to the expenditures which will be demanded to keep their college competitive with the rest of the schools in the race to deploy advanced services for teaching and research, as well as for everyday use.

Penn State's Schroeder indicates that from the outset the big stumbling block is budget, not technology. Their video network, until recently based on three BRI (basic rate interface) lines, gives administrators and others meeting capability like that of compressed 384 Kbps service. It links 10person meeting rooms across the state. (The distance education network, with multiple cameras in classes for up to 70 students, is separate). They now are moving it to IP, using a box that simulates the ISDN on one side and IP on the other.

"We're still looking for an alternative to our private network that will give us the same level of service and save us money," Schroeder says. With the University Park—Harrisburg video link set up in May, they will be aggressively following up with deployment across the entire system.

Likewise, the production side of the ATM network at A&M should be up and running this summer. By spring, the OC-48c was up in parallel while staff looked at management techniques. The general plan was to roll out the OC-48, bring the research network up on the OC-48, and then transition from the campus FDDI to the ATM backbone. However, there was some understandable reluctance to try to bring over 100 buildings onto the ATM backbone at once.

"We did that with the FDDI," Marti recalls. With a grin, he sums up the challenge of implementing a network change while still serving students and faculty: "It's like changing the tires on a car while it's going 70 miles per hour."

Curt Harler is a freelance writer and contributing editor for the ACUTA Journal. He writes prolifically and speaks regularly about telecommunications-related topics. Reach him at curt@curtharler.com.

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Voice-over-LAN: A Solution for Convergence in the Enterprise

Over the years the topology of computer networks has changed considerably, paralleling changes in the networking equipment and making better use of increasingly powerful computer platforms, both in centralized IT and on the desktop. Gradually, as computer networks have evolved, they have come to resemble telecommunications networks. For example, the traditional distribution plan for a PBX system—which includes vertical risers connecting floor-level wiring closets which in turn connect horizontally routed, pointto-point station connections—is now replicated in switched LAN arrangements. Furthermore, the long-distance voice network, which was built on switched, end-to-end connections, resembles, architecturally, the new IT services such as frame relay. Meanwhile, the

equipment used in voice networks has grown more computer-like, until the point has been reached where the difference between an IT platform and a voice platform is fast disappearing.

Where the two models still differ, the opportunity has now arisen to complete the synthesis, not just because it can be done, but because doing it would be beneficial to the organization. In fact, the long-sought goal of convergence between computing and voice is fast becoming a reality through the new concept of voice-over-LAN.

The Voice Environment

While the computing network environment has changed extensively over the past decade, the telephony network looks more or less as it did in the 1960s. Individual wires from individual

By Kevin Johnson

telephones are run to wiring closets which are connected, via vertical risers and high-capacity cables, directly into a PBX.

Since the 1960s, the PBX has, of course, been upgraded to a digital model, and the handsets themselves can be digital, connected over digital lines. The dedicated network topology is the same because voice is well suited to a switched environment, and switched environments generally work best in star topologies. As a result, voice service has typically remained consolidated in a single, centralized switch.

The Case for Convergence: CTI and Voice over LAN

Computer telephony integration (CTI), which combines voice and computing capabilities, differs in concept from convergence in that

the networks themselves are not combined but, rather, integrated at the functional level. These are supported by several de facto standards, particularly, the Telephony Application Programming Interface (TAPI) from Intel/Microsoft, the Telephony Services Application Programming Interface (TSAPI) from AT&T/Novell, and CallPath, which is an IBM standard.

CTI is an important capability, but it only takes us part of the way toward maximizing the potential of integrating the computing and telecommunications environments. Convergence, which combines service delivery within a shared network fabric, offers greater benefits to data and voice network users since it is not restricted merely to CTI applications.

Voice-over-LAN describes a concept as well as a group of technologies that unify all of the

functional and physical levels of LAN and local voice networks. It allows cost savings, flexibility, uniformity, and high service efficiency. For end users, this translates into greater ease of use, familiarity with system operations, and a clearer sense of what to expect from the combined services. This benefits both the LAN and the telephone user communities (who are, indeed, the same people!). The PBX systems greatly benefit from the enhanced capabilities of the distributed and switched LAN architectures, while the LAN community benefits from the sophisticated call connection functionality.

Voice systems have had a strong tradition of dependability and extended uptime, while data systems are renowned for being customizable and scaleable. These strengths complement each other

and give convergence a natural advantage.

LAN Evolution

Initially, as CTI and convergence evolved, the advantages of a switch-based topology for LANs were still not apparent since the 10Mbps shared-media Ethernet seemed adequate for network traffic and it was less expensive per desk than a switch-based solution. Now, however, LANs have migrated from the 10Mbps shared-medium model to switched 100Mbps technology with gigabit speeds being deployed on the backbone.

It is this evolution to switching and higher speeds in the LAN, as well as the consolidation of the LAN backbone, that has brought LANs and voice networks to the point of authentic convergence. In this approach, it is the data net-

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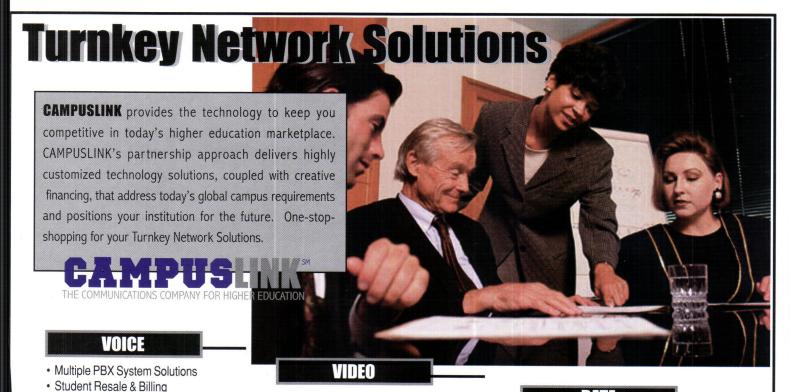
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work that has the higher capacity, the greater sophistication, and the manageability to support both systems. LANs have become faster and smarter, and the next wave of improvements is making them smarter still, with negotiable quality-of-service and low-latency technologies suitable for delaysensitive traffic.

Voice-over-LAN: A Feature-Rich Opportunity

Voice-over-LAN is the term which has emerged to specifically address the convergence of voice and data within the LAN environment. With voice-over-LAN, converged voice, data, and other types of communication traffic coexist on the LAN.

It is not too strong a statement to predict that voice-over-LAN represents the "endgame" or target of local telecommunication architectures. It is the inevitable direction in the industry and, more importantly, in the eyes of the end-user community.

This is a major statement as well as a major architectural concept. The benefits to bringing voice onto the LAN and integrating it with the desktop platform include the following:

- Significant cost performance efficiencies and protection of the IT investment
- Improved employee productivity through the use of multimedia applications and more intuitive solutions
- Better network management
- Better telephone response systems for retrieving data over the phone
- Better corporate communications and training through broadcast voice/data messages

In addition, voice, when implemented as an IP and/or LAN-based application, operates in a familiar IT-oriented manner, is scaleable, and provides interoperability within open-standards-based systems.

Voice-over-LAN enables the integrated multimedia desktop, delivering predictability, automatic adaptability, and productivity enhancements for effective personto-person collaboration. It employs a single, customizable user interface for voice, data, video, and collaboration and allows unified messaging (e-mail, voicemail, and FAX), as well as CTI applications.

As a single convergence infrastructure, voice-over-LAN facilitates the parallel convergence of network operations, administration, management, and provisioning as well as wide area aggregation at the access point and the

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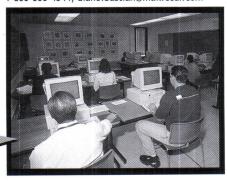






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Migrating the Infrastructure to Voice-over-LAN

Migration to voice-over-LAN is not an all-or-nothing single event, but is likely to encompass a number of smaller elements or activities. Consequently, migration does not happen overnight, but is more of an evolutionary process that includes beneficial steps along the way. Over time, organizations can focus on improving elements of their network infrastructure and desktop workstations in addition to their telephone systems. This requires a wellthought-out strategy and overall plan, which begins with the LAN infrastructure.

The first step in deploying voice-over-LAN is to upgrade the present LAN infrastructure—including cabling plant, hubs, bridges, routers, switches, and network adapters to support the demands of voice traffic without affecting the flow of existing data traffic. The PBX is not considered part of the infrastructure in a voice-over-LAN environment; it will evolve into a call server that can be considered another type of end station on the LAN.

Migrating the PBX

Legacy Telephony

PBXs are relatively inflexible, proprietary, and expensive to maintain and upgrade. For organizations with large campus environments, an intermediate step

between the legacy PBX and server-based telephony may be an architecture featuring multiple PBX components distributed throughout the campus. Previously, this type of architecture required a dedicated fiber backbone to connect these multiple units. Under a voice-over-LAN solution, these units, outfitted with network adapter cards, can be connected together over a LAN backbone infrastructure. This

phony architecture. However, it also does not necessitate replacing old PCs with new ones outfitted with a USB interface.

Server-Based Telephony

A server-based telephony architecture allows for the traditional functions of the PBX to be broken down into components and distributed on the LAN network. The switching function of the PBX

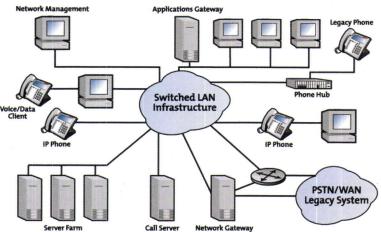
> can be handled by the frame or cell switches of the data network, while the call control function can be moved to a server. Specific telephony applications can also be moved to distributed application servers and integrated with other networked data applications.

Consolidating the Organization

One of the biggest advantages for deployment of voiceover-LAN is the integration of voice

and data network support teams and eventual reduction in support costs. In many organizations, these teams function separately, and facilitating cooperation between these teams has been a notoriously difficult task. It should be noted that many organizations have already begun consolidating the support organizations for voice and data without deployment of a voice-over-LAN architecture. However, migrating to voice-over-LAN, and further, to a serverbased telephony architecture, will force organizational consolidation between personnel from the voice and data environments.

IT Model of the Future: Voice Over the LAN



infrastructure is already in place in larger campus network environments. In this case, the horizontal connection between the PBXs and the telephone sets at the desktop can continue to use the traditional voice network infrastructure.

