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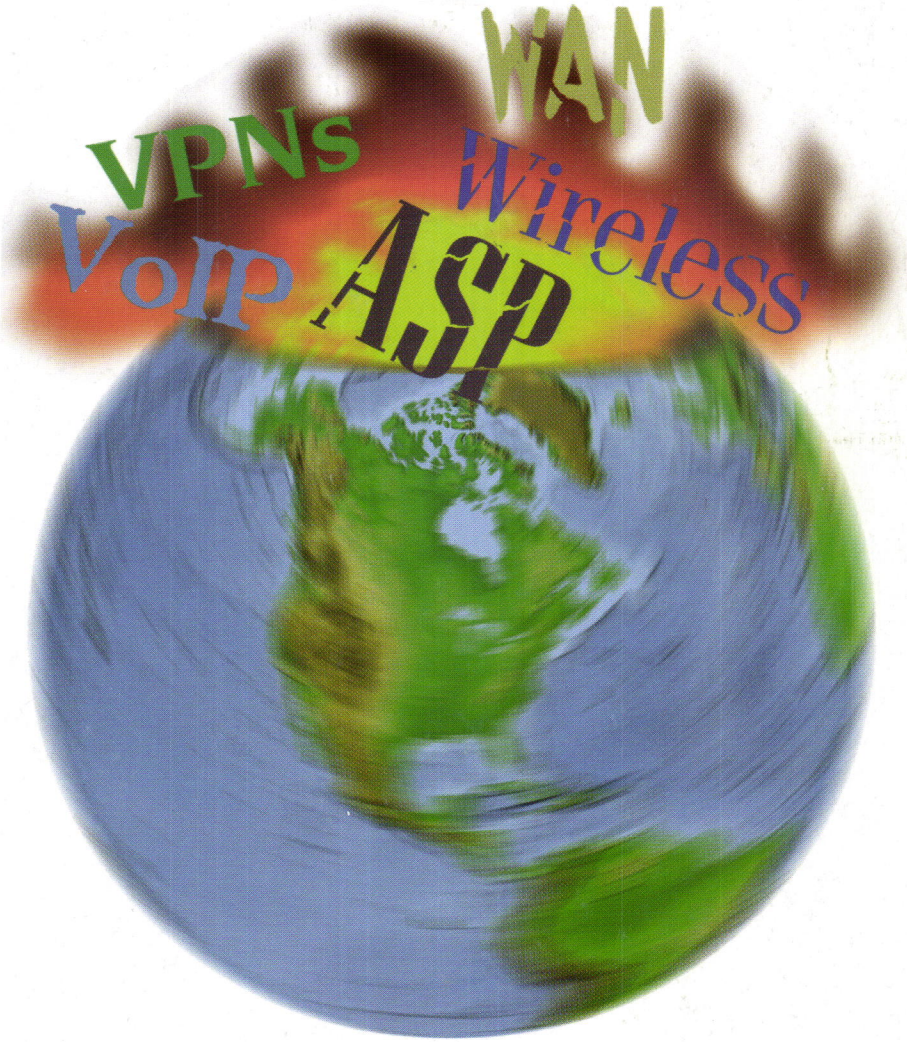
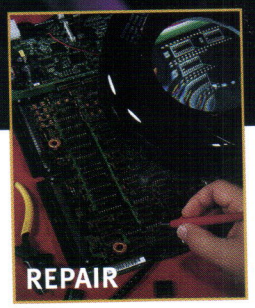
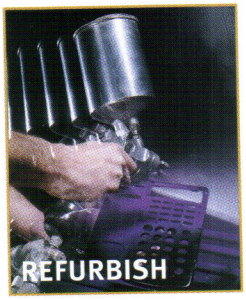
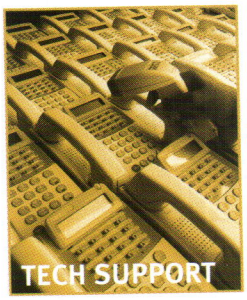


This Issue: New and Emerging Technologies

We major in higher ed phone systems.







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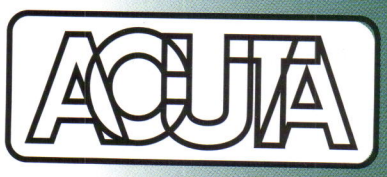

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Hyatt Regency
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Track II: Convergence of Voice, Video, and Data

Winter Seminars
January 14–17, 2001
New Orleans, Louisiana
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Newport Beach, California
Newport Beach Marriott

30th Annual Conference
July 29–August 2, 2001
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So while I don't think the residential campus will disappear, I do expect to see even residential students demanding a lot more service in this virtual mode and wanting it delivered not only through their PCs connected to the Internet but also through the new, up-and-coming wireless technologies that are not necessarily PC-driven. Pressure for that kind of service is going to grow dramatically. I believe that the only way that most institutions can manage that pressure is to partner heavily, to be very precise in what they're trying to do, and to be willing to displace old business models with new business models.

William H. Graves, PhD
Chairman & Founder, Eduprise
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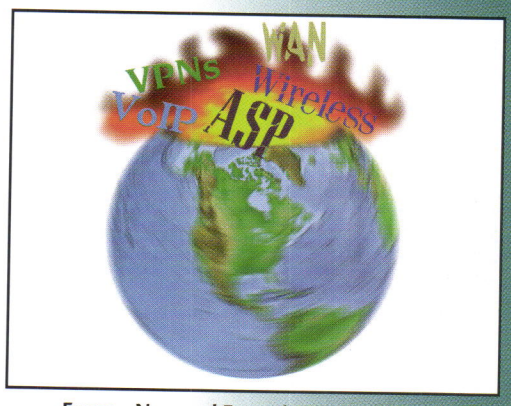


Focus: New and Emerging Technologies

COLUMNS

INTERVIEW

BOOK REVIEW

Anthony R. Tanzi, RCDD
Brown University
ACUTA President
2000–2001

President's Message

Change—Friend or Foe? It's Up to You

Technologies that have been introduced into our everyday lives have led to different ways for us to live and work. Since most of us seem to make major use of technology either at work or from home or when traveling (an extension of the office), it seems fair to say that new opportunities and challenges come along with new and emerging technologies.

Some of these opportunities can be friendly, requiring only that we continue to do the normal day-to-day activities that we all do to meet the basic requirements of our jobs.

Some opportunities require us to exert an effort, to go above and beyond, taking up valuable and coveted time, usually at the expense of some activity or event we consider having higher value—either at work or after our workday is done.

Regardless of whether or not we see opportunities and challenges as a normal part of our workday, we need to understand that each is based on one platform: change.

Change is either a motivator or an inhibitor, and an event that requires action. It alters, modifies, varies, transforms, revolutionizes, adjusts, and amends. Think of change as expressed by Dr. Gerald A. Heeger in his article in *Educause Review* (May/June 2000): "Leaders in higher education must embrace change, direct it, and recognize that it has positive, negative, and always unanticipated consequences. They must address change as they would any other managerial challenge, and they must recognize that new markets and the appeal to new money require completely new organizational—and business—models."

How many of us actually follow the advice expressed by Dr. Heeger? How many of us can say that we have defined and developed a road

map that we can follow as we go down the paths of change that will inevitably come from the new and emerging technologies that we all have been touched by or will need to deal with in the coming months?

Do we fear change and hide behind it by having little patience for new technologies, instead finding comfort with more established technologies that do not reflect the true potential of today's tools? Are we mindful of the need to have a vision that will allow us to embrace change rather than fear change? Without clear vision and focus, opportunities for exploiting new technologies often appear less attractive, resulting in a lack of appreciation for and loss of commitment to the use of the technology.

Have we made the commitment to innovation and creativity, and are we open to the use and support of those new and emerging technologies, such as wireless mobile networks, the Internet, voice over IP, ATM, network convergence, and optical networking?

As you read the thoughtful and comprehensive articles in this edition of the *ACUTA Journal,* you might want to think about what the impact of technology will be on your institution and how well you are prepared to deal with change.

Try thinking and planning strategically using the model developed by Elaine Kotell Binder in her January 1999 article in *Association Management* magazine. Ms. Binder suggests that we see planning for change and its impact on us as a continual process based on our responses to four questions:

1. What are the needs, expectations, and preferences of our customers?

2. What is the capacity and position of our unit in our organization?

3. What are the realities that affect our unit in our organization?

4. What are the implications of our decisions?

These are critical questions that should have compelling answers, some of which will make even greater demands on our time and further impact how we live and work. These articles should give us a better understanding of how to address change by defining roles, responsibilities, and rewards presented by new technologies. With this information, we can build the road maps that will help us define how others—and we ourselves—will work in the future.

Technology Advances: The View from 10,000 Feet

by Curt Harler
Contributing Editor

It's the 21st century—should institutions trash their PBXs? Will the warm handshakes friends share at ACUTA conferences be replaced by cold, electronic computer handshakes? More to the point, what do you tell the provost who grabs you at lunch and says her kids want faster Internet connectivity at home: DSL or cable modem?

Rest assured that someone from administration will soon be asking the same questions about the campus network. It would be hard to find a box or technology installed on campus today that isn't under siege from another technology or emerging standard. As we take a quick flyover of several of the emerging technology trends, it becomes obvious that the real question is how to deal with the different opportunities presented by new systems.

New and Exciting

Most campus clients or customers think in terms of applications, not technology. And for most (outside the biophysics department), technology has not changed the basics of what they do: It simply allows them to do it faster and more accurately. While the journalism department might like to trumpet all of the changes we've seen in the past few years (and, indeed, the technology in the wiring cabinet does look different), its basic function is the same. It moves voice, data, and video signals from place to place. Quality has improved. Reliability, in theory, is better. Yet there still are choices you must make on the level of basic technology to assure good quality of service.

Economics, not technology, is the main driver today. Outside of teaching hospitals and a few fair-haired special projects, today's typical college telecom director's life is ruled more by economics than technological innovation. Yet proper use of technology can make you look like an economic genius as you provide higher levels of service and better throughput and you future-proof the network at a cost less than usually allowed by today's squeaky-tight budget.

Don't let the administration buy into the rumor that IP-based networking will bring transmission costs close to zero. That's this year's version of the 1960s urban myth that nuclear power would make electricity so cheap the utility would not have to meter it. Whether capacity is IP-based or based on any other system, networking is getting no closer to being free than it ever was. In fact, the opposite is true.

Take the Internet, for example. While it is true that the price of network capacity is being halved every 10 months, traffic doubles every seven months. Run this by the math department: The result is that the absolute amount of dollars spent in connectivity is increasing 80 percent per year. The cost issue is not disappearing; instead, it's getting bigger. The same is true in most other technology areas. Those high-flying dot-com companies have to make money somehow. So where is an institution to turn for help?

Division Outsourcing

The people in the economics department will be delighted by the services offered by application service providers (ASPs). In fact, ASPs should be on the radar at any small college, especially those with stressed-out business offices. ASPs can be thought of as do-it-yourself outsourcing businesses. For a fee, they provide computerized applications—such as payroll and human resources management—usually over the Internet. They offer a chance to get state-of-the-art software applications without making a major investment up front. Looking out to 2004, the MultiMedia Telecommunications Association (MMTA), headquartered in Arlington, Virginia, expects some 3 million organizations to use ASP services. These organizations will spend more than $7 billion on application services. That's up from a mere $10 million in 2000.

According to research done for MMTA by the Cahners In-Stat Group, the major problem the ASP market faces is getting its message to smaller customers while remaining solvent.

"The term 'ASP' is unfamiliar to small companies today. This puts application service providers at a huge disadvantage when they try to reach these potential customers," says Kneko Burney, director of In-Stat's markets and computing practice. As a result, small-company ASPs will need to partner with well-known brands to reach small customers. "Any organization that is experiencing rapid growth or significant change that really needs to focus on that growth or change should consider outsourcing its IT for all but its core operations," Burney says.

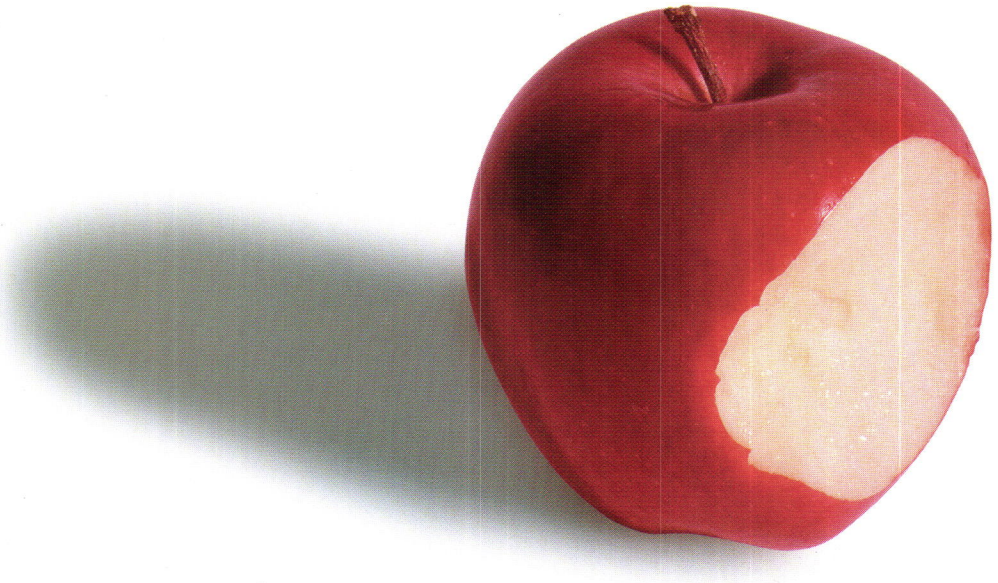
Until recently, colleges that needed a particular software package purchased one-time product licenses based on the number of seats or the number of users. This forced colleges to make an all-or-nothing buying decision, and it often proved a costly proposition for institutions struggling to make ends meet. They either had to bypass superior products or bite the bullet and cut corners elsewhere. If they elected to buy software, they had to contract for professionals to implement applications, train IS people, and maintain and update the software.

ASPs lease software to their customers, providing all of the monitoring and updating for a flat monthly fee. It is the equivalent of renting the software. ASPs typically host software applications on central servers. The users at the university access the applications they need. All of the administrative hassles of software ownership and management are borne by the ASP. The institution simply uses what it needs for as long as it needs it.

Wireless World

After a brief but mostly useful lifespan, pagers are all but history. ▶

If the cost of automating your call center is hard to swallow, try smaller bites.



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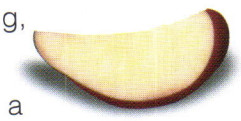

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While there may be a few applications left for paging, the industry is going to be left in the dust of cheap cellular service. Why beep someone and ask them to find a phone and call back when you can simply ring their cell phone, have a conversation, resolve the issue, and move on with your business?