There are two advantages to this architecture: Distributed PBXs can scale more cost-effectively than a single, large PBX, and it eliminates the necessity for installing and maintaining dual backbones, one for voice and one for data. Because this architecture does not implement voice-over-LAN to the desktop, it represents only a partial step toward a server-based tele-



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The first operational element to be integrated will be the maintenance and support of the network infrastructure. Initially, the voice team will continue to maintain the legacy voice infrastructure, but that task should gradually disappear as users and workgroups are moved to the voice-over-LAN infrastructure.

The lighter burden for infrastructure maintenance could enable personnel previously dedicated to supporting voice systems to move into application development teams with members from both the data and voice environments. This blending of organizations will mitigate some of the potential conflicts between groups of people from the voice and data environments, and will be necessary to develop applications that tightly integrate voice and data. Furthermore, it may also reduce worries about job security on the part of voice-only staff who may fear they have become expendable. Above all, a consolidated organization that supports all forms of network communications in the enterprise will be better able to deliver increasingly sophisticated network services and applications to users.

Network Management

Network management becomes increasingly important as the network becomes more complex. To date, a fair degree of progress has been made on this front, and in the data world some of the key questions have been sorted out. Although operating systems and applications fit together relatively seamlessly in management terms, the issues become more challenging as voice switching enters the equation. Because PBXs have evolved into a wide variety of different interface standards in which no two are alike, it is difficult to make one talk to another. There is no simple way to make one fit into the rest of the corporate environment.

The advent of voice-over-LAN technology allows the leveraging of management technologies already developed in the LAN and in the client/server environment such as Simple Network Management Protocol (SNMP) and widely used management platforms like OpenView from Hewlett-Packard or CA Unicenter from Computer Associates. It also means that both voice and data applications and all kinds of users will be able to see the benefits of advances that are about to arrive, such as bandwidth management.

Successful management of the merger involves cross training, educating both the voice team in LAN and data applications and the data team in the fundamentals of telecommunications. For a while, traditional PBX systems will be supported alongside newer systems, requiring the management teams to combine knowledge of the old and the new. But this does not represent a heavy burden. Making a move toward a serverbased PBX will lessen the difficulty of the management team transition, and the hardest situation is likely to be where a campus attempts to go from a centralized, traditional PBX to a voice-over-LAN environment in a single step.

Key Issues to Be Resolved

In order to legitimize voice-over-LAN and LAN PBX technology and to achieve wide acceptance, certain dilemmas must be resolved:

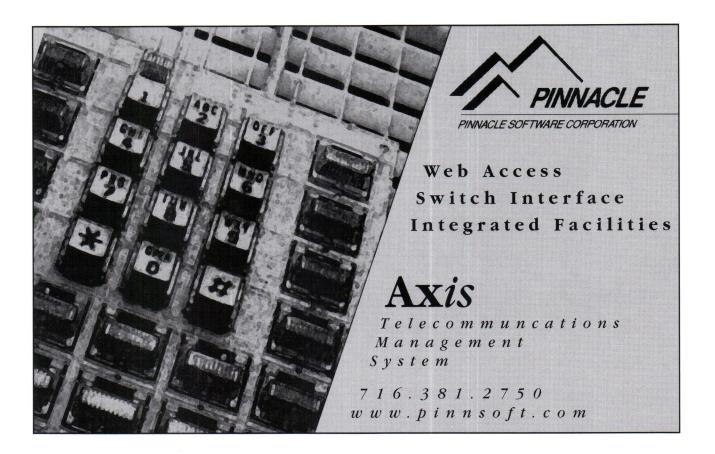
Users will not want to compromise on the present reliability and high level of functionality delivered by today's proprietary PBX platforms, so equivalent reliability standards have to be proven.

- · Power for IP phones is an important issue. Power is not available currently through LAN ports as it is through PBX ports. This issue also extends to battery backup of the desktop terminal.
- People are used to viruses. downtime, lost data, lockups, and many other ordinary, day-to-day, computer-related problems. This is not typical of voice systems. So there needs to be some resolution to the issues of reliability of voice operating on the data platform.
- Users have questions regarding how to leverage existing wiring and cable plant.
- LANs have certain distance limitations (e.g., 100 meters between hub and desktop). How does the user support a telephone infrastructure outside of those limitations?
- Quality of service: The issue of dependable QoS is unresolved.
- · How can the customer be assured of adequate prequalification (confirming specifications for server hardware, OS configuration, LAN interfaces, etc.) and testing?
- · From the new perspective of converged systems, how does the telecommunications manager quantify the value proposition?
- What are the hot IP applications?
- How can the user leverage legacy voice investment through migration?

Importance of Open Systems

No strategy in computing or telecommunications is sensible today unless it is solidly based on open systems. The industry has changed to reflect this truth. Influential vendors reliant on proprietary solutions can be counted on the fingers of one hand.

One of the major attractions of the voice-over-LAN concept is that



it is built entirely on open systems. All the components are readily available in the marketplace. For example, the extensive use of Windows variants for commercial applications provides a solid infrastructure on which to build.

Much of the core work that underpins voice-over-LAN is actually done in independent standards bodies such as the IEEE and the ATM Forum. These bodies have shown in recent years that they can address convergence issues and deliver sound, workable specifications within acceptable time periods.

Conclusions

Achieving the end goal of voiceover-LAN implementation will be accomplished over time and requires a series of logical steps. Individual organizations may start the migration at different points, depending on their installed base of equipment, economic issues, or recent decisions that have been made to meet customer service demands and strategic goals. In general, various compelling events are likely to precipitate these voice-over-LAN migration steps. Examples of such events, often designed to simplify management, satisfy growth, or save money, may include the following:

- Renewing the maintenance contract
- Establishing new locations or branch offices
- Upgrading voice or data systems
- Hiring new people (with new skills)
- Reorganizing (downsizing or substantial moves and changes)
- Developing new bandwidth requirements (backbone and/or selected user workgroups)

- Optimizing wide-area access
- Delivering training (i.e., video) to the desktop
- Improving communications via voice-annotated text or other media

As these events occur, requiring decisions about information technology or services investments, organizations should be considering the potential of making voice-over-LAN a goal. Voice-over-LAN represents a major initiative and key paradigm shift in the networking environment. It promises to be one of the essential aspects of the enterprise—as pervasive as PBXs and LANs are today.

Kevin Johnson is director of advanced networking technologies at Mitel Corporation. Reach him at 613/592-2122.

Going Beyond Best Effort IP Networking

by Tony Rybczynski

Enterprises of all types are building their businesses around their networks. This is particularly true in the business of education. Enterprise networks allow connectivity from end users to applications, between applications, and between users for all forms of traffic, both within the enterprise and to off-net employees, students, and partners. A major challenge is to evolve today's best-effort networking environment to one in which preferential treatment can be given to applications and users that need it. This is the realm of quality of service (QoS), class of service (COS), and policy management.

The emergence of various forms of multimedia IP applicationssuch as audio and video streaming and multicast, IP telephony, desktop video conferencing, and collaborative applications—has generated a great deal of excitement. While there is debate in the industry on how quickly multimedia will become mainstream, there is no debate about the rapid developments in standards and application and networking technologies. Coding and compression of voice and video are being built into business PC motherboards and operating systems. In addition, application programming interfaces are being defined to support COS capabilities for all forms of applications. Two good examples are Winsock2 and XTI for the Windows and UNIX environments respectively.

There are three major forces behind the growth of multimedia: (1) In certain vertical markets such as education, healthcare, and film production, the value of multimedia applications is being demonstrated today and will be driven top-down. (2) Multimedia will also be driven bottom-up by end users looking to enhance their working environment, for example through deployment of distributed collaboration tools. (3) In enterprise networks there is a need for a wellmotivated and educated work force; there are already billions of dollars spent on corporate education.

These are not the only drivers for IP COS capabilities. As IP data applications become mission critical, enterprise users are demanding that this traffic be given some form of priority over less critical data applications under normal operating conditions, as well as under congested and failure conditions. Then there is the challenge of establishing usage policies and managing which users get access to network resources.

QoS-based Networking

The best-effort networking model is being complemented by COS and QoS. COS is akin to firstand second-class mail, while QoS is more akin to services with

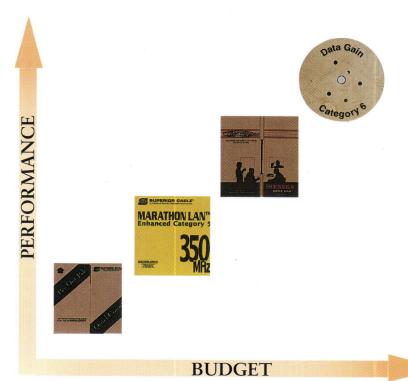
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...IntServ is more of a small network solution, although RSVP will likely remain as one way for applications to signal their needs to the network, particularly for demanding applications such as high-quality video transmissions.

specified performance attributes (e.g., guaranteed overnight delivery, registered mail). More technically, COS is a classification scheme whereby traffic with similar performance requirements is grouped together for handling by the network. QoS, on the other hand, covers attributes such as latency, jitter, throughput, and loss. A lot of this terminology has come from ATM networking, which was designed from the very beginning to support multiple classes of service (e.g., unspecified, constant, and variable bitrate services) with a range of QoS attributes (e.g., latency, delay variation, cell loss, and peak and sustained cell rate). However, in the industry these terms are used rather loosely.

Some would argue that "throwing bandwidth at the problem" could alleviate the need for QoS mechanisms. For example, connecting workstations in a campus environment through high-performance Layer 2 and 3 switching running over Gigabit Ethernet or ATM is allowing IT to get ahead of the demand curve. However, even when bandwidth seems to be in high supply (as in campus networks), there is a need to address

congestion and failure modes, as well as need for mechanisms to defer potentially costly upgrades to add bandwidth. And, of course, the WAN is an environment in which bandwidth is hardly abundant at little cost.

The IETF, the international standards body for IP networking, has embarked on two initiatives to take IP beyond the best-effort modus operandi:

(1) The Integrated Services (IntServ) initiative was the first response and included the definition of three classes of services: (a) best-effort class; (b) guaranteed service class with bandwidth, bounded delay, and guarantees of lossless operation; and (c) the controlled load service which approximates the best-effort class in a lightly loaded network. The IntServ architecture included the specification of the Resource reSerVation Protocol (RSVP) which was both a way for an application to specify what it needed and a way for routers to allocate network resources to the application flow to meet the requested performance requirements.

IntServ suffers from a number of drawbacks. Scalability is limited because each router along the path has to maintain and manage state information for each application flow crossing the network. In addition, because IP is connectionless in nature, RSVP requests have to be reissued periodically to reconfirm or reestablish network resource allocation—a very processor-intensive activity. In addition, RSVP is not well suited to shortlived flows, which constitute a significant portion of IP traffic. The result is that IntServ is more of a small network solution, although RSVP will likely remain as one way for applications to signal their needs to the network, particularly

for demanding applications such as high-quality video transmissions.

DiffServ (Differentiated Services) is under development and offers a simpler framework for IP QoS. A major distinction is that no per-flow state signaling is specified, significantly enhancing the scalability of this approach. Furthermore, not only does this avoid the need for per-flow state information per router, but aggregation of traffic belonging to a particular class is also supported. An important advantage of the DiffServ architecture is that incremental deployment is possible since not all network devices along the path need to be upgraded for users to achieve some of the IP QoS benefits. Rather than relying on signaling mechanisms such as RSVP, DiffServ relies on the use of the previously unused type of service byte in the IP header (relabeled under DiffServ as the differentiated service or DS field). Initially, two service classes are being defined: best-effort and expedited forwarding.

IP packets with similar QoS requirements are handled at each network node by a series of queues, one per QoS class. Queue management governs how the various queues are serviced across the available bandwidth. A number of scheduling options exist. Priority queuing results in higher-priority queues being totally emptied before serving lower-priority queues. Weighted fair queuing serves all queues in a fashion such that each queue is given a weight that determines the share that a given gueue gets of the available bandwidth. To be effective, the length of the packets must be taken into account. A further refinement is referred to as hierarchical classbased queuing, whereby traffic sub-classes are defined which share a portion of the available bandwidth. These schemes are progressively more sophisticated and are therefore implemented in hardware to operate at the required speeds.

The above queue-management techniques deal with handling of packets as they exit each node in an uncongested network. We can call these emission priority handling. In real-world networks, congestion takes place due to unplanned demands or network failures. The solution of adding buffering is not only expensive but leads to potentially large delays and unacceptable delay variation (also called jitter). Once buffers overflow, packet loss results, leaving packet retransmissions to end-toend protocols such as TCP. However, while waiting for buffers to overflow may eliminate the congestion, it also has a dramatic effect on TCP traffic. This has been solved by randomly discarding packets when queues start building up but prior to buffer overflow. Weighted random early discard (WRED) applies the same strategy but enhances it by recognizing that the discard priorities for the different classes of traffic should not be the same.

Policy-Enabled Networking

Providing preferential treatment for certain applications and users is a key requirement now being addressed through the addition of switch-level QoS capabilities. However, while this is necessary, it is not sufficient. In order to manage the allocation of resources in those parts of the network for which over-engineering is not practical, a structure of networkwide control mechanisms needs to be established to ensure that the "right" applications and end users have access to network resources. This is the role of policy management. Policy management is an implementation of a set of rules or

policies which dictate the access and use of resources on a per-user, per-application, or per-company basis to meet established business objectives. It is essentially focused on providing end-to-end QoS (bandwidth, latency, priority) and security (authentication, authorization, auditing). Policy-enabled networking provides the enterprise with a simple, unified solution to better meet business needs. The key elements of policy-enabled networking include policy servers and directories and policy-enabled switches.

Advanced directories provide a logically single, global directory of policies, user information, network configuration data, and network addresses. Policy servers are responsible for gathering all of the relevant information, making a decision based on the administrator's policies, and then communicating that decision to the network via a policy transaction protocol. The goal of the policy server is to develop a response to an application/end-user networking need, consistent with the policy, retrieving other data such as network availability or utilization, time-ofday, or service-level-agreement (SLA) information as appropriate. The response is transmitted to the policy enforcement device (e.g., a switch/router) using a policy transaction protocol such as COPS, SNMP, or CLI. Policy servers and directories are integrated into the network management system, but are, in fact, more tightly linked with real-time network-level functionality than, for example, other network management functionality, such as configuration management.

Each device along the traffic's path individually ensures that application QoS requirements are met and that the policy is enforced locally, relying on a policy server to

coordinate the end-to-end policy. In the ideal world, applications will all indicate their requirements using DiffServ, IntServ, or IEEE802.1p protocols. However, most current applications are unable to do this. Therefore, application awareness is built into Intelligent Layer 2 switches at the workgroup level, routing switches at the campus level, and routers and enterprise network switches at the WAN edge level. Configuring each switch is cumbersome, and therefore policy management is provided to provision, enforce, and audit the right network behavior.

A high degree of configuration flexibility is a must in any policy management environment. For example, for those portions of the network in which bandwidth overengineering is a viable option, the value of comprehensive QoS capabilities may have diminished value. In addition, the existing switched infrastructure (i.e., at the workgroup level) may not be policy-enabled. These examples illustrate the need for configuration

Policy-enabled networking ensures that the highest availability (even under failure conditions) is provided to business-critical applications, simplifies operations by providing a unified directory environment, and generally lowers the total cost of ownership by making the best use of available bandwidth.

flexibility allowing policy and QoS functionality to be deployed in the network in a controlled, as-needed fashion. Flexible movement of intelligence for policy-enabled networking is provided. For example, QoS and policy enforcement can be flexibly configured at the workgroup, campus, or WAN edge levels without a price/performance penalty.

At the directory level, disparate physical directories (which have typically emerged over time) are linked into what is, in effect, a single, global directory. This logically centralized directory has the ability to be distributed (avoiding the need for a megaserver), replicated (improving performance), and partitioned (isolating more secure information). Policyenabled networking can eliminate the need to throw more bandwidth

at the problem as traffic grows. Policy-enabled networking provides an environment in which application performance can be provided while supporting business-driven controls to manage network resources. While the emphasis here has been on QoS, these same policy management capabilities apply to managing security in an enterprise networking environment. Policy-enabled networking ensures that the highest availability (even under failure conditions) is provided to business-critical applications, simplifies operations by providing a unified directory environment, and generally lowers the total cost of ownership by making the best use of available bandwidth.

Some Final Words

Going beyond best-effort networking is critical to meet enterprise networking needs for both data and emerging multimedia applications. DiffServ is perceived to be the most widely applicable new standard, although other schemes will be supported at the network edge. Policy management is a key element of the solution, providing the management tools to control which users and applications get preferential treatment in the network. These developments are necessary if IP is to meet the vision of integrated IP and application-optimized networking.

Tony Rybczynski is director, strategic marketing and technologies, in Nortel Networks' Bay Networks Group in Ottawa. He has over 26 years' experience in various forms of packet switching and writes for a number of trade magazines. Reach him at tonyryb@nortelnetworks.com.



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The Politics of

Convergence

by Michael A. Palladino and Laurie Cousart

Convergence is fast becoming a reality. In "bleeding-edge" environments, data, voice, and video traffic already travel on a single set of wires on a single network. In the foreseeable future, this convergence of separate technologies will be commonplace on many college and university campuses. For institutions to remain competitive academically, in research activities, administratively, and financially, they must stay as close to the leading edge with converged technologies as possible.

To prepare your communications department for this major technological revolution, many changes are necessary. In an article entitled "The Synergy of Network Convergence and the IP Infrastructure" in the ACUTA Journal of Telecommunications in Higher Education (Spring 1999),

Doyle Friskney discusses infrastructure, business, and organizational changes that are required.

Communications professionals will be busy in the coming years with the technical aspects of convergence, according to Friskney. He says that to establish the necessary infrastructure, the following initiatives must be accomplished:

- Develop a plan to deploy network-based voice, data, and video services.
- Propose a funding strategy.
- Establish a partnership with a multi-services IP network vendor.
- Deploy a high-speed backbone that supports some quality of service.
- Install switched Ethernet to all end users.

- Establish a campus network directory or naming-services strategy.
- Merge all computing and communications responsibilities into one organization.

The last of these initiatives merging all computing and communications responsibilities into one organization—deserves, perhaps, more consideration than it has received. Without minimizing the massive effort necessary to achieve technical convergence, if this political or organizational convergence is not achieved simultaneously, the total effort will not be as fruitful. Even where these groups have come under one management organization, the service delivery to the customers has not always been fully integrated for optimal efficiency. Also,

Without minimizing the massive effort necessary to achieve technical convergence, if this political or organizational convergence is not achieved simultaneously, the total effort will not be as fruitful.

a newly merged department may not yet be positioned strategically to take full advantage of the emerging technologies.

Background to Convergence at the University of Pennsylvania

The University of Pennsylvania is a large urban campus located in West Philadelphia's University City neighborhood. Approximately 7,500 students reside on campus, and another 7,500 students, faculty, and staff reside in the surrounding community. The voice network supports 25,000 Centrex and 15,000 voicemail users. The data network supports over 15,000 off-campus users with a 1,000-line modem pool and over 25,000 oncampus users with over 30,000 IP addresses. Approximately 50 percent of these IP devices are attached to the network via switched Ethernet connections. The video network supports nearly 10,000 users predominantly in oncampus residential housing. This network provides over 60 channels of programming, including satellite, off-air, and local-origination.

The University of Pennsylvania health system has its own data, voice, and video departments. Their voice network supports over 12,000 users and has 5,000 voicemail users. The data network also supports 12,000 users, and the video network supports more than 1,000 users. There are also more than 150 satellite clinical care facilities that, when fully integrated with the main Health System network, may include as many as another 5,000 users.

Penn's Current Situation

The university's data and voice groups have separate management and organizational reporting lines. Penn's networking group (ISC Networking) reports to the vice-provost for information systems and computing and then jointly to the provost and to the executive vice president. ISC Networking was created in 1985 and is responsible for the data network, services (e-mail, Web, Netnews, etc.), systems, and engineering of the video network.

Telecommunications for the university reports to the vice president of business services and then to the executive vice president. The modern group was created in 1984 in response to divestiture and is responsible for administrative and residential voice communications and voicemail and oversees a large off-site Centrex system.

The health system's networking group reports to the chief information officer and then to the CEO responsible for the data and video networks. The health system's telecommunications department reports to the associate vice president for facilities and then to the senior vice president for hospital operations, who is responsible for voice communications, voicemail, and a large call center. Adding to this overall complexity, some schools manage their own data, voice, or video networks, data and video servers, and data and voice switches.

Many of these groups have parallel networks and use separate wires and often separate wiring closets. This grew out of different demands of the underlying networks, which were developed at different times and offered as services by different groups of people. Since they are separated organizationally, the voice, data, and video departments have multiple help desks, databases, and billing systems. They do separate purchases and have different funding strategies. They have different goals, missions, and strategic plans. This separateness can result in operational inefficiencies. Each group—although it may try hard to consider the other when making decisions—ultimately does what is in its own best interest.