That being said, in the wireless world the next acronym to become familiar with is WAP (wireless application protocol). WAP provides the application environment and communication protocols that allow cell phones and personal digital assistants (PDAs) to access the Internet. Released in April 1998, V 1.0 outlines the necessary application, session, transaction, security, and transport layer formats for WAPs.

WAP is coming into its own today. Look for just about every kind of wireless unit to be WAP-enabled. The standard already is taking Europe by storm, where it is not unusual to see people paying bills over their cellular phones while waiting for a bus, accessing Internet-based stock market resources on interurban trains, and generally taking the Internet to the street.

In the United States, WAP will be a major selling point for cellular phones this fall and winter. But remember, in the same way that today's hottest fashions become tomorrow's discards, WAP may already be doomed to extinction. Newer technologies are already on the drawing boards around the world.

A system called International Mobile Telecommunications-2000 is supposed to be rolled out commercially in Japan and Western Europe before the end of this year. IMT-2000 is the wireless world's vision for a unified, global, multimedia wireless infrastructure. Some hurdles—such as the basic difference between the CDMA popular in the United States and GSM used in Europe—need to be worked out before IMT-2000 becomes commonplace in our market. But its promise makes it likely that we will see some grand, unification-theory style development that will bring the promise of WAP to users of all modes of cellular under the cloak of IMT-2000.

Videoconferencing

Here's one for the engineering department: Quick, choose: H.320 or H.323? That might be akin to choosing between a Mack truck and a Miata. The entire family of H.320 standards has the same goal: to let videoconferencing equipment from a variety of vendors work together in harmony. From a dollars-and-cents point of view, H.323 is what's happening. For under $100, one can get an H.323-compatible system for an individual PC. Circuit City or Staples sells the Intel PC Camera Pro Pack—including H.323 software and a serviceable monitor-top camera for those without a digital video camera—for $129 less a $30 rebate. Look for that price to slip further during the Christmas season.

Cheaper systems are also available. However, there should be no doubt in any telecom manager's mind that a standards-based system (whether a room system or a PC system) is worth the small premium.

So what about the Mack and Miata? Both are forms of transportation, yet each has a different use.

The view from here is that most institutions will find themselves with two separate kinds of videoconferencing for two separate uses. High-quality room systems will be in demand for administrative use. Quality is required for medical systems. Quality will be demanded in many distance-learning applications. Yet there will be a great deal of interest in lower-end, PC-based systems, too, as researchers share spreadsheets and individuals access increasingly popular Internet-based class materials or want to chat with friends and parents "for free" on the Internet.

Note, too, that H.323 was designed around ISDN with modifications for asynchronous transfer mode (ATM). Already the ITU-T is working on a recommendation called H.248. Known as the Media Gateway Control (MeGaCo) protocol, it is already poised to replace H.323.

Whatever the protocol used, conferencing will come to the classroom. A team of researchers at Georgia Tech, led by Professor Gregory Abowd, is working on what they call Classroom 2000. Its goal is no less than elimination of the need for students to take notes during a lecture, freeing them to participate in class discussions. The project uses existing technology such as whiteboards, the Web, and audio and visual files. Instead of writing on a blackboard, the teacher writes on a whiteboard, which projects the information on a screen for the class to see and also records the information to a computer. All the information provided during the class is stored on a computer and used to create a series of Web pages indexed to the syllabus for students to access over the Internet.

Two Classroom 2000 ready rooms have been set up at Georgia ▶

Tech, while Brown University, Kennesaw State University, McGill University, and Georgia State University also have similar classrooms. Although you don't want to hear this, my guess is that most schools eventually will find themselves dealing with both an upper-end and a lower-end conferencing system. Just be sure both are standards-based.

DSL vs. Cable Modem

"I want my Internet connection to be faster, and I want it cheaper," is the plaintive cry from friends and colleagues. The best answers, given the economics of most users' situations, boil down to digital subscriber line (DSL) service and cable modem. The question is which to choose.

Look first at DSL. While there are many DSL flavors available from a technological point of view, as a practical matter most people will see only two choices: asymmetrical DSL (ADSL) and symmetrical DSL (SDSL). ADSL offers a slower speed from the PC to the Internet, but a fast download speed—usually at half-T1 to full-T1 rates—from the Net back to the user.

The theory is that most users enter a few keystrokes seeking information and then receive massive screen presentations or page downloads from the Web site. Unfortunately, that isn't the way it is these days. The typical user is sending spreadsheets and digital photos and playing games across the Internet. The result, for an ADSL user, is akin to going to a cafe and getting a nice, hot cup of coffee one day and a cold, flat cup the next. Sending files is as important as receiving them, and it requires equal speed both upstream and downstream. Thus, the popularity of SDSL is understandable.

> ... when planning the network and the applications it will carry, don't leave people out of the equation. Your human staff is in more danger of burning out than any of the cards in those 20-inch racks.

The telcos were quick to recognize that SDSL offered customer satisfaction, and most of the rollouts of DSL-based service today are SDSL. DSL is an always-on system. And the bandwidth you contract for is always available.

What about cable modems? In today's market, dollar-for-dollar, cable modems offer better service speeds than DSL—often two to four times faster for roughly the same price. However, in a college town, there is something else to consider: Cable modems offer wonderful speed, but only as long as there are few users on that link. Cable modem throughput is divided by the number of users accessing the service at any given moment. In a typical college setting, students finish dinner and log on to do homework and send e-mail. That 7:00 p.m. –10:00 p.m. time frame likely will give much poorer connection rates than one would find at 2:30 p.m. The same will hold true in the business office at 8:30 a.m. when everyone logs on to start the business day.

There isn't much individual townies can do about getting guaranteed service levels. On campus, be sure to get guaranteed service levels if going the cable modem route. This is not out of the question anymore. Through the late 1990s, the biggest slam on cable networks and cable modems was a lack of responsiveness to problems and extensive downtime. Cable company executives were not deaf to the complaints. Now, several communities are being served by cable even for basic telephony needs, and the service is quite good and reliable. Yet there still are some cable companies that seem to believe three or five days is a normal turn-around time on a service outage ticket. If you are going the cable route on campus, be sure you and your provider agree on service levels.

Sociology Musings

Unified messaging—the ability to have voice mail, pages, e-mail (and probably postal service, some day) all on the same platform—is heralded as the Holy Grail of messaging technology. I've seen the systems. They work. They work well. I don't want them. Maybe it's an age thing, but I really feel sorry for the harried, young working mom who feels she must access voice mail over her cell

phone while dropping her kid off at daycare and taking the curlers out of her hair—all the while navigating a minivan through traffic with a McDonald's breakfast balanced in her lap.

Knowingly or not, telecom managers are implementing technology (usually at the behest of a department manager) that places a huge burden on employees regularly. We are expected to keep all of the many networks up and running 24/7, and that stress trickles down (or pours down) on the staff. We demand overtime when there are viruses in the LAN, lightning hits in the WAN, floods of extensions must be input during registration week, or the system crashes during the month-end billing cycle. Most workers know the situation and accept the occasional technology-caused crisis.

However, when planning the network and the applications it will carry, don't leave people out of the equation. Your human staff is in more danger of burning out than any of the cards in those 20-inch racks. Many people would rather have a day off than overtime pay, yet most also know that they'd never take that day off, so they might as well accept the bucks and move on. Humans can mess things up, too. The word "sabotage" derives from the French word for wooden shoes: *sabot*. Workers would jam their wooden shoes into the gears of newfangled equipment, and that sabotage would bring the wheels of the Industrial Revolution to a halt.

We see the same thing happening with malicious software mischief. Unethical humans are quick to take advantage of any chance to manipulate new systems for fraudulent gain. While there are technological fixes, these are people problems.

My final prediction: In the long run, people problems will be more of a challenge than all of these technical problems combined. IS/IT managers will find it much more difficult to find and keep good, trained staff and to deal with human mistrust or misuse of equipment than they will find it to fathom gigabit Ethernet and ATM or any other technology that comes our way.

Curt Harler is a contributing editor of the ACUTA Journal. *He also has articles published regularly in other telecommunications publications and is well respected as a speaker and presenter on telecom topics. Reach Curt at curt@curtharler.com.*

▼

WAP
Are You Ready for a Wireless World?

by Dr. Ron J. Kovac and Amy Errington
Ball State University

Almost all of us use it in a way we don't even notice: TV remote controls … cellular phones … garage door openers. This is the world of wireless, a land where two devices communicate with each other without any apparent connection. It's a world where growth projections exceed 400 percent. It's a world of convenience. In this world the day is coming when we will all wonder how we got along without it.

For those who absolutely must have access to stock quotes, financial information, weather reports, and sports scores regardless of time or place, there's good news. This good news comes in the form of wireless application protocol (WAP). Essentially, WAP is a stack of protocols designed to enable fast, secure, and wireless Internet access over cell phones, personal digital assistants (PDAs), and handheld computers. WAP standards attempt to define how mobile users request information from the Internet and how the requested information gets back to them. WAP is a cutting-edge technology that promises to be a useful tool for accessing data over cellular devices.

Why WAP?

As it promotes and enables access to the Internet by the mobile world, WAP's open standards define the presentation and delivery of Internet content to wireless devices. It is important to note that WAP is an open standard rather than a proprietary one. Without open standards, vendors create proprietary technologies that only work with their own counterparts. We experience this lack of standards with many of the wireless devices currently being made and are forced to choose between non-compatible technologies. Consumers and most of the companies in the industry will benefit from widely accepted, open standards. By unifying efforts in research and development as well as in marketing, the industry power behind WAP and the openness of this standard will help speed the development of WAP and its delivery into the hands of consumers.

Why WAP Is Necessary: Device and Delivery Limitations

Current Internet standards are essentially designed to be used with wired computers that have a fair amount of memory and processing

power. Since the majority of Internet users are accustomed to relatively quick download speeds and reliable connections, mobile professionals who try accessing the Internet through a laptop and a wireless modem or cell phone are usually disappointed and frustrated by the slow speeds. WAP is designed based on the constraints of current wireless communications and the limitations of mobile devices. There are several reasons why it is necessary to have new standards for delivery of the Internet over a wireless device, such as a cell phone. The reasons fall within two general areas: device limitations and wireless transmission problems.

1. Device Limitations

• Display

Most of the text and graphics currently on the World Wide Web are designed to look good on a color screen that is more than 10 inches from corner to corner. The average WAP-enabled device has a monochrome display with a 2-inch diagonal span.

The size of the screen on the various devices will determine how the Web site looks. WAP protocol adapts to the display, which varies between manufacturers and devices (Ericsson Wireless, 1999). This screen-size limitation is overcome by the presentation of the content. The markup language and the microbrowser that is designed to display it have been constructed with the display limitations in mind.

• Input

In addition to limited screen size, WAP also compensates for the limited input available on small, portable devices. With no mouse or QWERTY keyboard, trying to sort through content from a traditional Web site is cumbersome. WAP addresses the limited input issue through the Wireless Application Environment (WAE), and more specifically, Wireless Markup Language (WML). As opposed to HTML, WML does not demand much user input and scrolling. WML pages are arranged as stacks of cards, so instead of scrolling up and down the page, the user flips through the deck by using special buttons on the WAP-enabled device.

Generally speaking, the purpose of WAP is to create open standards defining the presentation and delivery of Internet content to mobile wireless devices.

• Power

In mobile wireless communication devices, memory and processing power are sacrificed for portability and price. Reducing the weight and cost of the device means it cannot handle much data. This is because data requires significant computational power and ROM/RAM resources. As technology continues its "faster, smaller, smarter" trend, cell phones and PDAs will probably see an increase in memory and CPU power as well. However, it is not likely that these handheld mobile devices will match or overtake the power of their desktop counterparts.

Limited battery power is another drawback of mobile devices that WAP tries to alleviate. Because WAP minimizes the amount of bandwidth necessary for data communications, it helps reduce the amount of power consumed by the device (AU-System, 1999).

2. Wireless Transmission Problems

• Narrow Bandwidth

Bandwidth limitations are certainly an important reason for the development of WAP. In addition to counteracting device limitations, WAP is being touted as a standard to help compensate for transmission limitations due to the nature of the current wireless network. The bandwidth available for wireless is very low in comparison to what most people use for Internet access at home or in the office.

WAP combats the problem of slow data transfer speeds due to limited bandwidth by minimizing the traffic between the wireless device and the Internet. WAP minimizes traffic through compressing and encoding binary data, reducing the number of transactions, and cutting the actual amount of data needed for each transaction (AU-System, 1999).

• High Latency

A second problem with wireless data transfer results from the inherent high latency in the wireless network. For data, this means it takes a long time to send packets from the Internet, over the air, and to a wireless device. In wired

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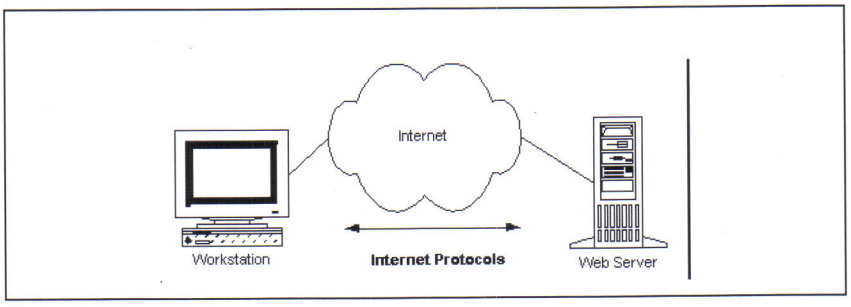
Figure 1. Basic Internet Data Transfer

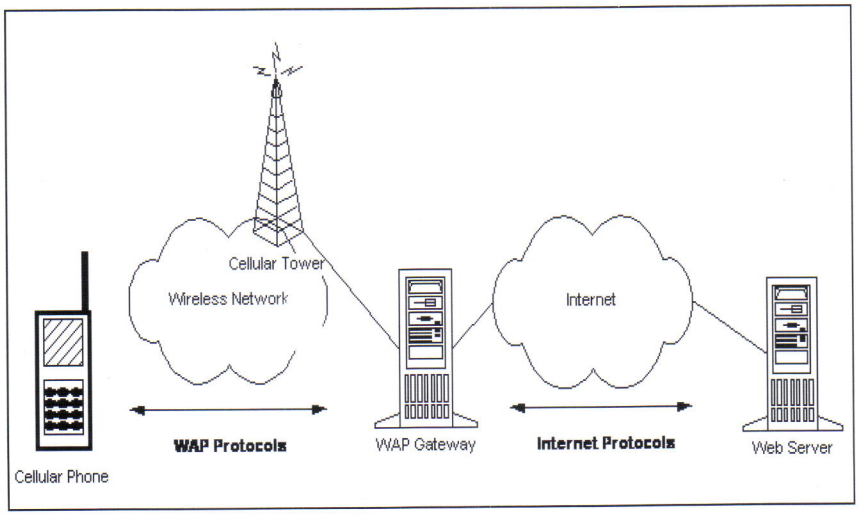


networks, the roundtrip time between request and response is very low and thus can be handled synchronously. In other words, the request waits until it is acknowledged on both ends before a new request is sent. However, in a wireless network, the high latency would make this "handshaking" (that is, request and response) process unbearably long. That is why WAP contains methods for asynchronous requests and responses. New requests can be sent before the old requests have been acknowledged.