Conditions for Progress

Several obstacles have prevented Penn from implementing a converged network or a full integration of data, voice, and video signals over a single network:

- 1. There is not yet a technical solution that is possible or costeffective.
- 2. Many infrastructure upgrades (conduits, fiber-optic cable, electronics, etc.) will be necessary.
- 3. A single strategic plan and a single funding strategy are necessary.
- 4. To prepare for the technological changes that come with convergence, it is important that all of the groups responsible for delivering data, voice, and video services are themselves integrated.

This proposed new unified group would be able to optimize service delivery to its customers and position itself technically for the delivery of integrated services in the future. However, before Penn can discuss (or, at least, while it discusses) technical convergence, it must deal with political and organizational issues and begin to bring together six groups managed by four separate entities: Health System Data and Video, Health System Telecommunications, University Telecommunications, and University Data and Video. The schools managing their own networks, servers, and switches must also be brought into the discussion.

Issues

Several financial and political issues need to be addressed before Penn's computing and communication responsibilities can be successfully merged.

We must identify and resolve existing cross-subsidies from telecommunications to other groups and initiatives not related to communications. Sources of this revenue—the margin between the cost of telecommunications services and prices charged to end users—are beginning to shrink because of increased market competition, growth of alternative communications methods (e-mail,

cellular, voice-over-IP), and changes in the regulatory environment. These trends are expected to accelerate. Any surplus revenues should instead be earmarked to replace aging infrastructure, offset costs of new telephone equipment, and develop new service offerings to support the academic and research missions of the university.

The resources associated with merging the two groups successfully will be significant. The director of telecommunications and the executive director of networking will direct these activities and serve as "change agents." Additional support resources will be needed to obtain benchmarking data, seek input from our customers in the schools and centers, and develop and implement the restructuring.

The reorganization and merger is expected to achieve efficiencies in business process and customer service and may reduce the cost of purchasing equipment and services. Any savings in these areas should be reinvested to support the new and emerging technologies that will be important to maintain our competitive edge in information technology.

Why Converge?

Given the massive effort necessary for technical and organi-

- zational convergence, why should we bother? Aren't we already extremely busy? There are many reasons for considering convergence in addition to remaining competitive. We envision some immediate opportunities arising from the proposed combined voice/data organization, including the following:
- Potential cost savings and cost avoidances in equipment purchases, labor contracts, and management of voice, data, and video network facilities. These savings should occur by leveraging the sizes of contracts and purchases and eliminating redundancies. It should cost less to aggregate multiple contract employees from different vendors under one large master agreement. For instance, it might be possible to get "free" Internet connectivity if it is part of a multi-million-dollar contract for long distance service. Conversely, will long distance be "free" on IP networks?
- Cost savings and operational efficiencies. Similar functions, such as management of all infrastructure (backbone fiber, feed cable, and conduit) could be consolidated. All planning, installations, and maintenance support could also be

Since they are separated organizationally, the voice, data, and video departments have multiple help desks, databases, and billing systems.... Each group ultimately does what is in its own best interest.

unified and simplified. There should be process and service improvements like a single point of contact for order placement; moves, adds, and changes; and reporting trouble calls. A single financial group might be established for billing and asset management. Even if no cost savings are realized from this, there would be benefits to customers. It should greatly simplify their efforts in requesting services and understanding their bills. Process savings could accrue to customers as well as to the central group.

• Improved ability to track and support new and converging technologies. Truly merged data, voice, and video departments will have staff that will think about the integration of technology delivery. They will think outside of the box. They will relish projects that once

used multiple technologies and now use the IP network: automatic call distribution, unified messaging, cellular offerings, network fax, digital video, and voice-over-IP. As Friskney says, these groups must prepare now by designing infrastructure to handle integrated services. However, they must also prepare now by delivering better support for services using integrated technologies. This can only begin if one organization is responsible for the entire backbone network of conduits, feeds, cables, closets, risers, wiring, and faceplates.

• Merging the staffs should leverage our institution's existing strengths. We expect that merging voice, data, and video departments will make the new unified organization better. The networking group will benefit from the strong customer service skills of the voice

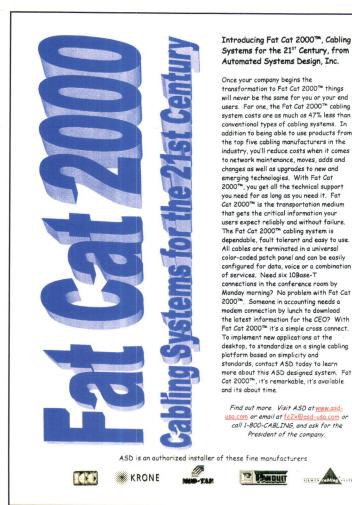
group. The engineering staff in the networking group will assist in technology forecasting and research and development activities. The voice/data group should build new strengths to respond to changing customer demands and technologies. Cross-training in services and devices will bring about new and exciting synergies. New business opportunities should emerge by combining the highly talented technical, management, and leadership staffs in the two organizations.

• Increased ability to retain and attract new staff interested in emerging technologies. Current staff with the right attitude will be inspired and revitalized. Rather than fearing convergence, they may see opportunities to become more valuable as employees and advance their careers by acquiring new skills.

There may be some other emerging services that are possible. The university's data group has a team working on institutional collaboration with Philadelphia area schools. Some of the services that could be provided include Internet and Internet2 connectivity, long distance, and local bypass.

We've Already Started

The staffs of the university and the health system have been working cooperatively for over a decade despite organizational differences. Data and voice groups at the university have jointly developed specifications, completed infrastructure projects (such as ResNet), and created a single wiring and project-management group. The telecommunications groups cooperate on common Centrex, long distance, and cellular contracts. The two data groups work together on strategic planning and standards, as well as day-today tactical planning.



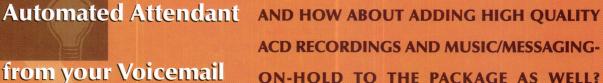


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The schools use the wiring and project management groups, and nearly everyone uses the technical specifications that were developed by the university's data and voice groups. There is good coalition building and strategic planning since there are campus-wide planning committees that include most of the campus communications groups. At Penn, convergence is not just about data, voice, and video; we partner and plan with Campus Security for alarms and CCTV, with Facilities for environmental controls, and with the Campus Card staff for access and point-of-sale card readers.

Recommendation/Plan

Given the overwhelming evidence in support of convergence, why hasn't Penn begun to integrate its various computing and communications responsibilities into one organization? Historical, financial, and political issues have held us back. Our expectation is that these issues will be addressed very soon. The executive director of networking and the director of telecommunications are empowered to initiate and manage this transition and have embraced this opportunity by proposing action steps to move us ahead.

The recommendations include combining the university voice and data groups and then reorganizing for various operational and strategic efficiencies. Our intention is to seek staff and customer input to see what works and what could be better. We will do benchmarking internally and externally; search across both groups to understand the customer interface, financial models, and backbone facilities; and seek new synergies and opportunities. We will involve the university community and incorporate feedback, comments, and suggestions. It is our desire to begin implementing the recommended changes and be restructured and under the new organization and management within a year.

Positioning/Conclusion

If the data, voice, and video departments at your institution are merged (or even if they're not), there are several steps you can follow to position yourself for convergence in the future. This may also serve as a blueprint to building a successful organization.

- Prepare for convergence. Plan for it technically and organizationally. Do not ignore the politics. Look for hidden reasons why convergence is not happening at your institution.
- Do a strategic plan. At Penn, we developed "PennNet21," a technical white paper from which to develop business plans and strategic plans, and which provides a framework for tactical day-to-day planning, designs, and installations (see it at http://www.iscnet.upenn.edu/PennNet-21/p21contents.html).
- Set priorities. Resources are limited. Do only what is important and stop doing what is not strategic or does not fit into your overall plan. Eliminate legacy systems such as asynchronous and repeated connections, electronic key systems, Appletalk, and IPX.
- Establish a funding mechanism. For the university's data group, the network planning task force has proven to be a very successful forum through which we discuss the never-ending tension between increasing services and decreasing funding (see http://www.upenn. edu/computing/group/nptf/NPTF2-8-99/index.htm for details on our latest "State of the Union").
- Establish partnerships with key vendors. Penn is partnering with Qwest, MCI, Bell Atlantic, and 3Com.

- Upgrade to high-speed network backbones, a high-speed routing core, and large bandwidth Internet and Internet2 connections. Upgrade your entire wiring plant to CAT5 and move to all switched electronics.
- Build coalitions with other campus communications organizations. Penn's data, voice, video, campus card, facilities, and security groups all work together to solve technology issues and deliver solutions.
- Initiate joint strategic planning, establish joint standards, and do joint purchasing of equipment, supplies, and facilities.
- Look for opportunities—both externally with your vendors and internally with other service organizations and your customers.
- Position yourself and your staff. Send your data staff to telephony meetings, conferences, and seminars. Send your voice staff to networking meetings, conferences, and seminars.
- Become the change agents—if necessary—to help move your organization to a truly merged and converged environment, both technically and organizationally. Get past the politics of convergence to position your institution for the challenges that lie ahead with the technical, financial, and administrative issues.

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Computer Telephony Integration

Second Edition Author: Rob Walters

Artech House, 1999: 462 pages

Reviewed by Bill Brichta

There's nothing new under the sun, or so we hear. Innovation does not always produce an original invention, but may be the result of discovering a special synergy between two devices or technologies someone else sweated over to create. Computer telephony integration is just such a discovery.

In his book on CTI, Rob Walters discusses the history that led to the creation of the computer and telephone integration products of 1999. He also describes the necessity behind this invention the "what ifs" that led to a consideration of the possibilities and fostered the development of CTI.

Although some of the chapters in the book can be a little tedious, they will be useful if you really want to understand, from every technical vantage point, how true CTI really occurs. The text provides a solid grounding in how to think of CTI applications and why that should matter as our jobs, responsibilities, and organizational demands continue to change. The discussion of unified messaging and how the server and architecture work together to deliver this application is a good example. Besides just diagramming the pieces that need to coexist properly for the application

to work, Walters also explains all the limitations.

Equally impressive is how thoroughly the author enumerates and documents in table form all of the current products by vendor and by category. For those who need information on new CTI products and their strengths and weaknesses, the text likely has at least one reference to assist.

Several of the chapters-Integrating the Two Worlds, The Computer and Telephony Environment, Integration Technology, and Media Processing Technology mainly serve as a primer for the really innovative ideas that follow. The chapters on Application Elements and Creation, Applications and Case Studies. The Market for CTI, and Merging on All Fronts illustrate what is realistically possible with CTI and where that might fit at your university.

Additionally, since the author's approach is to build from the ground up for the novice on the subject, the reader does not have to understand how CTI works going into chapter one. Using fairly simple examples, Walters explains how to understand the mechanics. At times the material comes across much like a programming textbook and is occasionally dry. Fortunately, there are numerous examples to explain nearly all of the concepts. There are also abundant diagrams, as well as a glossary of CTI terms in an appendix.

A number of case studies deal with how to think about CTI efficiencies in your operation, which is the major benefit I see in this text. After reading the examples of CTI applications and industry cases Walters includes, you might even see other possibilities that have not been considered.

Thumbs up

At a minimum, this book will serve you well if you are approached on your campus with a question about CTI and what the switch can and cannot do. It goes beyond an adequate introduction of the subject, and will allow you to speak authoritatively when those questions are asked or at least serve as a good resource in your department's library. The likelihood that CTI opportunities will increase makes this book worth the purchase price.

Bill Brichta directs the communications planning and operations of Information Resources, Lehigh University, Bethlehem, Pennsylvania. He has served as an ACUTA director-at-large for the past two years.

Pursuing the Promise of the Paperless Office

Document imaging and networking merge to enhance business operations and customer service at Ball State



by Ron Kovac, PhD

The paperless office has been an elusive promise for decades. In reality, we have seen the opposite. Although computers have helped immensely with structured data—helping sort and maintain electronic files of student records, payroll figures, and the like, the growth of unstructured data (paper documents) has actually increased. Document imaging and management (DIM) may bring substance to promise at last.

DIM is the latest advance in record management and knowledge management aimed at unstructured data. At one time photocopying and filing documents in folders stored in file cabinets constituted good records management, but problems with this methodology abound: storage issues, manpower, placement and misplacement of files, time and energy required to shuffle paper, and more.

To remain competitive and meet regulatory guidelines in today's fast-paced business world, we must be able to maintain and retrieve records and information effectively. Many organizations are looking to DIM systems to increase their efficiency while providing better customer service. Although microfiche, microfilm, and photocopied documents contain a wealth of data, the static format renders that data inaccessible for all practical purposes. Imaging documents makes them readily available to users when customers request information and also to management personnel who are planning for the future.

How is DIM Accomplished?

DIM scans paper documents and converts the information into a digital format. Once digitized, the documents are stored using indexes or keywords that assist the user in document retrieval. DIM requires only one handling of paper documents, structures the documents easily for all to access, and makes distribution as efficient as e-mail.

Basic technical system requirements include the document management server, the campus network infrastructure, and the client. For most packages the document imaging server consists of a Windows- or NT-based PC running the DIM server software. An extensive amount of storage is required for images. This is usually provided for by RAID (redundant array of inexpensive devices) hard disk storage and a jukebox. Similar in concept to the classic 45 rpm jukebox at the local diner, the optical jukebox is able to read and write optical images to 5.2-inch disks and has almost unlimited storage capacity. Ball State University required, as part of its RFP, the maintenance of the past three years of data online which required a jukebox large enough to store this data.

For the network infrastructure, the university used its existing 10/100 MB Ethernet network to distribute the images to all neces-

sary parties within the university. Because of compression algorithms present in the software (in this case TIFF 4), the addition of DIM into the university environment put minimal added strain onto the network.

At the user end a few items are necessary. The DIM package we selected required only a 133-MHz-based PC, so no upgrades were necessary. The next item necessary was a scanner, which is used to put additional documents into the system at the unit level. The third item was the client software. The document images and DIM software can be accessed either via the Web or a specific client software piece, depending on the user and his or her requirements.

The University Need for DIM

The seeds for DIM started at the unit level within the university. Numerous units, independently of each other, began feeling the pressures of the weight of paper documentation and had simultaneously developed goals which called for increasing efficiency and customer service.

In the Registrar's Office, for example, past student records and transcripts were kept on paper-based transcript cards. Each time a potential employer called for information on an official transcript, staff had to go to the vault, pull the file card, photocopy it, emboss it, and send it. This was a very time-consuming and labor-intensive process. Similar needs and frustrations were found in the Foundation Office, which maintains records on past donors and makes them available to other departments.

One enterprising unit wondered if other units were having similar problems and developed a survey to determine how widespread the

paper problem was. Five units (Registrar's Office, University Relations, Business Affairs, Human Resources/Payroll, and University Computing Services) responded that they were each beginning to look at DIM. A university-wide committee was formed to develop a common solution based on the identification of common goals and the completion of the RFP process. The committee was to be chaired by University Computing Services (UCS) as it was felt that UCS would need to provide the physical infrastructure (PCs and network), technical know-how, and technical support for the units.

Looking for a Solution

After reviewing the charge, the committee developed a set of common goals, derived from unit as well as university needs, which the DIM solution was to meet:

- Provide a common platform and software for all units.
- Simplify workflow to improve efficiency and customer service.
- Provide a Web interface to all images.
- Be scaleable to meet current and future university needs.
- Be, as far as possible, a non-proprietary solution.
- Operate in either a centralized or decentralized mode.

Additionally, preliminary "scope and scale" figures were developed to assess the system's size. This data was derived from reviewing past paper workflow situations and making educated projections for future initiatives.

Each department determined which of its documents could be scanned in order to reduce paper storage. The total number of

documents to be scanned from each office was considerable:

Bursar's Office 36,000
Student Aid Finance 44,820
Payroll/Emp. Benefits 74,765
Human Resources 20,800
Scholarships/Finan. Aid 118,275
Admissions 126,500
Student Records 13,500
Registrar's Office 91,700
Vault
Univ. Development 4,650
Univ. Foundation 82,400
Total 737,810

Because the university lacked (and had no interest in developing) expertise in DIM systems, the RFP also called for complete turnkey installation, maintenance, support, and retro-conversion of the thousands of existing paper documents. The strategy was to get all accumulated paper records onto the system and train personnel without undue burden on university staff.

The RFP also specified that electronic images were to be delivered via a Web interface to the users. BSU currently has a wellsupported and maintained network infrastructure using TCP/IP, and this strategy was chosen to capitalize on this infrastructure and minimize costs. This strategy could also allow for further expansion of the image-based information to faculty, students, and outside parties without major change and with minimal support. We received eight responses to our RFP, which was published in early 1998 with review scheduled for summer of 1998.

After the committee reviewed the bids, four finalists were asked to present their solutions and answer specific user questions. The presentations included hands-on demonstrations of the software engine and explanations of the

vendor's package of support, turnkey installation, maintenance, and retroactive conversion.

Preliminary Analysis of Results

The DIM system is currently operational within four units at the university, and the feedback is extremely positive. The following is a sampling of the noted observations:

- Customer service. The ability to service customer needs and the decrease in rote activity are being welcomed. For example, transcripts no longer require 24-hour turnaround.
- Staff morale. What was once thought of as a job replacement tactic is now viewed as a better way to do business. Less rote and repetitive clerical activities are making the staff feel more valued and empowered. The only noted downside is the lack of exercise: now all tasks can be performed from the desktop.
- Storage space. Different units have different requirements for record storage, but feedback points to at least a flatter curve for storage growth. Reductions are more often seen in local storage, with more material going to off-site storage or for destruction.
- Record salvage. In the Registrar's Office records from the 1930s and before were beginning to deteriorate from the acid content in the paper and the glue used. Imaging the document inhibits this due to the decrease in paper handling.

Lessons Learned

Although each site installation had its own unique attributes and characteristics, there were more similarities than differences in the document imaging implementation. Some of the lessons learned include the following:

- Clear vision of the goals. Without a clear vision of what you are seeking, you will never obtain the goals. This vision needs to be articulated and validated by all parties involved (to include all unit heads, staff, and administration). The vision needs to be strategic (e.g., to reduce workflow time by 50 percent, or to reduce storage needs by 30percent) and tactical (e.g., the imaging of all donor records in order to decrease dissemination time and labor).
- Willingness to change. If any of the people involved are resistant to change, the implementation of document imaging will be difficult if not impossible. Document imaging involves rethinking workflow, daily procedures, and staff functions. Everyone must commit to the change to realize the efficiencies and effectiveness that DIM provides.
- System thinkers. We can all get caught up in the details of our own positions and fail to see the total cycle of a job. Our customers certainly see this as delays and inefficiencies. People who have the vision to see all parts of the job function and who can fairly analyze tasks are essential.
- Managing the present and planning for the future. In order to properly state the RFP, a sizing of the DIM system must be done. Questions arise such as: How many documents will we image? What color, size, and type of paper do they arrive on? How far back do I need to retrieve the documents? How long is it acceptable to wait to retrieve the document? In addition, after reviewing past data to look for trends and anticipating coming initiatives, estimates of the system requirements must be made for the future.



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 Understanding the technical parameters of and for document imaging. The RFP writers must first understand the technological infrastructure that the DIM system will ride on. This includes the network parameters, server infrastructure, PC capacity, and technical education. Additionally, an understanding of the unique document imaging language and processes must be achieved in order to write, evaluate, and implement DIM properly. Concepts such as online, near-line, workflow analysis, indexing, and fundamentals of scanning must be understood. Usually this means including on the selection committee a member of the university computing services group and a consultant for DIM training.

What the Future Holds

Although predicting the future is always risky, some themes are obvious from the feedback we obtained at Ball State. All the departments using DIS are now seeing applications beyond their original goals. A common document imaging system has opened up opportunities for integrated applications (between unit tasks). In addition, we have seen a scaling factor whereby increases in workload have not necessarily meant increases in operating costs.

There are also some fears for the future:

- (1) The implementation of document imaging is a no-return movement. It would be extremely difficult, if not impossible, to go back to paper. This means the vendor and the product must be industry standard and open architecture.
- (2) Currently, in the state of Indiana, the legality of a document image is the same as for the paper

document. This should not change; but if it does, the initiative is thwarted. With the DIM annual growth rate at almost 100 percent and given the immediate and longterm gains, both of these fears appear mitigated.

Getting Students Involved

Although DIM is being targeted at the administrative units within the university, this does not stop pursuit of the educational mission. Within the Center for Information and Communication Sciences program, a course is taught in

This early pioneering effort at document imaging was clearly targeted at the administrative environment, but with a little thought and creativity, the same tool can aid immensely in the educational mission.