• Unreliable Connections

While it may be rare for a backhoe to cut through buried wires, thereby stopping an Internet session dead in its tracks, cutoffs like this happen with some regularity in the wireless world. Geographical obstructions as well as a lack of service in many areas cause wireless connections to be unpredictable and unstable at times. WAP takes this instability into consideration by allowing lost sessions to be resumed.

Figure 2. WAP Internet Data Transfer



WAP vs. Internet Protocols

When a user at a computer workstation requests information from the Internet, the request travels through a series of cables and routers to reach its intended source. Figure 1 represents the general view of data traveling over the Internet.

The cloud contains any number of wired network components. The Web server could host public Web services or a private corporate intranet. The same cloud is used in the WAP model for Internet access. The difference is that WAP requires an interpreter in order to translate the data from one cloud to the next. This makes Internet content presentable and deliverable despite all of the wireless limitations discussed above. With the added cloud, different device, and required intermediary, the WAP Internet access model looks a little different (see Figure 2). In short, the additional cloud in wireless networks makes it necessary to expand traditional Internet standards so they can be used for wireless presentation and delivery methods.

Underneath the additions that WAP brings to Internet access are some traditional Internet standards for sending and receiving electronic data. In fact, when information is not already written in WML, everything to the right of the WAP gateway (Gateway→Internet) is identical to the workstation-to-Internet model shown in Figure 1. The similarities between the Internet model and the WAP models are not a coincidence.

The reason for building off of existing Internet architecture is twofold. First, it gives WAP developers a point of departure. For example, WML, the Web language for the wireless environ-

ment, is closely related to HTML in format. Having some knowledge of HTML's structure and its tags makes it easier for a Web designer to create pages suitable for WAP-enabled devices. Secondly, the consumers benefit by being familiar with the Internet. The addressing scheme has the same hyperlink format (http://www.website.com) that users have come to expect and understand. Developers and users are both becoming increasingly familiar with the Internet and its capacity for information delivery. Although frustrations with small screens will always exist, this familiarity makes it easier to transition to a wireless Web via WAP.

The WAP Gateway

The gateway is at the heart of WAP since it acts as the interpreter between the wireless cloud and the Internet cloud. The WAP gateway sits between the wireless operator's network and the Internet. It provides a path from WAP-enabled devices to any wired-application server connected to the Internet. That application server could be a standard Web server hosting Internet pages or a specialized server, such as a university intranet server housing departmental database information.

The gateway removes much of the processing burden from the wireless device. It also decreases the time between the user's request and the response by keeping track of the wireless subscriber's requests and caching frequently used information from the different Web servers that the user accesses.

A WAP gateway is just a regular Web server with special WAP software running on it. There are many value-added resellers who currently offer software development kits for the WAP gateway. For example, Angelica Wireless offers a WAP-service gateway package that can be installed on a server running either a Windows NT or Linux operating system. Once the server is turned into a WAP gateway, the "magic" of the WAP stack begins.

Wireless Bearers

The entire WAP stack rides on top of existing bearer networks. It is designed to work with any current or planned wireless service, including SMS, circuit switched data, and general packet radio service (GPRS). WAP also works with all mobile network standards, including CDMA, TDMA, and GSM. WAP has been carefully designed to work with all of these industry standards to help achieve faster acceptance.

Politically, bearer network independence is a good move for ▶

WAP because it allows WAP to stay away from the problems that have evolved from heated debates such as the TDMA vs. CDMA battle. Some industry experts point to bickering over the U.S. digital wireless infrastructure as a major holdup for the WAP market. WAP attempts to sidestep all of the petty bickering over infrastructure by adapting to all of the bearer technologies. Due to past and current standards battles, many service providers are hesitant to invest in new technologies like WAP.

WAP Applications

Internet access through mobile devices is not intended to be used to "surf the Net." On the contrary, Web-enabled phones and PDAs are intended to be used for time- and location-sensitive information.

While most WAP proponents are touting it as an Internet information tool to be used for entertainment, finance, and information services, other WAP supporters believe that it can save lives through enabling specific markets, such as the health-care industry, to receive critical, time-sensitive information. Since WAP incorporates push technology, it enables the automatic broadcast of industry-specific critical messages (such as organs available for transplants) as well as general "here and now" information such as flight delays and traffic alerts.

WAPping It All Up: An Inside Look at a WAP Scenario

Cindy is attending an orientation session at State U. in Indiana and is worried about her cat in San Francisco. She left Fluffy outside and is worried that it might get too cold before she flies back the following morning. She wants to find out what the current temperature is in San Francisco so she can either relax or call her neighbor and ask him to take Fluffy in for the night. Cindy turns on her cell phone and opens the "Favorites" window on her Up.Link microbrowser. She uses the four arrow keys on her phone to guide her to the "Yahoo! Weather: San Francisco" site and presses the "Enter" button on her phone when she highlights the correct URL. This is where the user interface ends and the behind-the-scenes WAP stack takes control.

Let's just say that Cindy's phone is on a CDMA-based digital network. It makes no difference to WAP what type of network the phone uses, as long as it is digital. The URL request is digitized and broken into packets that travel over the network. In the case of CDMA, the packets are spread throughout the spectrum of the allocated wireless band. Once that signal travels through the air and reaches the antenna, the radio waves are funneled into a wire for the rest of their journey. The signal is demultiplexed, and the spread spectrum of data becomes a continuous stream of ones and zeros again.

This bit stream travels through the circuit-switched host operator's network, which is a series of switches along miles of wire and fiber, until it reaches the WAP gateway associated with Cindy's service. In the WAP gateway, important header-containing information, such as the source and destination addresses, is added to Cindy's original transmission. Cindy's request is now ready to head out over the immense network that makes up the Internet.

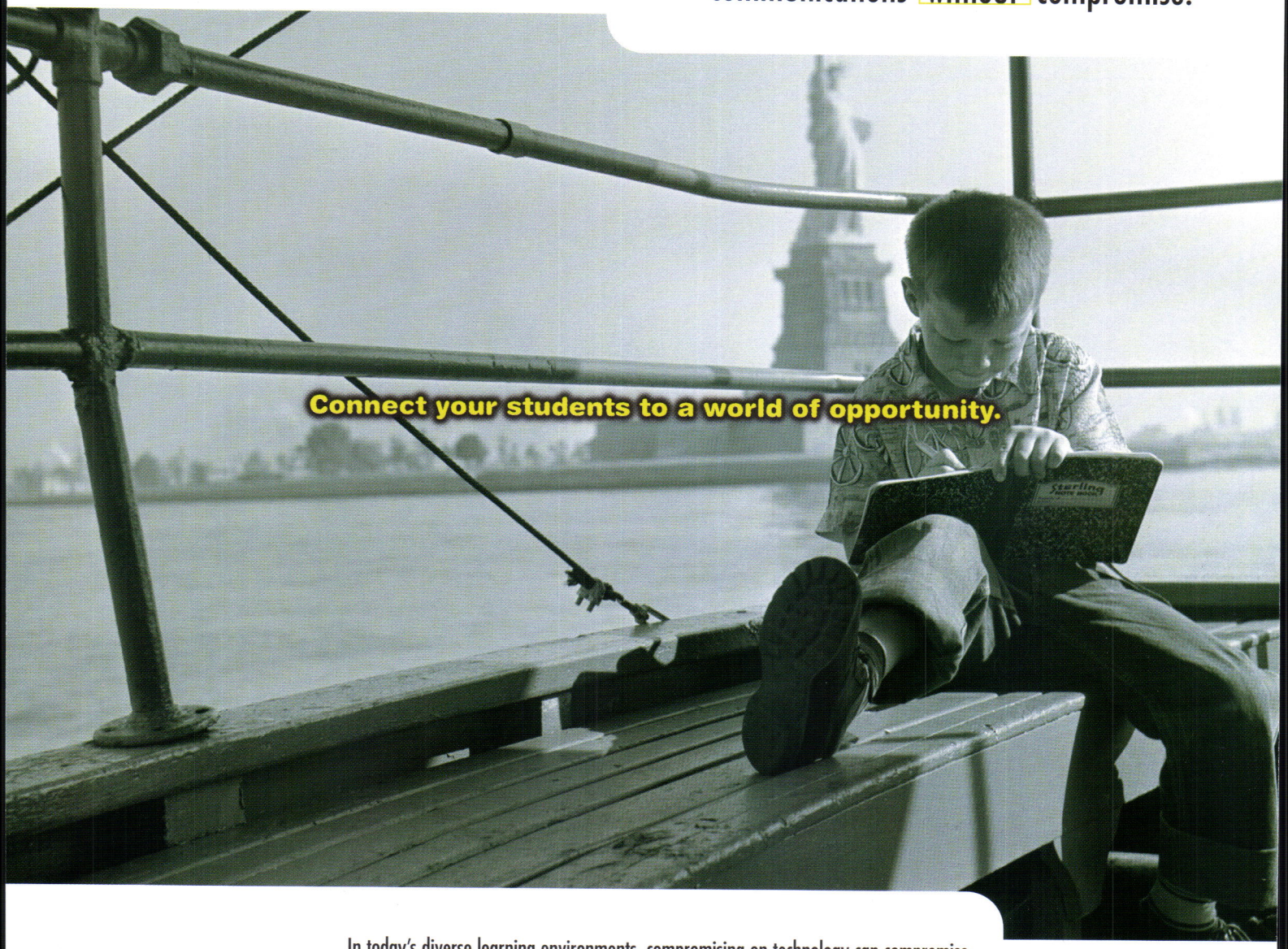
If Cindy had sent her request from a PC on a wired network, the layers within the PC itself would have handled the addressing and other steps that prepare a packet for its journey through the Internet. But since the request came from a device with size and power limitations, the added responsibilities of preparing the signal for an Internet journey came from a remote device: the WAP gateway.

After being dressed up and prepared for the Internet, Cindy's request is once again broken into packets and bits and sent over miles of wires and cables. The packets travel through many IP routers that pass them along en route to their destination. Finally, the packets reach a server on the Yahoo! network and are reassembled into a form of Cindy's request. The Web server accepts the request but does not engage in an extensive handshaking session with the sender, to cut down on the roundtrip time.

After the brief transaction, Yahoo!'s server packetizes the response and sends it back to the WAP gateway. Since Yahoo! has already invested in WML content, the WAP gateway does not need to spend extra time translating the response. Had Yahoo! sent a response in HTML, the WAP gateway would have needed to send it all the way up to its WAE layers for interpretation and then translate the response into a language the WAP protocols could handle.

The WAP gateway still has some interpretive duties in order to prepare the packet for its final journey over the wireless network. It must adapt the packets containing Yahoo!'s message so that they can return over the wireless network and be understood by the microbrowser on Cindy's cell phone display. The compressed message is multiplexed and sent back through the WAP stack and out onto the wireless network. ▶

communications without compromise.



In today's diverse learning environments, compromising on technology can compromise opportunity. But with integrated voice, data and video, educators are better equipped to command attention and provoke imagination in meaningful, memorable ways.

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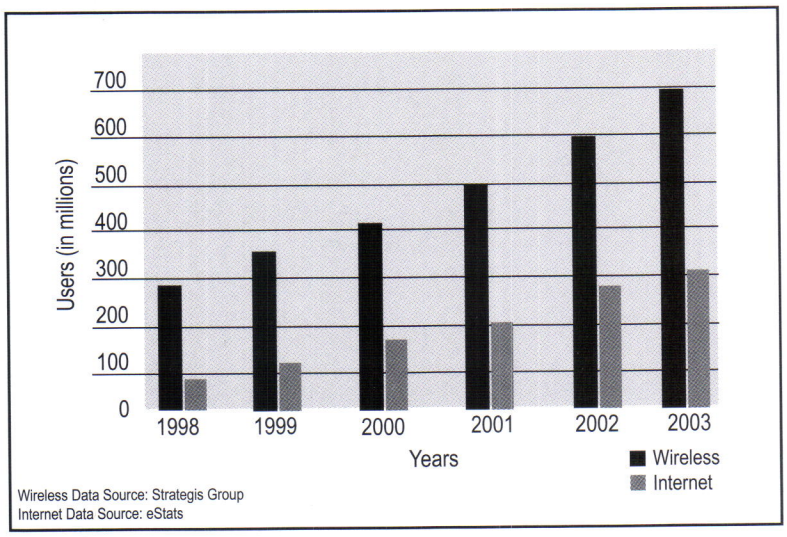
Figure 3: Worldwide Wireless and Internet Use



Cindy stares at her cell phone's display and sees the response come back. It is 65 degrees in San Francisco, so Fluffy should be okay. Of course, Cindy has no clue as to what just happened behind the scenes to deliver the information she requested. If she did, she probably would not be as impatient in getting a response. Cindy does have to wait at least 15 seconds for the Internet connection to be established, but as the networks migrate to 3G systems, the connection time will disappear.

Implementation in a College Environment

We see wireless growth as tremendous in the future here at Ball State University. Why? Because our clients, the students, expect it! Every year, we are seeing an increasing number of PDA devices being brought in and a phenomenal number of cellular phones and laptop computers being used. The expectation is communication anyplace, anytime and with any device. This is not unrealistic and is mirroring, or leading, the trend of the American population. We all have Cindys on our campuses.

We are moving on two fronts to keep up and, hopefully, lead this challenge, the preliminary step being the installation, testing and operation of wireless LANs within the university environment. This was done for familiarization and testing purposes—does it work within the environment? In order to enter the wireless world, one must ask the right questions and gear up to the new support issues. These wireless LANs (WLANs) have brought us to new levels of understanding and of questioning for this technology, and they have prepared a mindset for the transition.

The second approach we are taking is the installation and operation of digital microcell antennas directly on campus. This infrastructure will support the WAP environment on the campus and also serve as a test bed for our wireless initiative. Additionally, the installation will generate some revenue for the campus.