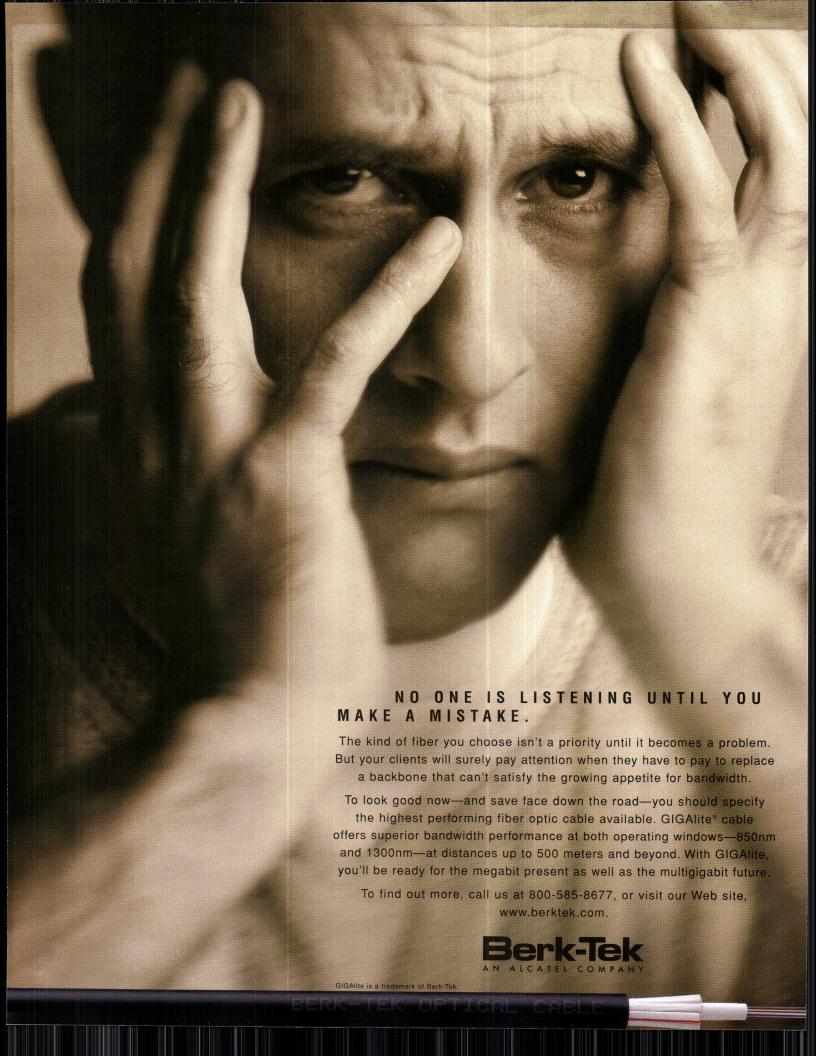
document imaging and management. In the fall of 1998, this course used the university's initiative and RFP to review the DIM field. In order to learn how DIM worked, students were assigned to put together a working prototype and a business plan for a document-imaging application within the university. This project provided students with a comparative understanding of the advantages and limitations of available technologies for electronic image processing and introduced the students to the process of imaging

and its relationship to corporate America. The prototype involved using the selected DIM software with the Human Resources Department to develop an easier workflow for the plethora of resumes received for job postings.

Conclusion

From the annual growth rate of the field, it appears that DIM is here to stay. The promise of a paperless office has been a long time coming, but without control of the unstructured data within an office it is not possible. DIM provides this control and manipulation. One of the real keys to the recent growth has been the acceptance of the network infrastructures and Web interface, which have decreased the cost of implementation for DIM and capitalized on the existing information infrastructure. Although the university environment may not have the overly burdensome paper flow typical of the medical field, the higher education community is not without its forms, receipts, documents, and mail. This early pioneering effort at document imaging was clearly targeted at the administrative environment, but with a little thought and creativity, the same tool can aid immensely in the educational mission. The product of our electronic world and generation may ultimately be the realization of the paperless office.

Dr. Ron Kovac is a professor in the Center for Information and Communication Sciences at Ball State University and was the instructor for the document-imaging class mentioned in this article. Reach Dr. Kovac at rkovac@gw.bsu.edu.



New Visions for University Cellular Services

by Stu Warford

For the last several centuries, education has been centered around concepts related to the art and tasks of teaching: the classroom, the authority and expertise of the professor, and the needs of the university. As we move into the Information Age, when the volume of information is expanding exponentially, we see a shift in the thinking of education's visionaries. Current educational philosophies hold that education, in order to remain viable, must transform itself to attend to the needs of the student and the process of learning, as opposed to teaching. According to this philosophy, education must be provided in a form that makes sense to the student. That is, it must:

- be provided geographically where the student is (as opposed to in a classroom);
- be provided "on demand" when the student needs it (as opposed to according to a schedule established by the institution);
- be respective of the background and experiences of the student (rather than assuming that students must experience all lectures); and
- represent a shift in the faculty role from the knowledge expert delivering topic content to mentor providing learning guidance.

Concurrent with this shift in strategy, in many institutions there has been a clear indication that an emphasis in information technologies needs to be anytime, anywhere access to computing and educational resources. This emphasis stresses that students, faculty, and staff need to be able to access institutional resources without regard for the time of day or the day of the week, and that they should be able to gain access not only from traditional locations on campus, but from home or offcampus office locations, or while on the road. To facilitate this transition, faculties are being asked to be available to meet the needs of students and co-workers on a more flexible basis, including time outside normal classroom periods. Obviously, an educational philosophy such as this can benefit from various data and voice technologies.

Pepperdine University, serving 7,500 students in five colleges on six campus locations in the greater Los Angeles area, is a Christian, liberal arts university. Based on its Christian heritage and traditions the university honors the teaching and learning traditions, and overtly encourages students and professors to personally interact in the educational process. This emphasis on personal interaction is a hallmark of the university's character.

As a further expression of this character, the university is looking at strategies that will provide a "virtual office" environment, where faculty will be available to students even when not in the office. Technology which facilitates this is important to the university.

To address some of these needs. Pepperdine interviewed several cellular companies in search of a partner to collaborate on innovative and unique services which would

support this anytime-anywhere, virtual-office concept. It was important that the company we selected be able to do the following:

- · Provide basic cellular services in the greater Los Angeles area, where the university's six campuses are located.
- Respond to the challenges of the university main site in Malibu, California. This campus is geographically remote and situated on hilly terrain. Basic cellular service is not available on much of the campus.
- · Show creativity and flexibility in putting together a program to meet the university's requirements. This program would consist of both technical and administrative components.

In return, the university offered the following:

- A large pool of potential subscribers. Several of the university's graduate programs target working adults in the Los Angeles basin. Many of these students, especially in our graduate business program, are experienced decision-makers in their own corporate workplaces.
- Willingness to negotiate creative solutions to such problems as credit checks, billing, and collections. Specifically, the university was willing to assume some of the billing operations as well as any bad debt for university subscribers.

Another obvious benefit to the cellular vendor would be the potential positive press that would accrue to this program based on the creative solutions that were put in place.

Most of the interviews were generally disappointing, with vendors simply offering their basic corporate and/or affinity plans that they traditionally offer to other

corporate customers. We were particularly disappointed with the potential of having different programs for different groups of people. For example, some cellular vendors proffered one program for alumni, a different program for students, and still another program for faculty and staff. Each of these programs would feature different rate structures, different terms and conditions, and different marketing and billing options. This approach appeared to be overly complex and would simply lead to confusion for both the telecommunications staff responsible for marketing the programs and potential subscribers. We would first have to determine what group a potential customer belonged to before being able to explain the program terms and conditions. This would be further complicated when servicing a customer who belonged to multiple groups, such as an employee who is also a student.

For each of the vendors we interviewed, we stressed the need for a creative, innovative, and flexible approach to our requirements. Of all the vendors, AT&T Wireless Services (formerly LA Cellular) appeared most interested in responding to our requirements. Together we worked on a program with the following components:

A Single Plan

A single-plan approach would allow us to market to all potential customer groups with a single marketing strategy, including ad campaigns, collateral material, and campus kiosks. However, there are multiple customer-selectable rate options in this single-plan approach. Subscribers can choose from the following rate structures:

 An analog plan for a basic monthly fee with no "included

...[S]tudents, faculty, and staff need to be able to access institutional resources without regard for the time of day or the day of the week, and they should be able to gain access not only from traditional locations on campus, but from home or off-campus office locations, or while on the road.

minutes." This plan is available for those who do not wish to upgrade their older analog phones. The price of this plan is structured specifically to discourage participation in the plan, as the cellular industry is motivated to convert existing subscribers to the digital network that features larger capacities.

- A SmartDigital plan that features a basic monthly fee and no included minutes.
- Several included-minutes plans that use SmartDigital technology. Included-minute plans feature a flat monthly fee and a pool of minutes that can be used within a month. For example, one of the plans features a monthly fee and includes 75 minutes that can be used during the month with no additional perminute fees (except, of course, any long distance charges).

SmartDigital phones will search for available digital channels to service the call but will also use available analog channels if no digital service is available in the area. Calls can be successfully switched by the cellular network between digital and analog channels, even mid-call, with no intervention by the subscriber. Included in the SmartDigital plans are the following features, which are provided for no additional fee: caller ID, call forwarding, call conferencing, call waiting, messaging (alpha pager services), and voicemail.

From time to time, cellular companies offer special promotions to the public for specified periods. For example, AT&T Wireless Services will often offer 1,000 free weekend minutes to encourage subscription. Our agreement with AT&T Wireless Services provides that any such public offerings will also be made available to our own subscribers.

From a customer perspective, the Pepperdine/AT&T Wireless Services offering is attractive for several reasons:

- · All rate packages are priced about 5 percent below the street prices for similar AT&T Wireless Services public offerings.
- · Optional phone sets and accessories are available from AT&T Wireless Services at a discount, but they are generally equivalent to AT&T Wireless Services's offerings to the public. However, AT&T Wireless Services provides free installation for a phone kit that normally retails at \$99.
- This program provides free roaming throughout the state of California (where we are located), a substantial increase over public offerings.
- For those electing SmartDigital services, the program includes digital messaging and voicemail, which is typically an additional chargeable option for the public.
- A component of each subscription contributes to a student scholarship fund, and we emphasize this in our marketing efforts.

Co-Marketing Strategies

Our agreement with AT&T Wireless Services allows for a comarketing of the services. Specifically, Pepperdine provides mailing lists of alumni, donors, employees, and students to AT&T Wireless Services on a periodic basis for marketing purposes. AT&T Wireless Services also regularly places ads at their expense in various university publications, including the student newspaper and various alumni publications.

The university is working with AT&T Wireless Services to identify various locations where self-service kiosks can be located to provide point-of-sale information. Information about the program is provided

to new students in new student orientation and in new student information packets that also include student phone authorization codes and long distance calling cards.

Cell or Micro-Cell Site on Campus

Various vendors had approached the university over the years, offering a revenue stream in exchange for being allowed to place antennas on our Malibu campus. University management had always resisted such proposals unless it could be demonstrated that such antennas would contribute directly to some wireless service for students, faculty, or staff.

Because of this, language was placed in our agreement with AT&T Wireless Services that spoke to this issue. Initial engineering has demonstrated that the placement of a cell on campus would not aid

any nonuniversity areas in the Malibu area. This is disappointing because, as a result, the expense of a cell site or a micro-cell network on the Malibu campus would have to be justified in a business case based on subscriptions from the Malibu campus alone. We are currently in negotiations regarding this important aspect of the service. We have emphasized that the success of this program, especially the enhanced technological features of this program, hinges on this important aspect of basic cellular service coverage for our Malibu campus.

Local Routing of Cell Site Calls

If we are successful in establishing a cell or micro-cell site on campus, then we will also be able to intercept calls placed on the university cell site, and route them through our PBX system, utilizing

the "free" nature of on-campus calls, least-call routing between the various campus voice-WAN sites, and the competitive call costs represented by our various long distance contracts. Billing for such calls will be handled by our internal telemanagement system (provided by Pinnacle), just as if it were a normal, campus-originated call.

Enhanced Services

A strategic component of this project was to identify ways in which the service could be shaped with enhanced services to create a special "wireless office" environment for university students, faculty, and staff. Four-digit dialing and simultaneous ring have been identified as important components.

• Four-digit dialing. The university features a PBX WAN that spans four of our six campuses in the

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greater LA area. Voice T1s span from three of these campus locations to the Malibu campus, where calls are switched via two Intecom PBXs. Survivable switch components are located at two of the three remote campus locations. Inbound and outbound telco trunks are located at each of the four campus locations to provide for least-cost routing.

Calls placed into the university from outside usually require dialing a seven-digit—and in many cases an eleven-digit—number. Calls from inside the university, even from campus to campus, may be reached by dialing only the fourdigit number.

The university PBX utilizes both DID and non-DID lines to establish connections with the outside world. A DID line allows callers from outside the university to directly dial a specific customer inside the university. The following DID lines are configured on our PBX systems:

Pepperdine Extension Allocations (DID)

Range	Area Code	Prefix
1600-1699	818	501
2300-2399	310	568
2500-2599	714	223
2800-2999	310	258
3000-3999	310	317
4000-4999	310	456
5500-5799	310	568
7200-8199	310	317
	1600–1699 2300–2399 2500–2599 2800–2999 3000–3999 4000–4999 5500–5799	1600–1699 818 2300–2399 310 2500–2599 714 2800–2999 310 3000–3999 310 4000–4999 310 5500–5799 310

We have been able to work with AT&T Wireless Services to provide four-digit DID dialing through their network and, by extension, through the AT&T national cellular network. This means that from any remote location-Malibu, Dallas, or New York—a subscriber can complete a DID call by dialing just the four-digit campus number. This makes it especially easy, for example, to check voicemail from off campus by simply dialing the

same four digits you would use while on campus.

This capability was a software feature provided by the AT&T cellular network at no additional capital expense. Pepperdine provided the DID mapping for the four-digit to ten-digit dialing, and AT&T Wireless Services enabled this feature on their side. There is currently no extra subscriber charge for this capability, although at some point in the future there could be a nominal charge.

• Simultaneous ring. Finally, we have been working with AT&T Wireless Services on technology that would provide simultaneous ring capabilities for any incoming call. With this feature, incoming calls ring simultaneously on the subscriber's campus phone and cellular phone. Answering either phone terminates ringing on the other. (There is no particular advantage to answering the call on one phone over the other.)

This enhanced function would require the tying together of the AT&T Wireless Services and Pepperdine phone networks. Specifically, electronics would be co-located with the university's PBX switches and matrixed with them such that an incoming call would cause simultaneous routing of the call to both phones. When either phone is answered, signaling would cancel the call on the opposite system. A database internal to the system would map a subscriber's on-campus extension with their cellular number.

Conclusion

This program is still in its implementation stages. Certainly the provisioning of adequate basic service levels on the Malibu campus is a major challenge for both Pepperdine and AT&T. In many ways this has turned out to be a

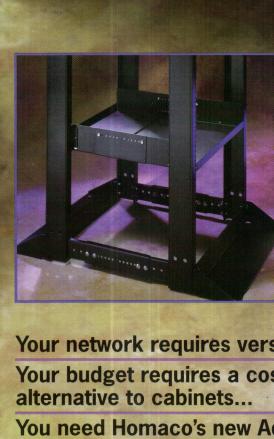
key component for a successful project. If we can solve that challenge, then the features of enhanced services, such as four-digit dialing and simultaneous ring, will greatly contribute to the notions of the virtual office. Regardless of location—dorm room, office, or out-of-town—subscribers will be able to receive calls placed to their campus extension or dial a campus number with the four-digit DID number. The differences between the campus phone and the cellular phone disappear. Wherever they are geographically, they are in their virtual office or dorm.

Such technologies, along with appropriate data services like virtual private networks, will tear down the barriers represented by distance and will pull together faculty, students, and staff to improve the dimensions of education. Stu Warford is director of telecommunications services at Pepperdine University. He can be reached at swarford@ pepperdine.edu.

Correction

On page 47 of the Spring 1999 issue of the Journal, we identified Luther Robb, the recipient of the Bill D. Morris Award for 1996, as a retiree from the University of Pennsylvania. Our apologies to Mr. Robb who wrote to correct us: "While that is a wonderful Ivy League institution, in fact I am retired after 40 continuous years as a student and on staff with the Pennsulvania State University."

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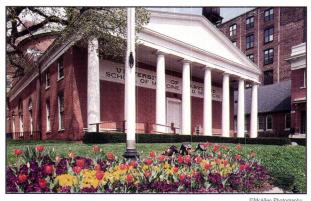
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Maintaining Excellence at UMB

The University of Maryland, Baltimore (UMB) has earned a reputation for excellence as a professional schools campus and an academic health center

responsible not only for instruction and research but also for patient care. In the past five years, UMB has initiated several

> creative efforts that have enabled the university to reap the benefits of new technology and increase efficiencies as we maintain-or even lower—the cost of operations. Examples of these innovative programs include:



• UMATS Network

UMB plays a strategic role in the University System of Maryland (USM) UMATS (University of Maryland Academic Telecommunication System) network. Thirteen institutions of higher education throughout the state are connected by a network that provides varying amounts of bandwidth between the institutions. Bandwidths from DS1 to DS3 to OC3 are provided based upon the communication demands between institutions. UMB is the northeastern Maryland hub for this network, and the

by Paul Petroski

data communication staff serve not only our campus but also those who connect through our point of presence (POP) to the entire UMATS network. Data transport, Internet access, and compressed interactive video are the main uses of the network at this time.

With three distance education classrooms that are a part of the interactive video network (IVN), UMB can deliver courses to multiple sites throughout the state of Maryland. The vice president for academic affairs has been instrumental in making these classrooms available to all healthcare and human services disciplines. This leadership and the strategic use of distance education have enabled several of the professional schools within the university to increase their enrollments through distance education offerings. With the opening of a new school of nursing, distance education rooms now also enable teleconferencing and telemedicine applications. Dial-up access using ISDN has been incorporated by several of the schools on campus.

Telemedicine applications are being broadcast on the dial-up services from Baltimore to Area Health Education Centers (AHECs) in western and eastern Maryland. The applications have proven to be cost-



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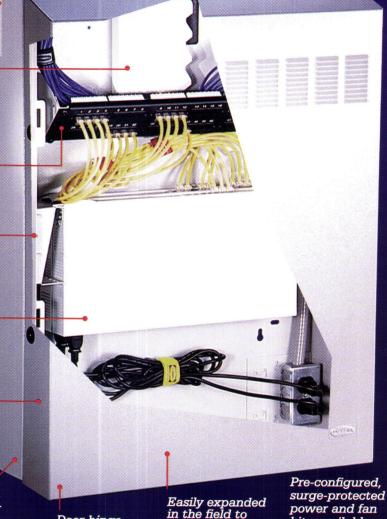
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effective and have been well received by the schools and their partners in the rural parts of the state. As an example, child psychiatric evaluations have been provided to areas lacking local expertise. Considerable efficiencies have been gained by reductions in the amount of time employees had to drive to remote locationstypically four to six hours per day.

Through the use of interactive video, the campus will minimize the need to use scarce capital funds on increased classroom space, additional commuter parking, and increased administrative space.

An assessment of the feasibility of using excess bandwidth to carry voice over the network is under consideration by the operation committee of UMATS. UMB will be a critical player in this evaluation. As an active and strategic participant of the USM network, the campus has positioned itself well to meet future information technology demands. By participating in this systemwide effort, the campus has saved tens of thousands of dollars annually.

• New Health Science and Human Services Library. In April 1998, the university opened a new Health Science and Human Services Library, a state-of-the-art facility that has been called the "heart of the campus." With more than 1,500 data connections, a distance education center, three computer-assisted learning centers, and more than 40 group-study rooms to accommodate electronic access to information resources, this facility will serve as a model for health science libraries of the future. Students, researchers, and professional staff have seen the benefits of the information technology planning that went into this building. The telecommunication group was instrumental in implementing the technology changes that have occurred over the past

seven years to make this a state-ofthe-art facility. Changes in cabling, electronic equipment, and software upgrades were implemented to enhance the educational opportunities of the health science and human services professionals that will use this facility in the 21st century. Adaptations were also made for voice, data, and video transmission in light of the changing technology.

• Extension of Bell Atlantic Centrex Contract. In 1988, the university signed a 10-year Centrex contract with our local exchange carrier, Bell Atlantic. At that time the cost per line was the lowest rate offered in Maruland. Many features were bundled with the line rate. Standard message unit pricing and least-cost routing using the automatic route selector (ARS) were implemented to provide the university with the lowest toll rates. In July 1997, after six months of negotiation, the university signed a three-year extension to its Centrex contract with Bell Atlantic. As part of this contract, the line rate was locked in at a price that has enabled the university to keep end-user charges at the same rate that they have been for the past 10 years.

In addition, the university negotiated the implementation of a virtual private network for costeffective communication for its users. The university also switched its standard message unit service to measured message unit service with six-second incremental billing. The savings to the university users have been approximately 25 percent, saving end users some \$80,000 annually.