Conclusion: WAP Outlook

It should come as no surprise that WAP is such a hot topic, given the increasing popularity of wireless tools and the increasing reliance on the Internet. Wireless and the Internet are two of the fastest growing industries around the globe. Thus, to those in the industry, the WAP formula would probably look something like this:

WIRELESS + INTERNET = $$$$$

In a nation with support groups for people with Internet Addiction Disorder, wireless Internet access is an inevitable part our increasingly wireless and Internet-oriented world. WAP has evolved from the demand for Internet access regardless of time and place, and all levels of the wireless industry are embracing it. The current prediction is that by 2005, the number of Internet users will climb from its current 130 million to one-half billion. Global wireless subscribers are also on the rise. Between now and 2005, the number is predicted to increase from 300 million to 1 billion (see Figure 3). It is numbers like these that encourage the widespread acceptance of a workable standard like WAP (WAP Forum, 1999).

Dr. Ron Kovac is a professor in the Center for Information and Communication Sciences program at Ball State University and an associate in the Applied Research Institute. Amy Errington is a graduate student in the CICS program who won national honors for a recent paper on WAP.

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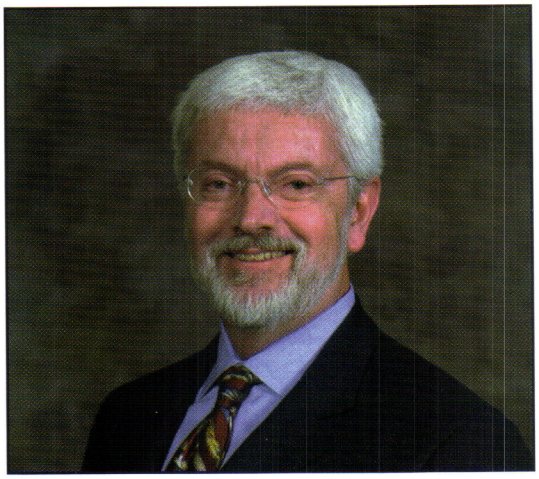
Interview:

William H. Graves, PhD

Chairman & Founder, Eduprise



William H. Graves, chairman and founder of e-learning services company Eduprise (www.eduprise.com), shares his insights into the evolving campus environment with ACUTA publications committee members James S. Cross, PhD, Michigan Technological University, and William A. Brichta, Allentown College.

Dr. Graves spent a number of years at the University of North Carolina at Chapel Hill on the faculty and as a dean and an academic administrator, and then as the senior technology officer. As a dean, he became increasingly interested and involved in the applications of technology to instruction. That led to the creation of the Institute for Academic Technology (IAT) as well as his being named the senior technology officer.

In 1997, Graves decided to leave the university, where he is now professor emeritus.

ACUTA: Why did you decide to leave the university?

Graves: There were a lot of reasons for leaving the university. One is that the IAT was trying to help other campuses understand the implications of technology for teaching and learning. We were trying to help them develop strategies for e-learning, that is, the use of the Internet for teaching and learning. But we were also being asked by many campuses to provide on-site help in the implementation of e-learning programs. We couldn't do that from our university base. So a number of us from the IAT decided to leave the university to provide a full range of planning, development, integration, and ongoing support services for those institutions which view e-learning as mission critical and which want the support of an experienced partner. Today we're known as Eduprise, and we provide extensive Internet professional service on top of our product-independent ASP model for hosting learning management systems and providing related 24/7 support.

ACUTA: The various representatives of the 800-plus member institutions of ACUTA are being asked to evaluate and implement a number of new technologies: IP telephony, voice over IP, wireless LANs, cellular telephony, directory services, digital certificates, and broadband access to support a virtual-campus environment. What are some of the challenges that traditional campuses will face as they begin to plan for this virtual-campus environment and integrate these technologies into their strategies?

Graves: There are two challenges, and the first one is to have a strategy for these virtual-campus issues. But let me first explain what I mean by virtual campus. I use the phrase "virtual technology" to refer to anyplace-anytime technology. Distance education can refer to an anyplace-anytime model, but it can also refer to someplace-sametime, someplace-anytime, and anyplace-sametime

models. So if I refer to a virtual campus or a virtual course, I'm referring to a course, for example, that is delivered primarily in anyplace-anytime mode. A virtual campus is an organizational construct for aggregating virtual courses into virtual academic programs. There is very little facilities obligation, if any, on the part of the institution or virtual-campus organization. There is no particular obligation to supply the student with a computer or an Internet connection: The student will assume that responsibility in order to access the course almost anyplace. Similarly, there are few, if any, sametime class meetings, whether online or in someplace(s).

Going back to the first challenge, institutions should develop what I call an e-learning strategy. Each institution has to decide to what extent it's going to offer some academic programs in the anyplace-anytime mode, or at least dominantly in that mode. And that means developing that part of the strategy for e-learning. To what extent will virtual technologies be used simply to enhance the traditional on-campus classroom experience versus to what extent will these anyplace-anytime technologies be used to put together or participate in an anyplace-anytime instructional program—a virtual-campus program?

The second issue hits closer to the ACUTA client base: How will ACUTA institutions provide technology support to their virtual-campus programs, along with support for their traditional programs? In my mind, that's a very big issue: To what extent will all that support be provided internally versus to what extent will some of that support be provided by partner organizations and companies?

Not only must an institution decide to what extent to offer virtual academic programs, but it must also decide to what extent to rely on virtual operating services (provided by partner organizations) to support its e-learning strategy with planning, instructor training, pedagogical consultation, instructional design and other ongoing support services, such as the application service provider hosting of a learning management system with 24/7 system administration and 800-number support for students and instructors.

The power of this concept of virtual operating services owes to the thought leadership of the Nobel laureate economist Professor Ronald Coase. His work in the 1930s, when fast forwarded to today's Internet era, leads to the observation that the most nimble and cost-effective organizations, whether they're for-profit or not-for-profit, are those that are partnering as a means to avoid capital investments and to gain speedy access to expertise that is otherwise difficult to recruit, reward, and retain in today's Internet economy—all to speed the development of new strategic services, such as virtual academic program offerings. The Internet makes it possible on the open market to purchase many of the support services needed to develop and deliver a core product or services, and this is a nimble means to avoid developing and managing those support services internally.

This is not a brand-new idea in higher education. For years, some institutions have outsourced the cafeteria, the bookstore, and even some telephony services. What I'm talking about here with regard to e-learning is the extent to which you would partner with a company like ours for support services or even partner for academic programs with other institutions. That's what the Kentucky Commonwealth Virtual University (www.kcvu.org) is doing. KCVU has no faculty. It is not accredited and does not offer its own degrees, but rather relies on existing, more traditional colleges for programs, faculty, and degrees.

KCVU outsources a hosted learning-management system and a range of professional support services from Eduprise on infrastructure that Eduprise outsources from a business partner, Internet backbone service provider PSINet. That learning-management system on those hosted servers is accessible by both faculty and students through a Web browser, and the resulting learning environment is branded by KCVU, not by Eduprise. So KCVU is outsourcing academic programs and instructors from partner colleges and universities, while outsourcing infrastructure, technical support, and a range of instructor and student support services from our company. KCVU is a virtual organization with a small staff focused on student services and, therefore, on student satisfaction.

ACUTA: As we look at these issues on campus and attempt to engage the various constituents, how do we get the various campus constituents—faculty, staff, students, and alumni—to buy into this model and deal with the political issues?

Graves: First you have to look at the purpose of what you're trying to do. In my mind, the issue can be captured with a phrase: "provider centric versus market centric" or "academic centric versus market centric." The traditional campus is very much provider centric. It's very focused on the faculty and the academic programs the faculty puts together and sanctions. That's the traditional academic culture. And it's an entirely appropriate culture for traditional purposes and some other purposes.

For example, the educational programs offered by traditional institutions, certainly those for 18- to 22-year-olds seeking a liberal education or for graduate students who aspire to become researchers or scholars, are designed and

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governed by faculty because they "know best." So the faculty determines the nature and quality of the curriculum, and that makes sense. That's why many 18- to 22-year-old students go to college, or at least that's part of why they go—for that civilizing experience, that general education experience. Their parents may pay for that experience, and they want to be there. I don't see that form of traditional education going away. I do think we can use Internet technology to enhance that residential experience.

So the traditional academic culture is a valuable culture, but it doesn't fit very well with some of the new market demands being made on our campuses. Many students enrolled in our postsecondary system in America are nontraditional. There's a whole market for adult education, nontraditional post-baccalaureate programs, professional development, continuing education, and corporate training supplied by colleges and universities. Those are nontraditional needs, and they are market-driven needs. And the market is looking for cost-effective virtual-education and training programs to meet those needs. Trying to do so within the traditional academic business model, which evolved to meet an entirely different need, can be problematic. That's why some institutions are creating separate organizations—sometimes for-profit organizations—to meet these market-driven education and training needs in a timely and cost-effective manner. That's also one reason why partnering to acquire virtual support services for e-learning can be compelling, while as well providing additional leverage in the form of support for the tr 'itional academic program.

ACUTA: How do CIOs and technology specialists engage their constituents and balance the different expectations? We have the traditional 18- to 24-year-olds, graduate students, adult learners, and the corporate clients all with a different set of expectations. How do we make the trade offs in terms of where we're going to put our emphasis and focus?

Graves: I don't think technology officers can do that alone. But they can help the leadership of the institution with what is really an institutional issue. Again, I think the first thing is to understand which audience or audiences you're trying to serve. If you're trying to serve the traditional audience, that's fine, keep on serving it. The traditional culture and business model does that reasonably well, so the question becomes how to enhance the outcomes of that traditional educational experience using technology.

There's a whole market for adult education, nontraditional post-baccalaureate programs, professional development, continuing education, and corporate training supplied by colleges and universities. Those are nontraditional needs, and they are market-driven needs. And the market is looking for cost-effective virtual-education and training programs to meet those needs.

On the other hand, if you're at the same time trying to reach some of the new nontraditional markets, then you may have to square up and face the need for new support services and new business models that cannot be easily accommodated within the traditional academic culture. You may have to deal with pressures such as "time to market," profitability, and the need for nontraditional rewards to be given to instructors based on the financial success of their virtual-instructional efforts. So the issue for many campuses is whether to develop market-driven virtual programs and, if so, whether to create a separate entity to manage and service such programs or whether to shoehorn them into the traditional academic model. And when you try to do the latter, at the very least you have to recognize some of the tensions that are going to come up in the process.

ACUTA: Do you anticipate a shift away from the traditional investment in a residential environment? You said earlier that there's still value in the traditional residential experience. I suspect that not all institutions are going to be in a position to do both—to continue to make the traditional investment in residential technology and, at the same time, explore some of the newer opportunities in technology being presented to postsecondary markets.

Graves: You're right about that. Let's consider a well-known liberal arts college, like Williams. Williams is probably going to stay in the business it's in for a long time. It may use technology to enhance the residential experience it offers, and it may decide that's all it needs to do. Williams is a national brand name; it has a market. Maybe it doesn't want to do more—or have to do more—to continue to thrive.

Let's also look at another brand-name institution. Harvard, too, is going to continue to offer a residential program for 18- to 22-year-olds, and it's going to continue to have a mostly residential graduate program. But it's name-brand professional schools—in business, education, public policy, and so on—may choose to develop virtual offerings to meet market needs in a competitive manner. These professional schools may be motivated to do so for any number of reasons: perhaps (1) to enhance

their endowments, (2) to keep or retain key faculty experts by offering additional income that such programs can generate, (3) not to lose market share in the professional development market, (4) to remain a name brand in the Internet economy, and so on. For example, one of the professional schools or even the overall institution may decide to try to increase revenues through the reach of the Web and the convenience of virtual instruction. The same scenario might well apply at any brand-name university, private or public.

Now let's consider a public regional university, a regional private, or a community college. Its brand name is usually regional, not global like Harvard's, not national like Williams'. It has an audience, but it tends by and large to be a regional or even local audience. Does such an institution believe it can retain its market share of its regional target audience without offering virtual programs, or does it believe it's going to have to offer some virtual programs just to remain competitive? Does it believe it could actually extend its audience beyond the region using virtual programs, and is that in its mission? Does it believe that other institutions putting together virtual programs could barge in through the Internet and attack its regional audience resulting in a loss of regional market share? It's a complex set of issues, and such an institution may not have the luxury of ignoring these issues.

ACUTA: Many of us in the public domain are not fortunate enough to chart our own destiny. What is your vision for the comprehensive public university that is being asked to be everything for everybody?

Graves: Allow me to draw on my experience with one of our clients, University of North Carolina at Wilmington. UNCW is a comprehensive, regional, public university, and it's charting a good course. That course is to do three things: (1) to make sure that it enhances its existing traditional ground-based program with technology to keep it vigorous and competitive; (2) selectively to offer virtual programs and to do that based on its own strengths or on local market needs; and (3) to get there quickly by partnering. UNCW's students and faculty have access to a 24/7 help desk that is part of our ASP hosted model for accessing a learning-management system.

Most campuses, like UNCW, aren't funded to provide 24/7 services on a high-quality basis, and that's one reason for looking at these new partnerships based on an ASP model that provides the 24/7 systems administration, the 24/7 help desk, and so on—all affordably priced through the leverage of a multiple-client service model that is much more economical than the do-it-yourself model. And these ASP services can serve traditional audiences as well as the new virtual audiences. Scale matters, and outsourcing partnerships provide the leverage of scale and diminish the need for capital investments.

ACUTA: The dynamics of a virtual-campus environment places demands on us to move to a 24/7 model. What's your vision of the future campus environment as we grapple with these issues in light of the limited resources that many of our campuses have to deal with?

Graves: We can glimpse the future by reading about what's going on in Europe and Japan with all the young people there now carrying Web-enabled wireless devices in a variety of forms. Wireless is happening there faster than here because those countries have standardized where we haven't. Our telephone companies were late to embrace the standards and protocols of the Internet, and that history appears to have repeated itself in the wireless market. But multifaceted wireless usage is starting to come into play in our country, and I do expect it to grow tremendously over the next few years. The bottom line is that if you're in a service business and you have service receivers (students and other constituencies) who want the convenience of this kind of access, I don't see how you can resist providing that convenience for very long. It's an access and convenience issue.

So while I don't think the residential campus will disappear, I do expect to see even residential students demanding a lot more service in this virtual mode and wanting it delivered not only through their PCs connected to the Internet but also through the new, up-and-coming wireless technologies that are not necessarily PC-driven. Pressure for that kind of service is going to grow dramatically. I believe that the only way that most institutions can manage that pressure is to partner heavily, to be very precise in what they're trying to do, and to be willing to displace old business models with new business models.

ACUTA: That's a good lead into our next question. What are the key opportunities and trade offs that campus administrators will have to make as they evaluate new opportunities in the future? Partnerships among institutions have been slow to happen. How do you see that evolving in the future where it's impossible for one institution to be everything?

Graves: You're absolutely right. There's the academic side of these issues, and partnering for academic programs hasn't happened to any great extent. And to probe another, related academic issue, let's consider articulation. Articulation issues involving the transfer of academic credits are much like the thorny multiple-platform issues that eventually lead to open standards and protocols, like those that are driving the development of the Internet economy. I already see KCVU promoting articulation

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agreements among the colleges and universities providing its academic programs. I see programs like the totally online, AACSB-accredited Web MBA program at the University of Baltimore being considered by other institutions as a program that they might like to license from Baltimore for use by their faculties so that they don't have to reinvent the experience of putting an MBA course structure online.

So I see academic trade barriers beginning to break down, but it's still very early, and most institutions are not accustomed to that kind of learner-centric academic collaboration. ACUTA's clientele no doubt understands that the Internet is powering a revolution in human communication and resource sharing. That revolution makes collaboration and partnering not only easier, but, for economic reasons, an imperative. That's why I've emphasized partnerships throughout this interview. Providing capital and operating costs for all necessary infrastructure and technology support from within the institution is prohibitively expensive, increasingly complex in its demands on systems integration, and also prohibitive in the opportunity costs of focusing on recruiting, rewarding, retaining, and managing the required technical expertise in a tight labor market at the expense of focusing on the core academic mission. So I think you'll see more and more outsourcing and partnering, even for network services and other technology services that are on the ACUTA radar screen.

ACUTA: What's your view of portal and ASP technologies as a major delivery vehicle for the future model as we look at our campus environments? Are there some examples out there of institutions that are playing a lead role in embracing these technologies?

Graves: Our clients have embraced the ASP model, and we're hosting their learning environments. Some examples I know firsthand include the University of Baltimore, UNC Wilmington, KCVU, University of Louisville, Sinclair Community Colleges, Webster University, and the University of Kentucky. Those institutions made decisions to use the ASP model for hosting learning environments, and they're making decisions to seek outside help integrating those learning environments into their ERP back office systems. Many of these same clients have also asked us to help build portals so that their students can have seamless access, not only to their courses online, but also to admissions, registration, and other student services.

The name of the game is integration, but, as you know, integration is very complex today. In-house integration is often an unrealistic goal, and many campuses will be looking for systems-integration partners. A good analogy is e-tailing. Online retailers by and large don't build their own systems-integration infrastructure. They lease it, rent it, or contract for it. They may have a lot of different technology providers, but they usually have a lead systems-integration partner with the responsibility for weaving together new systems and legacy systems into a customer-centric portal environment.

ACUTA: This has been an interesting discussion. Are there any final comments or insights you'd like to share as we look down the road at the next 10 years in terms of the key challenges we're going to face?

Graves: For traditional colleges and universities, the 10-year forecast is an interesting one. We'll see a lot of change. The "killer" opportunities are to reach new audiences and to serve more people at lower cost through the Internet—because the Internet reduces the transaction costs of the learning transactions that are higher education's business. But higher education has a split personality at the moment. Some leaders are focused on the traditional mission, while others are focused on the new opportunities. Both are valid focal points, and the challenge facing many institutions is to strike the right balance between the two and to respond with the right organizational and business models. The Internet can certainly be used to add value to the traditional academic program, but this carries the certainty of increasing total costs unless other costs can be displaced or academic productivity can be increased.

On the other hand, the Internet not only is driving the new opportunities, but is also the only vehicle for seizing these new opportunities in a scalable manner. The paradox is that the Internet levels the playing field across the continuum of institutional types because resources are more readily shared at more reasonable costs, while at the same time, it will take coordinated leadership to take advantage of these opportunities for "collabotition"—competitive collaboration.

ACUTA: It seems that a lot of what we have talked about has to do with universities starting to think more in terms of business decisions rather than political or traditional strategies. Will colleges and universities have to change their way of thinking, as in the e-tailing example, and not just continue in the same old way?

Graves: I'm not saying that every institution has to embrace a virtual-campus mission in addition to or instead of its traditional mission. But I'm saying that every institution needs to confront that decision point. That's because the Internet is driving many services toward commodity pricing, which means that institutions have to look at the cost structures of their academic programs, especially any projected virtual academic offerings, because pricing is often linked to costs and competitors may be able to offer similar virtual programs at low prices through the leverage of virtual service partnerships. A

brand-name institution's programs may be relatively insensitive to commodity pricing pressures, but for many institutions, survival may depend on competitive differentiation within a commodity market of education and training providers. So it's not just the issue of whether to have virtual academic offerings, but also how to support them cost and price competitively. When you try to do everything within the traditional business model, you're typically incurring costs that you don't need to incur, so that's when you start to look at ideas such as outsourcing and having virtual operations and virtual partners and so on. So that's why these are issues not just for the academic officer and the technology officer, but also for the business officer.

ACUTA: What does the future hold for the telecom manager who has years of experience? What does he or she do to prepare for the changes that you anticipate?

Graves: There will be greater need for horizontal integration across various vertical technology domains and greater need to team up with other campuses, as well as with commercial partners. The Internet, and now Internet2, are examples of services that require such partnering. Internet2, for example, currently requires new levels of both regional and national partnering. As these next-generation internetworking services begin to reach a broader base of campuses, they will do so via commercial offerings or consortia such as those that operate the current Internet2 gigaPoPs. The leadership focus will shift from managing technologies directly to managing multiple relationships, both intra- and inter-institutional and with commercial partners.

ACUTA: ACUTA has focused on leadership for the past year. You're saying that's a valid focus?

Graves: That's a very valid focus. Up to this point, we've focused on hiring expertise in every technology domain and then hoping that we can integrate these vertical domains in-house. The task is becoming too complex and expensive and "time to innovation" too important to continue down that inwardly focused path that requires heavy capitalization and expensive and scarce expertise. So I think that the ACUTA professionals on many campuses will need to be savvy about a whole range of technologies, but not necessarily expert in depth on each technology. Instead, these technically informed leaders will focus on facilitating partnerships with companies and other institutions and managing the resulting relationships in an integrated environment in which responsibilities are shared among many internal and external partners.

Virtual Private Networks: How They Can Work for Colleges and Universities

by Ted Udelson
Integrity Computing, Inc.

Like corporations and government, academic institutions have increased their use of the Internet for transferring proprietary data and connecting remote users. Virtual private networks (VPNs) provide cost-effective technology for safeguarding your data and maintaining confidentiality while it is being transmitted over a public data network like the Internet.

VPNs remedy a shortcoming of the Internet. Developed to provide free and open access between academic institutions, the Internet protocol suite, TCP/IP, originally did not provide a secure means to transfer data. VPN technology provides security features not found in the TCP/IP protocol suite. These features protect an organization from

- unauthorized access to organizational data (snooping),
- unauthorized masquerading by outsiders as insiders (spoofing),
- unauthorized alteration of data (tampering), and
- taking control of another computer to cause additional damage (hijacking).

VPNs can save money. By using the Internet or another public data carrier, VPNs can reduce the cost of data communication by replacing expensive private or dedicated communication carriers like T1, frame relay, asynchronous transfer mode (ATM), and so forth, with inexpensive carriers like the Internet.

What Is a VPN?

A VPN provides a secure virtual connection using a nonsecure public data network, such as the Internet. Establishing a VPN allows an organization to communicate securely via its standard low-cost connection to branch or remote offices, telecommuting and traveling staff, faculty and students, and other trusted individuals or organizations. Sites with VPN devices can communicate securely with each other through the Internet. Sites without a VPN device, on the other hand, must communicate without the security offered by VPN-enabled communication.

VPN Technologies

VPNs consist of three main technologies: authentication, tunneling, and encryption. VPN can also use compression to improve performance.

Authentication is the process of verifying users or data. Like firewalls, VPNs can verify where the data originated (IP address)

and for what application the data is intended, as well as validating user names and passwords. VPNs can further authenticate data by attaching a digital stamp. A digital stamp summarizes the data digitally before transmission. If the data are tampered with in transit, the receiving side will determine that the stamp does not match the data, and the system will reject the data.

Tunneling is a process whereby a message is encapsulated in another format. This allows the original information to be masked and rendered unreadable to unauthorized snoopers. It provides for unencrypted IP packets to encapsulate encrypted protocols.

Encryption protects networks from data tampering and snooping by scrambling the data into an unreadable format. Encryption is usually handled with encryption keys that scramble and unscramble the data. Encryption keys often have public keys and private keys. If Carol wishes to send encrypted data to Bob, she must first use Bob's public encryption key. Even though a public key is used to encrypt the data, only Bob's private key can unencrypt the data. In this way, only Bob can access the data encrypted with his private key. The longer the key, the greater the level of security. Longer keys, however, take VPN devices longer to encrypt and unencrypt.

Digital certificates can further enhance encryption. Digital certificates, authenticated by a certificate authority (a known, trusted third party), can both authenticate the user and guarantee that the data has not been tampered with, snooped, or spoofed.

Compression is necessary because the header information required by encapsulation, authentication, and encryption processes adds data to the original message. This can slow the speed of data delivery. Compression performed by VPN devices can counter this negative effect.

Why Should Academic Institutions Use VPNs?

Universities can realize significant savings by using VPNs. In the campus environment, it is often necessary to collaborate with outside researchers, telecommuting and traveling staff, professors, students, and other individuals and organizations. Traditional methods of secure communication meant either dedicated circuits (T1s, for instance) or expensive data communications networks like frame relay or ATM. Such services prove quite expensive compared to connecting over the ubiquitous Internet, which the academic community often considers a free commodity.

A problem for some universities is in equitable (shared) technology resource allocation for different university departments. Chance Reschke, senior network security analyst for Formix Corporation (www.Formix.com), has served the academic and research community for 14 years. Reschke states, "Far too frequently, there is no coordinated, centralized control of information technology resources like campus networks. Some departments can monopolize existing network bandwidth, denying other departments their more modest resource requirements. Shared Ethernet channels sometimes choke when burdened with floods of traffic from one department, denying other departments the most basic network services." According to Reschke, universities can segregate resources by establishing VPNs across the shared campus backbone.

Perhaps the biggest problem solved by VPNs is with security for university networks. Reschke says that students frequently support university networks with little or no security planning. Lax security on one host in one department can compromise the entire campus network. Undergraduate and graduate students providing network support can lead to unplanned, uncoordinated technology growth, and inexplicable outages and problems. Reschke continues, "It's a virtual breeding ground for malicious activity."

A VPN within the campus environment can reduce or eliminate the risk for individual departments by authenticating all traffic to and from that department's hosts. A campus-wide VPN implementation can be a keystone to an enterprise-wide security infrastructure.

How Are VPNs Implemented?

There are three ways to implement VPN solutions: managed solutions, single vendor solutions, and mix-and-match solutions.

Managed solutions are provided by Internet service providers (ISPs). With a managed solution, the ISP provides VPN devices for all points of access, including full-time connections and dial-up connections. The ISP handles all the hardware, software, and logistics, while providing the edge devices connecting VPN participants to the Internet. The ISP must also administer users if the VPN is going to validate and authenticate use of ▶

resources. This leads to administrative overhead and greater cost. Managed solutions likely require that all VPN participants connect to the VPN using the same service provider. In a transient environment like a university setting, these restrictions prove difficult.

Single vendor solutions generally require an edge device like a firewall or VPN appliance for each permanent connection—the VPN may require VPN software or digital ID cards. Corporations most often use single vendor solutions because the edge devices are provided by the organization and the organization dictates the hardware and software used by all participants. This presumes that the organization can dictate the hardware and software required, which is rarely the case in the academic environment.

Mix-and-match solutions use devices and software from different companies. Some vendors offer VPN appliances (devices that offer a VPN-only solution in a single box) that are compatible with other vendors' VPN products. A ubiquitous solution would require extensive planning, integration, and testing. As part of an enterprise security framework, the mix-and-match solution may prove quite cost-effective in the academic environment.

What Challenges Face Academic Institutions?

Colleges and universities face special challenges not encountered by commercial, government, and other kinds of organizations. One major challenge lies in establishing standards upon which a VPN can operate. Such standards can include a common carrier (ISP), a common platform, such as BSD UNIX, LINUX, or Windows NT, or a common set of applications, like e-mail, file transfer, and terminal emulation.

VPNs are easiest to implement in a homogenous environment. If an organization has an NT server with only Microsoft clients, the organization can use Microsoft's Remote Access Server with point-to-point tunneling protocol (PPTP) and easily provide a modest level of security. The problem, according to Reschke, is that universities have transient researchers and students and other outside collaborators.

"Achieving platform homogeneity is only possible in the fantasy department," quips Reschke. In the transient environment offered by academia, standards for platforms, Internet carriers, or applications are nearly impossible to establish.

One of the biggest challenges facing colleges and universities is in the administration of VPNs. To provide user-based authentication, network administrators must provide user names and passwords and access restrictions to participants of the VPN solution in addition to their other network administration tasks. This can prove difficult in the transient and decentralized nature of many university networks.

VPN Implementation: The Internet

The Internet is the most common vehicle for VPN technology. Its inexpensive and omnipresent nature allows organizations to provide inexpensive widespread access. Remote users can use hardware or software to initiate VPN sessions. In this way, the data would be encrypted upon VPN session initiation.

- Implementation considerations

Implementation considerations include performance, architectural design, administration, and cost.

- Performance

VPNs can be implemented using software or hardware. A hardware solution is faster but more expensive. Ultimately, performance depends on the carrier systems. If carriers are busy, packet delivery is slower.

ISPs do not provide quality-of-service (QoS) guarantees stipulating transit delay. Even if ISPs could guarantee QoS, they could not guarantee that all transmissions would remain on their service until delivery. Therefore, such guarantees would depend on other carriers' services. Agreements among ISPs for QoS guarantees are possible, but do not yet exist.

Applications used will dictate performance considerations. File transfer will not require a constant bit rate, but real-time online interactions like video conferencing will suffer from the unpredictable nature of Internet-based communication.

- Architectural Design

The architectural design must fit within an organization's security framework. VPNs add valuable tools to the security arsenal. Organizations must develop a security plan using these tools, then implement that plan. VPNs, firewalls, authentication, access control, physical security, and all other components of network security must fit into the framework of that larger plan.

- Cost

According to *Byte Magazine Online,* "The cost of a VPN may be less than half that of a private dial-

in access solution. Rather than leasing lines directly to major partners and customers, you can use your existing Internet connections to send VPN traffic to one another."

Federal Computer Week reports, "Cost savings from using VPN technology have been estimated to be 50 to 80 percent less than using dedicated leased lines."

By setting up a VPN from a remote site to connect to the university headquarters, universities can have online, real-time database updates, regardless of where people are. All individuals associated with an institution can have up-to-the-minute access to all information, regardless of where it originates. Many universities want secure access for users who are at home or traveling. Again, VPNs can provide a safe and cost-effective solution.