• Bid for Outbound Long Distance Service. Last year the university solicited bids for its outbound long distance traffic. Over the previous 10 years the university had taken advantage of the State of Maryland's contract with AT&T, deriving the benefit of extremely

low costs for calls transported on the state calling network. Investigation of recent call data revealed that the majority of outgoing calls were interstate calls (55 percent of the total traffic). In addition, 34 percent of the total dollar volume was for international calls. With this data available, a bid for outbound toll calls was solicited. As a result of the new contract, UMB has experienced savings of approximately \$60,000 annually. This new contract with Quest/LCI will be reviewed in light of the MICTA rates that Quest has recently won.

• Emergency Response System. The Public Safety Office approached the Telecommunication Department in the summer of 1993 because they needed to replace the dispatcher hard-wired display panel for emergency ring-down phones throughout the campus. Working with Bell Atlantic and one of its value-added vendors, the university replaced the outdated dispatcher display panel with a computerized emergency response system that used ISDN technology to identify the number of any call coming into the Public Safety Dispatch Center. This successful implementation of ISDN technology, in conjunction with a vendor's database application, enabled the campus to use caller identification from its emergency phones as well as to identify any caller ID present in the database. This information allows the Public Safety Office to respond to emergency and nonemergency situations on this busy urban campus in a more timely fashion than was previously possible.

Support from the Top Down

Accomplishing these efforts required the support of the highest levels of the administration: UMB President Dr. David Ramsay, Vice President for Academic Affairs Dr. Joann Boughman, and Vice President for Administrative

Services James Hill. As a result of in-depth communication about the complex issues surrounding the use of technology in business operations, the university leadership had confidence in moving forward on some difficult decisions

Support provided to the middle managers who implemented the changes was also important. However, it was the telecommunication staff who played the essential role in gaining information about the most current options available, negotiating the contracts, and implementing the technologies. Identification of information technology as an enabler for the university's continued success was articulated as part of its strategic plan. Being able to do more with less places an emphasis on looking at the long-range effects that technology can have in accomplishing the mission of the university.

The planning process of the university allows middle managers, staff, and faculty to play an active role in establishing and implementing short- and long-term goals. This active participation by a diverse group of employees promotes buyin. As a result, upper management has received the strong commitment of the university staff.

As a state institution of higher education, UMB is required to follow state procurement regulations in purchasing and contracting of goods and services. Although it might appear that this would restrict the university's ability to implement technological change in innovative ways, it has, in fact, been a very structured and positive way to move the technology plan forward. With the guidance, support, and expertise of Director of Procurement George Shoenberger and his staff, we have used competitive bids, technical RFPs, and partnerships with other USM institutions to procure the technology needed by the campus.

Measuring Success

As we evaluate our efforts over the past few years, we measure our success by our accomplishments:

- The fiber-optic backbone is upgraded regularly. The university has implemented a campus infrastructure that supports faculty. student, and staff needs. Upgrades to our five-year-old fiber-optic backbone that connects all buildings on campus are ongoing. When major construction projects on campus are funded with state capital funds, appropriate infrastructure enhancements are included. Additional duct bank, new single- and multimode fiber runs, building switches, and hubs have all been implemented as an outcome of this approach to enhancing the technology infrastructure of the campus.
- · We have realized savings with Centrex. The extension of the Centrex agreement with Bell Atlantic has proven to be costeffective and opportune in a time of tight capital dollars. This agreement has enabled the university to maintain state-of-the-art voice service and enjoy the benefits of stable and, in some cases, reduced costs. The Centrex system provides cost-effective, ubiquitous, standardized communication among all our locations. Bell Atlantic maintains the system, and minimal university staffing is required to manage a reliable network 24 hours a day, seven days a week. Thus technology and financial constraints are being minimized for campus users.
- Staffing has decreased, but productivity has increased. With the reorganization of voice and data into one organization, we have eliminated two and one-half positions: one manager, one technician, and half of a clerical/ administrative position. In spite of this, productivity has increased: We are completing more moves, adds, and changes, and we have in-

- creased the number of voice lines and data connections each year over the past three years.
- Reliability is high. Our Centrex agreement gives Bell Atlantic the responsibility for managing the voice network. Does Bell Atlantic deliver reliable service? Minimal university staff is required to maintain a network that is operational 24 hours per day, seven days per week, and we cannot recall a single instance in which we have been without voice service over the past 10 years.

Conclusion

The benefits of these and other efforts have been evident to faculty, students, and staff. Greater bandwidth, more diverse opportunities for communicating, and more approaches to educating Maryland students have been provided. Feedback from upper management and students alike has been very positive. We have consistently delivered the latest technologies at affordable prices, and we are a vital part of the mission of the University of Maryland.

Paul Petroski is director of voice and data communications at the University of Maryland, Baltimore. Reach Paul at ppetrosk@umaryland.edu.



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From the Executive Director

Jeri A. Semer, CAE

Increased Regulatory Activity on a Number of Fronts

In recent weeks it seems that various regulatory issues have been heating up, and ACUTA's Legislative/Regulatory Affairs Committee has devoted considerable attention to monitoring developments and filing comments on behalf of the association. As many institutions are examining budgets for the coming year and various federal agencies are planning hearings or rulemaking proceedings, it might be helpful to summarize where things stand on several issues.

• Unauthorized Charges: An increasing number of ACUTA members are finding various unauthorized charges on their monthly phone bills. These charges can take many forms, ranging from outright fraud (slamming, cramming, etc.) to telephone-billed services ordered by students or staff that are billed to the institution without authorization for purchase.

The cost of unauthorized charges in both dollars and staff time is substantial. We are currently documenting these costs through a survey of member institutions, and we plan to compile a report to present to appropriate government agencies based on our research.

ACUTA also filed comments with the Federal Trade Commission in March. The FTC is considering expanding and strengthening its rules designed to prevent unauthorized charges. The agency's proposal would require authorization from the party responsible for paying the telephone bill before placing any charges for products or services on the bill (except for blockable 900 calls). A pre-subscription agreement would be required for monthly recurring costs. ACUTA supports the FTC's proposed rules, and we made

some additional suggestions to strengthen them further. Information on this is available on the ACUTA Web site at http://www.acuta.org/html/ftc1.html and on the FTC Web site at http://www.ftc.gov/bcp/adcon/900rule/900.htm.

• Universal Service Fund and Access Charges: Several proposals before Congress would radically restructure Universal Service fees and the Schools and Libraries Fund. In addition, the FCC and Congress are under pressure from various industry and user groups to change the way in which access charges (presubscribed interexchange carrier charges—PICC and subscriber line charges—SLC) are structured. ACUTA is watching these developments closely and will inform members of any changes.

In the meantime, the cap on SLC charges increased by an inflation factor on January 1, 1999, and the cap in PICC charges is scheduled to increase on July 1, 1999 by up to \$1.50 per line. ACUTA members may well see these increased costs passed along by their carriers unless prevented by contract. See the April 1 ACUTA Alert on this matter on the ACUTA Web site at www.acuta.org/html/alert5.html.

On February 22, the FCC issued an order in which they further define primary and secondary residential lines for purposes of calculating the applicable access charges. They adopted a location-based definition of primary residential lines, meaning that one line provided by a price cap LEC to a residential location will be considered the primary line, and all other lines will be considered secondary lines. The rules state that this applies to a college dormitory room.

This new definition applies only if you provide more than one line to student rooms and your student lines are considered residential lines, not business lines. This would primarily affect, for example, schools with Centrex service which provide more

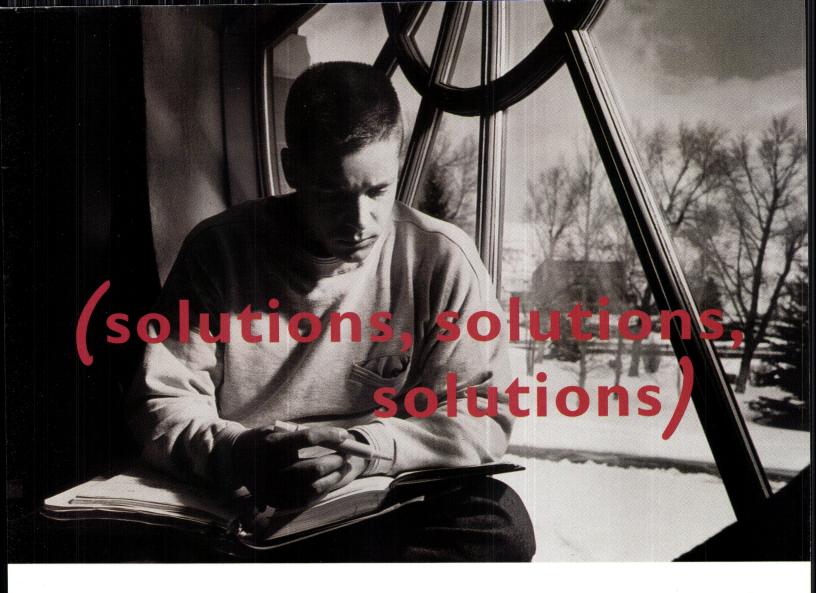
than one line per student room in states where dormitory Centrex lines are considered by state regulations to be residential lines. If this applies to you, your access charge bills may increase because nonprimary residential lines are charged at a higher rate. For more information, check the FCC Web site at http://www.fcc.gov/Daily_Releases/Daily_Business/1999/db990311/fcc99028.txt.

• Local Number Portability: In areas where LECs have made local number portability (LNP) available, you may soon see significant charges appearing on your bill which the FCC is permitting LECs to pass along to their customers. These charges may appear for up to five years. These charges will vary according to your area and may be retroactive depending upon your LEC. Initial indications are that the charges will range from \$.24—.53 per line per month. These charges will also apply in greater amounts to ISDN and T1 lines.

There has been a temporary delay in implementation of some of these charges as the FCC is investigating the tariffs that have been filed by some LECs to justify and document their actual LNP expenses. However, we recommend that you discuss this with your LEC in order to anticipate the budgetary impact.

There are many more areas of activity, including calling party pays cellular service, possible reorganization of the FCC, detariffing, and E911, that are being closely monitored by the Legislative/Regulatory Affairs Committee. ACUTA owes a great debt of thanks to the tireless volunteers on this committee who do such important work for the association.

In addition, for the most current information on any of these issues and how they will affect your institution, plan to attend the many Legislative/ Regulatory sessions that will be offered at the 28th ACUTA Annual Conference in Nashville.



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