• Administration

Administration will prove to be the biggest drawback to VPNs. For VPN systems to validate users, institutions must manage user names and passwords. As the network architecture evolves, network administrators must reconfigure firewalls and VPN devices to maintain the security infrastructure. The challenge for administrators will be to keep up with the dynamic nature of the academic community. Remote user support can challenge any organization because of varying geographic access, varying access times, and varying platforms. This is where managed solutions prove cost-effective. Regardless of implementation, if managed properly, VPNs are both secure and cost-effective.

Frequently Asked Questions

The following questions are often asked regarding VPNs:

1. What is the difference between a firewall and a VPN device?

VPN devices perform some of the same functions as traditional network security devices, such as firewalls. VPNs can run as part of a firewall or in addition to a firewall. Both firewalls and VPN devices can provide VPN services like authentication, tunneling, and encryption. Some firewalls provide VPN capability, some don't, and some provide it as an option.

Firewalls add some or all of these additional features:

√ packet filtering
√ network address translation (NAT)
√ demilitarized zones
√ application proxy
√ logging
√ alerts
√ stateful (packet) inspection
√ multi-level security
√ dual-homed domain name system

Firewalls do not necessarily provide all of these features, but at a minimum, the first six functions listed provide much of the security offered by firewalls.

2. If I already have a firewall, should I add an additional VPN device to provide VPN capability?

Some experts prefer to run all security services on a single device, which simplifies administration. Others prefer to use separate devices because a major security breech would require penetration of all devices.

3. What standards have emerged for VPN technologies?

Several standards have emerged as protocols for VPN. Some vendors have developed de facto standards for tunneling and encryption. Point-to-Point Tunneling Protocol (PPTP), introduced by Microsoft, is supported by all flavors of Windows and by many other vendors. PPTP is a Layer 2 protocol (referring to the Open Systems Interconnection reference model). PPTP provides for encrypted messages to be encapsulated (tunneling) into IP packets. ▸

Cisco's Layer 2 forwarding (L2F) is based on PPTP and performs similar functions. Microsoft and Cisco have agreed to merge the two protocols into a protocol called Layer 2 Tunneling protocol (L2TP). The Internet Engineering Task Force (IETF) has formed a working group for an IP security protocol called IPSec. IPSec provides a standard method for encryption, tunneling, and authentication for the Internet Protocol. Part of the larger IPV6 (next generation Internet Protocol), IPSec intends to address the security issues using the current implementation IP. While protocols like secure sockets layer (SSL) can authenticate and encrypt communication at the application layer, IPSec will secure communication for the underlying IP packet structure.

4. Given the diverse, transient, and often chaotic environment that characterizes the academic culture, is there a way to establish cheap and secure communication over the Internet?

Yes, says Reschke: "Universities can establish a poor man's VPN using a utility called SSH [Secure Shell]. Secure Shell provides a secure transport for terminal emulation [replacing unsecure telnet], file transfer protocol [replacing unsecure FTP]. SSH is available on nearly all platforms, uses public key cryptography, and provides end-to-end encrypted communication. SSH can tunnel any TCP/IP-based protocol, and therefore can provide secure communication over the Internet. It's a big improvement over clear-text telnet and FTP and other non-secure TCP/IP protocol suite applications."

Conclusion

VPNs can both reduce costs and improve security for a college campus. VPNs do not provide a panacea for colleges and universities. VPNs must fit within the entire framework of security, including network architecture, network authentication and access policies, and security implementation. VPNs definitely have a place in the academic environment, but require a planned, coordinated security implementation.

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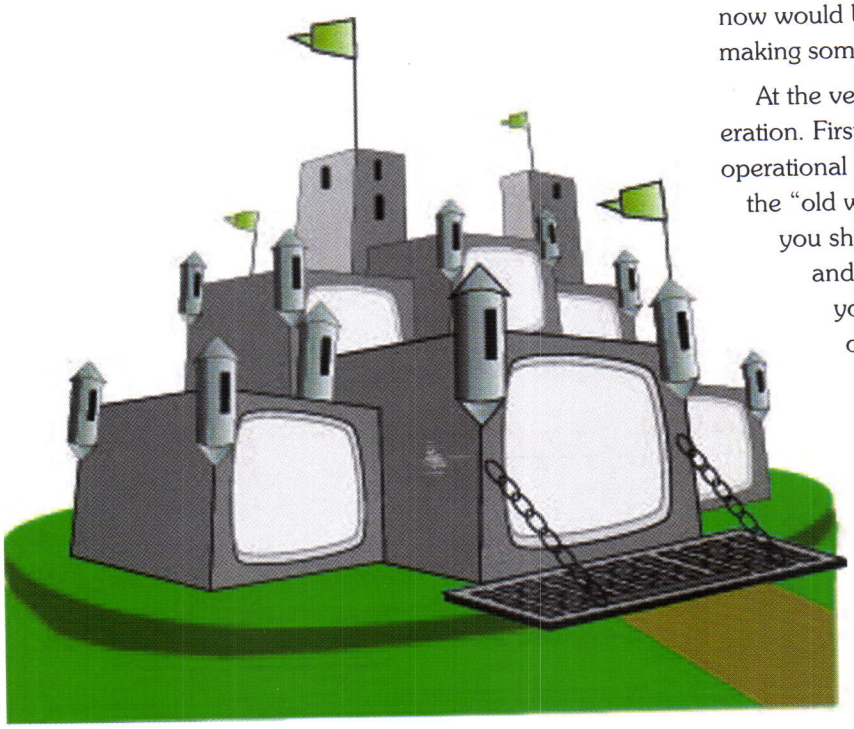
Network Security: How's Your Posture?

by David Zember

Cisco Systems



Network security is a complicated topic. There are always new threats to examine, technologies to discuss, and war stories to tell. Unfortunately, many organizations have yet to move from the we're-looking-at-it stage to the we're-doing-it stage. No one promised that it would be easy—nothing worth doing ever is. In fact, a good friend of mine once said, "If it was easy, you must have done something wrong."

Take a moment to consider your security posture. What are you doing to address the vulnerabilities, threats, and attacks that would compromise your network? Maybe your problems reside at Layers 8 (politics) and 9 (religion) of the OSI model. In any case, now would be a good time to sit up straight and start making some progress.

At the very least, two topics deserve special consideration. First, depending on whether your organization's operational security model could best be described as the "old world" model or the "new world" model, you should be able to quickly identify weaknesses and make changes where necessary. Second, you need to be aware of two specific attacks or trends that are affecting universities.

Operational Security

Many organizations approach network and information security as a project. A project has a beginning, an end, and a budget. This is the "old world" approach. In the old world approach, we go through the following process:

1. Identify a requirement and do some research.

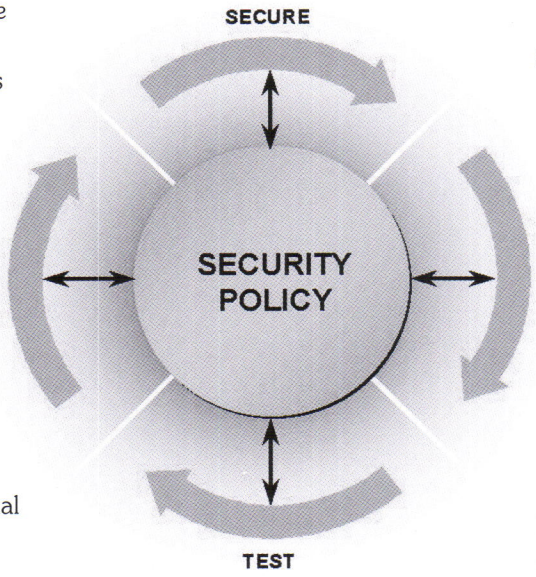
2. Identify the project budget.

3. Procure the products and services.

4. Manage the project until it is complete.

If you are trying to effectively secure networks and information systems on your campus, this "checkbox" approach will not work. You cannot do the project, check off the box, and be done, because securing networks and information is a process that should never end.

So what is the right approach? Cisco Systems prefers a "new world" approach that we call the Security Wheel. The Security Wheel has four recurring phases that center around your security policy. The outcome of each phase provides you with feedback to change and improve your policy. The Security Wheel is different from the old world approach because it is a process that never ends, focusing on continual improvement and operational excellence.



Your security policy is at the center of the wheel. If you don't have a security policy, write one now. You should be able to use the work of colleagues at colleges and universities with similar environments to get started. Think of the policy as the written representation of what you are protecting and how. Remember, it doesn't have to be perfect on the first try. This process is ongoing, so you will continually change and improve the policy.

There are four ongoing activities that will help make your security policy effective.

Test: With a policy in place, establish your baseline security posture. This process should help you determine where to start and what tools and processes you need to put in place. Focus on the big problems first. Since this is a process, you will get a chance to address the peripheral second- and third-level issues as you work your way around the wheel.

Manage and Improve: The outcome of the *test* phase should result in two things: changes to the policy and new management tasks. This might include new practices and procedures. It might also include new products or programs. It is this phase where you would introduce hardware and software solutions into your environment to help manage network security.

Secure: Introducing new software and hardware into your environment will expose holes in your policy. You will need to make changes in the policy and begin to tweak these tools to better meet your unique needs. The tweaking is the focus of the *secure* phase. As you put new practices and products in place, make sure the desired outcome is achieved. Keep your tool set current. Apply patches and service packs.

Monitor and Respond: This phase focuses on two things: responding to incidents and collecting statistics. Statistics are important for several reasons. The data that you collect in the course of a year is going to be crucial in justifying next year's budget. You will also use statistics to measure improvement and customer service. You will use vulnerability assessment and intrusion detection tools to monitor. Keep track of policy changes that need to be made at the next scheduled update.

At this point, you are ready to reestablish the baseline security posture. Measure and document your accomplishments. Set goals for the next period.

Very few organizations, including colleges and universities, can or should go at this alone. You need to develop a trust relationship with a partner to help you do the baseline posture assessment. Realistically, this partner could be a consulting firm or a vendor whose focus is security, such as Cisco Systems, Verisign, KPMG, or Ernst & Young. At the least, this should be an annual activity.

Recent Trends

In network security, there is a never-ending supply of new attacks and countermeasures. Here are two that are having a major impact on many campuses.

1. Distributed denial-of-service (DDOS) attacks:

These attacks drew a lot of attention in February of this year as hackers made headlines by nearly shutting down several premier ▸

online service providers and e-commerce Web sites. There is good news for universities here. You are unlikely to be the target of a DDOS attack. Then there is bad news. Universities are the first choice for hiding an attacker's identity and planting attack agents or remote control programs.

What is so disturbing about DDOS attacks is that little can be done by the site being attacked. The real burden belongs to the other members of the online community—namely you. You need to take the measures necessary to minimize the involvement of your campus in one of these attacks.

How can this be achieved? Here are some suggestions:

- Implement egress filtering at your Internet router. This ensures that only traffic with legitimate source IP addresses leaves campus.
- Disable IP-directed broadcasts in all campus routers. This will prevent your campus from becoming an amplifier for broadcast-type attacks.
- Cisco provides an *IP verify unicast reverse-path* interface command on its Internet router. This router feature checks each inbound packet. If the source IP address does not have a route in the routing table that points back to the same interface on which the packet arrived, the router drops the packet.
- Find and remove malicious remote control, Trojan horse, or agent software on campus systems. There are a number of host-based intrusion-detection systems available to help you do this. For example, intrusion detection software from Cisco Systems, Network Associates, or ISS could help you detect and remove Trojans like netbus and BackOrifice.

2. Malicious e-mail attachments:

We have recently experienced an increased number of viruses, such as the "Love Bug" virus, that are spread through malicious e-mail attachments. In most cases, end users unwittingly open an attachment that contains potentially destructive code that, among other things, propagates the virus to all address book entries and may corrupt or erase data on local or network drives. A newer type of virus exploits a vulnerability in html-based mail browsers that only requires a message to be previewed to spawn the malicious code.

For accurate, up-to-the-minute information about what is and what isn't capable of destroying your hard drive or carrying out some other threat, visit any of these sites:

http://ciac.llnl.gov/ciac/CIACHoaxes.html
http://kumite.com/myths/home.htm
http://vil.mcafee.com/hoax.asp
http://www.symantec.com/avcenter/hoax.html
http://www.datafellows.com/news/hoax/

There are some things you can do to reduce your exposure to such dangers. The most important is to communicate new threats to end users. The faster you communicate and educate, the better off you will be. Use the Web, e-mail, voice mail, overhead paging, whatever it takes. Second, keep your signature database current. A signature database is simply any vendor's catalog of virus definitions. Files are compared to these signatures and patterns to determine if a virus is present. Updates are normally available in short order. Post them and point your end users to them. Third, look at newer technologies that can "scrub" electronic mail as it comes in. Products such as Interscan Virus Wall from Trend Micro scan SMTP, FTP, and HTTP messages for viruses and malicious code. An approach such as this can be very successful in centralized network environments.

Some Final Words

The tendency with network security is to react to immediate threats and new vulnerabilities. If you can focus instead on proactive and preventive measures, you can get ahead. Again, the best approach is to regard network security as a continual process, not a project.

Remember the Security Wheel model, which allows you to work step-by-step, making changes to the policy as you go. This eliminates the pressure associated with writing a comprehensive network security policy. Also, phases can run simultaneously or in a different order, depending on your environment.

Finally, no person or organization can have all the knowledge, all the time. Develop a trusted partnership and leverage each other's strengths and experience. The network security partner should audit your security practices and conduct the periodic security posture assessments.

David Zember is a systems engineer with Cisco Systems, Inc. in Atlanta, Georgia. David works with organizations helping to design, implement, secure, and troubleshoot enterprise networks. Reach him at dzember@cisco.com.

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Communications Systems & Networks

2nd Edition

Author: Ray Horak

M&T Books, 2000: 697 pages

Reviewed by Terry Robb, University of Missouri

A few months ago, one of my applications developers came to me with a request. New to the telecom business, he was developing a custom program to keep track of our data network equipment, closets, transmission facilities, code levels, and so forth. As developers are trained to do, he interacted directly with the program's consumers, who were a typical group of networking techies. He needed a crash course in communications technology and terminology to understand their requirements. I immediately loaned him my copy of the first edition of *Communications Systems & Networks.* (I'm proud to report that he developed an outstanding piece of software.)

The second edition is just as good as the first, if not better. Frankly, I admire Ray Horak's courage for publishing in print. Our industry is changing so rapidly that at some point he, like Stephen King, might consider publishing e-books—a possibility, he concedes, although he has no such plans at present.

Like the first edition, the second edition profiles the usual suspects: voice, data, and video network technologies and applications. However, Horak also introduces or expands content on current hot topics, including IPv6, GE, I2, xDSL, LMDS, MMDS, PCS, LEOs, DWDM, and VoIP among many others. (Fortunately for the non-technical reader, he provides a large appendix of acronym definitions.) Recognizing the growing importance of the World Wide Web and the Internet, he devotes an entire chapter to this remarkable Information Age phenomenon. As in the first edition, Horak takes pains to explain all terms and technologies in clear language. He even uses clever allusions to illustrate technical points. If you want to discover the connection between prunes and voice over IP, for example, you'll have to pick up a copy of the book.

For this review, I focused on chapters that address issues I confront daily. For example, there is a very topical chapter on wireless networking. On my campus, the idea of wireless has captured the imagination of campus academics and administrators alike. The image of lounging on the lush grass of the Quad on a bright, springtime day exchanging e-mail or surfing the Web is very compelling. One administrator thought it would be as simple as setting up one radio tower in the middle of the campus to gain entry into this ubiquitous wireless nirvana. Reading this chapter would disabuse them of wireless as a communications silver bullet. Horak covers the broad spectrum (pun intended) of wireless technologies from licensed cellular and PCS carrier services to premises-based unlicensed wireless technologies. He also briefly describes the potential of wireless local loops as competition to our aged, but beloved, copper pairs.

Clearly the capstone of the book is the chapter devoted to convergence. Horak brings together the earlier technical chapters by describing the likely applications and underlying networks driving convergence within ever-shifting business and regulatory environments. Horak opines that the ultimate user interface to a converged network won't be an all-in-one network computer that relies on the network for applications processing and file storage. Rather, there will be a variety of modular communications components capable of accommodating a mix of voice, data, and video media. We are already seeing this occur as wireless voice- or even video-enabled personal digital assistants come to market, as well as wireless phones that double as full-function personal digital assistants capable of downloading stripped-down Web pages.

No book on networks would be complete without a chapter on the byzantine world of regulation. Because Horak intersperses discussion of regulatory issues within the technology chapters, the book's dedicated chapter on regulation is relatively short. Nevertheless, he traces the historical underpinnings of major regulations and focuses on the implementation of the 1996 Telecommunications Act.

I had the pleasure of reviewing the first edition for the *ACUTA Journal;* the pleasure is equal the second time around. I strongly recommend *Communications Systems & Networks* for your professional library. You might even consider a copy for your application developers.

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Software for Rent

Contact ASP

by Chris Harrison

In the not-so-distant past, prospective students chose which school they would attend based on such factors as cost, location, and reputation. While all of those are still important issues, today's students also consider technology an important component of a campus profile.

A new business has emerged that promises to level the field somewhat as institutions with smaller budgets struggle to compete technologically.

What Is an ASP?

Application service providers (ASPs) offer individuals or enterprises access over the Internet to application programs and related services that would otherwise have to be located in their own personal or enterprise computers. They are sometimes referred to as "apps on tap," according to Joseph Scotti, president and CEO of AUDITEL *(Private & Wireless Broadband, July 2000)*.

ASPs deliver and manage applications and computer services from remote data centers to multiple users via the Internet or a private network. These applications could be for e-commerce, accounting, customer service, knowledge management, or communications. If you've ever used an online mortgage calculator or signed up for a Yahoo! Mail account, you've used application service at its most basic level.

For those who remember the workplace of the 1970s and early 1980s, "timesharing" is not a new business concept. Twenty or 30 years ago, many firms wanted the capabilities that were possible with a powerful new IBM mainframe or DEC VAX minicomputer, but few could afford to install and maintain their own. So they outsourced the hosting of certain applications to a third party. The Web makes it even easier today to let someone else supply the expensive equipment, consistently provide the latest versions of software and the necessary technical support, and even furnish customized applications.

"Look at what the college has to do," says Scott Testa of Mindbridge, a Worcester, Pennsylvania, company that licenses its software to ASPs. "Depending on what kind of plan they're on, three or four times a year every institution has to change all their schedules. They add classes and take classes away. Professors come and go, and different administrative functions have to be performed routinely. New students have to be added, others have to be taken out of the system.

"For the small campus," Testa continues, "the IS or IT department may actually be only three or four people—or maybe only one person. It's unrealistic to think he or she can do everything. And in addition to registration, scheduling, billing, etc., there's maintenance of systems. What happens when some essential software needs to be upgraded? Does the telecom manager go out and personally upgrade 5,000 PCs? With an ASP, most of this functionality is offloaded, and the manager can concentrate on being a manager."

Attractive Benefits

ASPs seem to bridge a gap for smaller schools and companies, providing information technology, usually at a reasonable cost, through their ability to specialize and rapidly deploy centrally hosted applications. The ASP gives its customers an alternative to acquiring and implementing complex systems in-house. Some ASPs even offer solutions for managing internal information technology operations.

Speed-to-market is often cited as an important benefit of the ASP approach. The ASP is constantly updating its own equipment, applications, and expertise. ASPs can implement best IT practices for superior levels of availability, security, backup, disaster recovery, and customer service.

Some of the frustration of purchasing *software.1*, which becomes obsolete the next day when *software.2* is released, is gone with ASPs. Even customization of some applications is not impossible, although for a high degree of customization, using an ASP may not be the most cost-effective approach.

As hiring and retaining skilled technicians becomes more of a challenge throughout the industry, outsourcing the work they do may offer a viable solution, for the smaller campus especially.

Other issues that the small campus budget may not be able to address adequately but that are included in the service provided by the ASP include security, backup, and disaster recovery.

Show Me the Money

How much should using an ASP cost? As a commercial venture, an ASP offers leasing arrangements to its customers for a fee that may be a flat rate for a day, a month, or a year, or may be based on the number of users or locations. Some nonprofit and government entities provide their services at no cost. At some sites, advertiser support pays for the service.

Costs and service levels vary widely according to the types of applications and services provided. Some claim that their customers save as much as 50 percent over the cost of purchasing and managing the hardware and software for the application themselves.

The myth is that you will always save money using an ASP. In reality, the cost could be roughly equivalent to the amount you would spend doing it yourself. However, few organizations spend *more* when they choose to go with an ASP, and in the process they free up their own staff for work that is more mission critical. Also, there are usually significant gains in application deployment time by working through an ASP.

Who Are the Major Players?

A few of the applications that are available through ASPs today include enterprise resource planning (Oracle, PeopleSoft, SAP), accounting packages (Great Plains, Lawson, NetLedger), groupware ▸

(IntraSmart), and human resources and payroll (Employease).

At Comdex 99 in Las Vegas, Microsoft announced its entry into the market, putting together a set of core ASP technologies called Office Online, which cover both an operating system and applications geared to remote access.

One of the leading ASPs is Corio Inc., which offers a variety of products including enterprise resource planning and e-commerce hosting and processing.

A German company, SAP AG, introduced last year a personalized, on-demand solution called mySAP.com which allows potential customers to test a variety of SAP and third-party products online and choose the combination that works best for them.

Ebaseone in Houston, Texas, offers a solution it calls CorServ to independent software vendors who want to provide their applications over the Internet via a hosted environment. Ebaseone provides access to an international network of interconnected SONET rings, bringing virtually unlimited bandwidth availability. Other services include dedicated servers and network segments for each software provider. Sophisticated firewalls, encryption, intrusion detection, virus scanning, and 24/7 network management are also among Ebaseone's services.

Making a Decision

If you think an ASP might solve some of your problems, ask yourself the following questions:

1. How often do I forego an upgrade, either equipment or software, because of budget restraints? How do my budgeted costs compare to the fees charged by the ASP I might consider?

2. Is my current staff available to support the applications my organization uses, and are they capable?

3. How difficult is it to hire, train, and retain qualified staff?

4. Is my current level of security sufficient? Is our backup process adequate?

5. What is our present cost in both time and money when things go wrong?

6. Does my campus have a workable disaster plan?

If you have determined that taking the next step toward working with an ASP is the best move, here are some additional questions:

1. Am I comfortable giving someone else responsibility for my data?

2. What happens if I want to take my data to another provider?

3. Does the ASP have a disaster recovery plan?

4. Can they offer high-quality customer service? How do they respond in an emergency?

One of the most important steps in establishing a good relationship with an ASP will be the service-level agreement (SLA). Make sure that everyone, including end users, chief financial officer, and legal counsel, carefully reviews the SLA. Remember to build in appropriate penalties and adequate compensation in the event that service levels fall below contract levels.

Conclusion

Industry experts predict that ASPs will play increasingly significant roles in the future and may eventually eliminate boxed software and massive downloads. In a world with no licensing issues, no system crashes, and no wrangling over hardware incompatibilities, they say we will store all our data on the ASP's server and access it not from our desktop computer but from our laptop or even a television.

The ASP option may not be right for everyone. But it presents some interesting options for those who want the best for their campus but lack the resources to compete effectively for today's technology-savvy students.

Chris Harrison is a freelance writer who specializes in telecommunications issues and is a frequent contributor to the ACUTA Journal.

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VoIP inion

by Mark Katsouros

University of Maryland

Sending real-time voice traffic over a packet-switched network has matured well beyond the "fad" stage. Most of the leading networking and telephony companies now have generally available Voice over Internet Protocol (VoIP) products including switches, gateways, and phones (both "hard" and "soft"). But many questions still remain: What are reasonable quality-of-service (QoS) expectations? How reliable is it? Is it scalable? Will it integrate well into the existing circuit-switched environment? Is it cost-effective?

An attempt to answer these questions and others follows in this often opinionated but, hopefully, informative editorial. Opinions presented here are the result of various beta tests, trials, and tribulations at the University of Maryland's flagship campus in College Park and do not necessarily reflect the collective opinion of the university, nor do they offer insight into each and every VoIP product and service available.

Like other leading research institutions and large, national and multinational corporations, the University of Maryland has been experimenting with and utilizing VoIP technology for some time. First and foremost, as an educational institution and community leader, the university wishes to learn as much as possible about emerging technologies. (Of course, VoIP is really beyond the state of "emerging.") Moreover, we are considering several possibilities including: having a single communications (voice and data) infrastructure, at least in new or remote locations; taking advantage of an "infinitely" more extensive data infrastructure (allowing us to ▸

"connect" satellite locations that are beyond the range of our traditional voice network without having to install remote nodes/EPNs); and exploring the potential for more easily data-centric applications (CTI, Internet call centers, and so on).

On the often bumpy road to understanding VoIP, the university has experimented with and put in place a number of VoIP products, including Lucent Technologies' MultiMedia Communications eXchange, wireless Palm Pilot voice cradles, Definity IP, and iCosm Collaborative Video (iCV); Cisco Systems' Selsius products and Architecture for Voice, Video, and Integrated Data (AVVID); and 3COM's Network-Based eXchange (NBX) products.

What Have We Learned?

If you're trying to decide on a long-term VoIP strategy, you are not in an enviable position. The ramifications of what will happen if you do begin to deploy this technology are almost as scary as they are if you don't. First, there are three pretty distinct approaches to deploying VoIP technology:

1. Don't deploy at all, at least not now. (This approach has some significant implications for where your campus and/or your department will be in five years.)

2. Forklift upgrade or replace all existing circuit-switched equipment with the new stuff.

3. Take the hybrid approach (targeted at enterprises, including most of us, that have significant investments in installed circuit-switched equipment, such as PBXs).

No matter which approach you choose, the challenges are numerous. Supporting the QoS that widespread voice traffic demands requires either some fairly significant over-engineering or a very reliable method of prioritizing voice packets—and possibly reserving a minimal amount of bandwidth. This is not a vendor-specific problem, but rather an industry-wide challenge that is being addressed in the "labs" and, more so, by the standards committees. For example, when the IETF Signaling Transport (SIGTRAN) committee completes its work on IPS7 (a proposed signaling layer protocol), the delivery of VoIP, as well as multimedia services, will have a QoS similar, if not equal, to that now associated with Signaling System 7 (SS7), the PSTN signaling network. The IPS7 standard also promises to support internetworking between SS7 and IP networks.

If you're trying to decide on a long-term VoIP strategy, you are not in an enviable position. The ramifications of what will happen if you do begin to deploy this technology are almost as scary as they are if you don't.

Reliability challenges are also pretty much industry-wide, but the news on this front also seems good. The big vendors, such as Cisco, Lucent (now Avaya), 3COM, and others are engineering their solutions to have the ability to power hard VoIP phones directly from the switch (provided you haven't deployed a bunch of wonderfully fast but non-conductive fiber-optic cabling everywhere). That, combined with redundant servers and other hardware components, should help eliminate "reliability" from the list of issues.

Of course, the fact that most of these systems are NT-based might make some a bit skeptical. And what about the rest of the data network gear—hubs, routers, switches, and so on—not typically connected to some sort of fault-tolerant power system? This is another industry-wide, even Internet-wide, challenge that must—and certainly will—be addressed over time.

Scalability issues are a bit more complicated because they depend largely on the installed base of legacy equipment. Based on our own experience, for those with a large amount of Lucent/Avaya Definity equipment, going with their Definity IP products (at least for now) likely makes the most sense. These products integrate very nicely with existing Definity PBXs, including almost identical feature sets and administration screens, and total scalability.

Cisco's Selsius products (especially the newly released vintage) might make a lot of sense for those (perhaps new) large enterprises with little or no installed legacy equipment. They seem particularly well suited for building a converged network from the ground up. (Cisco's solution also features "Admission Control," which somewhat addresses QoS by

selectively routing calls over either the WAN or PSTN, depending on WAN bandwidth availability at call-placement time.)

For smaller enterprises, 3COM (which purchased NBX, one of the first IP-PBX vendors on the market) may have the most "tried and tested" line of VoIP products out there, but they do not, at least at the time of this writing, appear to be scalable in the "large enterprise" sense.

These are not the only companies offering products in this market, and of course it always pays to shop around.

Other Issues

Perhaps some of the most significant of all the issues are the economic arguments for—and challenges associated with—VoIP. There is the highly touted potential for long-distance savings by utilizing IP trunk products (gateways) to "connect" multiple IP (or IP-enabled) switches over the public Internet. Certainly, depending on the need and traffic, the cost savings could be phenomenal. However, stepping back to take a realistic look at this issue, not only is call quality, at least for now, far less predictable, it would seem doubtful that large, national and multinational companies, which are already paying as little as 3 or 4 cents per minute for long-distance, are going to realize any significant savings, especially after all the costs for high-tech equipment administration and maintenance and more frequent upgrades.

Additionally, there are significant economic modeling challenges associated with VoIP. With new and different methods of service (potentially "selectable" bandwidth, QoS, packet priority levels, and other possibly dynamic parameters) comes a whole slew of billing challenges. The Internet2 Consortium, with which the University of Maryland is involved, is attempting to explore, identify, study, and address these issues. (Internet2 provides a wonderfully "clean" test bed for VoIP applications, implementations, and subsequent data gathering.)

It would seem that the real cost savings comes not from "free" calls over the Internet, but rather from the potential to wire an entire enterprise (or at least new construction) with just one set of cables for both voice and data. Savings accrues immediately through simplified installation and reduced wiring closet load. And truly integrated voice and data network management also holds long-term cost savings through joint administration of user connectivity.

Which Vendors Will Survive?

There are good reasons why the University of Maryland has chosen to work with the vendors it has, including Lucent/Avaya, Cisco Systems, and 3COM. Lucent/Avaya, in addition to being a "partner" with the university on everything from technology trials to mentoring programs for technologically gifted students, is one of the leading telephony and communication research experts (thanks mostly to its infamous research arm, Bell Labs).

As you've probably seen in their television commercials, Cisco boasts that their equipment makes up the vast majority of the public Internet's gear. (They are, in essence, the Internet's "traffic cops," which could give them an edge in implementing proprietary QoS methods, such as prioritizing the transport of Cisco VoIP packets, though emerging standards will hopefully eliminate the need or desire for them to do this.)

Certainly 3COM is a leader and innovator with respect to packaging useful products and technologies in consumer-friendly, cost-effective, easy-to-use offerings. Their hubs and NICs have long been touted as the best available for the money.

Of course, these are not the only players, as the VoIP market (and technology in general) is moving so quickly that it is difficult to predict what will happen next week, much less in the long term. Besides these three vendors, a host of independent companies are producing truly leading-edge VoIP products and services. One thing is certain: The number of new technologies and acquisitions will only increase, meaning that we will be faced with even more choices as time progresses.

Where Do You Go from Here?

At the very least, identify a likely implementation path from the aforementioned approaches, and invest at least a small amount in some appropriate VoIP equipment now. As the advantages of a converged network undoubtedly push for solutions to the large (but shrinking) list of challenges, this is the time to gain valuable experience with installing, integrating, and managing VoIP equipment. VoIP is clearly the future of communications, and the future waits for no one.

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Campus Profile

Institutional Excellence in Telecommunications

Colorado Christian University

At the annual conference in Washington, D.C., Colorado Christian University telecom manager Wayne Kliewer (second from right), accompanied by former CCU coworker Jonathan McKinney, accepted the award from ACUTA President Tony Mordosky and Margie Milone.

As a winner of the Award for Institutional Excellence in Telecommunications, Colorado Christian University was honored at ACUTA's 29th Annual Conference for its work in setting a standard of quality and efficiency of service while enabling the network to pay for itself through cost savings. This article was adapted from material submitted for the award.

At Colorado Christian University (CCU) end users were frustrated with old equipment and slow connections, especially those at the smaller remote campus centers. Adding to the frustration, users did not have voice mail, and data connections to the Internet and the main campus were disappointingly slow. Budget constraints, however, forced users to accept the disparity between the types of communication needed and the types which they were being provided. A change had to be implemented.

Planning Leadership and Management Support

As a small school, CCU had historically placed the telecommunications function upon the shoulders of the facilities department. As the school continued to grow, however, it became apparent that the function needed to be centralized and receive full time attention. A new one-person telecom department was created and included with the Technology Systems Group. Before the upgrade project was begun, Wayne Kliewer was hired as the new telecom manager and given the tasks of learning telecommunications and finding a new telecom system so that the university could effectively manage the systems and costs to take advantage of economies of scale.

As a private university, CCU was able to take a planning path that was both efficient and effective. Beginning with calls to Nortel and Lucent, CCU sought a solution from one of the bigger telecom companies. After narrowing the selection process down, two local vendors were asked to design a network and complete a proposal for implementation.

When the designs were submitted and explained, the network that better included data in the design stood above the other. CCU decided that such a system would enable the university to move in some positive new directions, including distance education, video applications, and VoIP telephony.

Promotion of Technology and Maturity of Effort

An extensive effort that has touched every aspect of communications at CCU, the system upgrade has provided increased ease of management for both voice and data networks, especially given the significant distances covered by the statewide network. The school has also benefited from the increased ease in communicating, having one telephone network and a substantially more robust data network.

As a result of this project, the telecom effort has been merged with network administration. CCU has completed the datacom and telecom convergence project realizing that it has also taken another step in line with the evolution of the telecom industry. The current WAN infrastructure is capable of supporting

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voice, data, video, and VoIP communications among all seven university sites. CCU Network Administration is now in the process of making sure all LAN infrastructure has the same communications capability, paying particular attention to industry standard IP applications.

Quality Performance and Productivity Measurements

Lack of manpower forced CCU to rely heavily upon the competing vendors to arrive at current and future metrics. Most information collected dealt with the voice side of the project. Information from past bills determined cost savings that could be achieved affecting the areas of long-distance costs as well as circuit connection costs. Also, the two final vendors queried end users for what was needed and desired. The system that was chosen met virtually all the selection criteria generated by the end users.

teen percent from 23,000/month to 18,900/month. Moreover, the basic costs, including long distance, wide area data links, and dial tone have been reduced from $6,600/month to $5,000/month (a 25 percent decrease). In addition, this decrease was realized while simultaneously increasing communication bandwidth from 512k to the full 768k, and in most cases adding a twelve-channel link with the main campus on the voice side.

Once system details were worked out and the installation completed, all end users were required to undergo training for the new voice system. By design, except for the increase in network access speeds, the data aspect of the implementation was virtually transparent to the end user. A year and a half after implementation, few, if any complaints, have gone on record regarding the new system.

On the data side, traffic studies done on the data links between the Colorado Springs and Grand Junction campuses revealed that the available 256k bandwidth was insufficient. The remote centers contained approximately ninety computers that would all access the network at the same time during classes. Jumping from a 256k connection to a 768k data connection had immediate ramifications for the remote campuses.

Customer Satisfaction and Results to Date

We are very pleased with the results of this project. The data gathered shows that the university's long distance minutes have been reduced by eigh-

Overall, the implementation went extremely well. The greatest challenges were created by the local incumbent telephone company's lengthy delays of the DS-1 circuit installation—up to six months in some cases, but this was eventually resolved by involving the Colorado Public Utilities Commission. The typical challenges for small universities were somewhat alleviated by combining both voice and data into one WAN. The numerous "thank-yous" from users, however, made the trials and tribulations of planning and implementing such a system well worth the considerable effort.

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ACUTA Membership 2000-2001

Do a Friend a Favor

Here is a list of the current ACUTA membership. If someone you know is not a member, why not invite them to join us?

You'll be doing them a favor and expanding our network as well!

Abilene Christian Univ.
Adelphi Univ.
Agnes Scott College
Albert Einstein Coll. of Med. /Yeshiva Univ.
Albright College
Albuquerque T-VI
Alcorn State Univ.
Allentown College of St. Francis de Sales
Alvernia College
Amarillo College
Amherst College
Anderson Univ.
Andrews Univ.
Appalachian State Univ.
Arizona State Univ.
Arkansas State Univ.
Art Center College of Design
Asbury Theological Seminary
Ashland Univ.
Assumption College
Auburn Univ.
Auburn Univ. at Montgomery
Augsburg College
Augustana College
Aurora Univ.
Austin College
Austin Comm. College
Austin Peay State Univ.
Azusa Pacific Univ.
Babson College
Ball State Univ.
Baltimore City Comm. College
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Beaver College
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Benedictine Univ.
Berea College
Berklee College of Music
Berry College
Bethany College
Bethany Lutheran College
Bethel College
Bethel College
Binghamton Univ.
Biola Univ.
Birmingham-Southern College
Bloomsburg Univ. of Penn.
Bluffton College
Boise State Univ.
Bor. of Manhattan Comm. Coll.
Boston College
Boston Univ.
Bowdoin College
Bowie State Univ.
Bowling Green State Univ.
Bradley Univ.
Brandeis Univ.
Bridgewater College
Bridgewater State College
Brigham Young Univ.
Bronx Comm. College/CUNY
Brown Univ.
Bryant College
Bryn Mawr College
Bucknell Univ.
Bucks Co. Comm. College
Buffalo State College
Butler Univ.
Calif. Institute of Integral Studies
Calif. Polytechnic State Univ.
Calif. State Polytech. Univ., Pomona
Calif. State Univ., Bakersfield
Calif. State Univ., Chico
Calif. State Univ., Dominguez Hills
Calif. State Univ., Fresno
Calif. State Univ., Fullerton
Calif. State Univ., Long Beach
Calif. State Univ., Northridge
Calif. State Univ., Office of Chancellor
Calif. State Univ., Sacramento
Calif. State Univ., San Bernardino
Calif. State Univ., San Marcos
Calif. State Univ., Stanislaus
Calvin College
Canisius College
Capital Univ.
Carleton College
Carnegie-Mellon Univ.
Carroll College
Carthage College
Case Western Reserve Univ.
Catholic Univ. of America
Cedar Crest College
Central Christian Coll. of Kansas
Central Methodist College
Central Michigan Univ.
Central Missouri State Univ.
Central Piedmont Comm. College
Central Washington Univ.
Champlain College
Chapman Univ.
Charles Co. Comm. College
Charles Drew Univ. of Med.& Sci.
Chatham College
Cheyney Univ. of Penn.
Chicago State Univ.
Chipola Junior College
Christian Brothers Univ.
Clarion Univ.
Clark Atlanta Univ.
Clark Univ.
Clarkson Univ.
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College of William & Mary
College of Wooster
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Colorado State Univ.
Columbia College
Columbia College
Columbia Univ.
Columbia-Greene Comm. Coll.
Columbus State Comm. College
Comm. College of Allegheny Co.
Comm. College of Rhode Island
Concordia College
Concordia Univ.
Concordia Univ.
Concordia Univ.
Concordia Univ. at Austin
Concordia Univ. Wisconsin
Conn. College
Conn. State Univ. System
Cornell Univ.
Creighton Univ.
Cuyahoga Comm. College
D'Youville College
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Dartmouth College
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Davidson College
Daytona Beach Comm. College
Del. Tech. & Comm. College
Delaware Valley College
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Denison Univ.
DePaul Univ.
DePauw Univ.
Dillard Univ.
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Eastern Conn. State Univ.
Eastern Illinois Univ.
Eastern Kentucky Univ.
Eastern Mennonite Univ.
Eastern Michigan Univ.
Eastern New Mexico Univ.
Eastern Oregon Univ.
Eastern Washington Univ.
Edgewood College
Edinboro Univ. of Penn.
Elizabethtown College
Elmhurst College
Elon College
Embry-Riddle Aeronautical Univ.
Emerson College
Emmanuel College
Emory Univ.
Emporia State Univ.
Evangel College
Fairfield Univ.
Fairleigh Dickinson Univ.
Fairmont State College
Fashion Institute of Tech.
Ferris State Univ.
Ferrum College
Florida A & M Univ.
Florida Atlantic Univ.
Florida Comm. Coll., Jacksonville
Florida International Univ.
Florida State Univ.
Fordham Univ.
Fort Hays State Univ.
Fort Lewis College
Fox Valley Technical College
Franklin College of Indiana, Inc.
Franklin Pierce College
Frederick Comm. College
Friends Univ.
Frostburg State Univ.
Furman Univ.
Gallaudet Univ.
Gardner-Webb Univ.
George Mason Univ.
Georgetown College
Georgetown Univ.
Georgia Institute of Tech.
Georgia Southern Univ.
Georgia State Univ.
Gettysburg College
Goldey-Beacom College
Gordon College
Goshen College
Governors State Univ.
Grace College
Graceland Univ.
Grambling State Univ.
Grand Valley State Univ.
Grant MacEwan Comm. College
Greenville Technical College
Griffith Univ.
Grinnell College
Guilford College
Gustavus Adolphus College
Hamilton College
Hamline Univ.
Hampden-Sydney College
Hampshire College
Harding Univ.
Hartwick College
Harvard Univ.
Haverford College
Hobart & William Smith Colleges
Hofstra Univ.
Honolulu Comm. College
Hope College
Houston Comm. College System
Humboldt State Univ.
Hunter College, City Univ. of NY
Idaho State Univ.
Illinois College of Optometry
Illinois Institute of Tech.
Illinois State Univ.
Indiana Univ.
Indiana State Univ.
Indiana Univ. of Penn.
Indiana Univ.-Purdue Univ.
Indiana Univ.-Purdue Univ. at Indianapolis
Indiana Wesleyan Univ.
Iona College
Iowa State Univ.
Ithaca College
Jackson State Univ.
Jacksonville State Univ.
James Madison Univ.
Jefferson College
John Carroll Univ.
Johns Hopkins Univ.
Johnson & Wales Univ.
Joliet Junior College
Judson College
Kansas State Univ.
Keene State College
Kent State Univ.
Kenyon College
Kern Comm. College Dist.
Kettering Univ.
Keuka College
Kingsborough Comm. College
Kirkwood Comm. College
Knox College
Kutztown Univ.
KY Christian Coll./Univ. Telcom
Lafayette College
Lake Forest College
Lake Superior State Univ.
Lamar Univ.
Lander Univ.
Lane Comm. College
Laramie Co. Comm. College
Lawrence Univ. of Wisconsin
Le Moyne College
Lebanon Valley College
Lee College
Lees-McRae College
Lehigh Univ.
Lewis Univ.
Lewis-Clark State College
Lincoln Land Comm. College
Lindsey Wilson College
Loma Linda Univ.
Longwood College
Louisiana St. Univ & A & M Coll.
Louisiana State Univ. Med. Ctr
Loyola College in Maryland
Loyola Marymount Univ.
Loyola Univ. Chicago
Loyola Univ. of New Orleans
Luther College
Lycoming College
Lynchburg College
Macalester College
Madonna Univ.
Manhattan College
Mansfield Univ.
Marian College of Fond Du Lac
Marietta College
Marist College
Marquette Univ.
Mars Hill College
Marshall Univ.
Mary Baldwin College
Mary Washington College
Marymount College
Marymount Univ.
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McMaster Univ.
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Medical Univ. of South Carolina
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Mesa State College
Messiah College
Metropolitan Comm. College
Metropolitan Comm. Colleges
Miami - Dade Comm. College
Miami Univ.
Michigan State Univ.
Michigan Technological Univ.
MidAmerica Nazarene Univ.
Middle Tennessee State Univ.
Middlebury College
Middlesex Co. College
Midland Lutheran College
Millersville Univ.
Milligan College
Millikin Univ.
Mills College
Millsaps College
Milwaukee Area Tech. College
Minot State Univ.
Mississippi College
Mississippi State Univ.
Missouri Southern State College
Missouri Western State College
Monash Univ.
Monmouth Univ.
Monroe Comm. College
Montana State Univ.
Montclair State Univ.
Morehead State Univ.
Morgan State Univ.
Morningside College
Mount Holyoke College
Mount Royal College
Mount St. Mary's College
Mount Vernon Nazarene College
Murray State Univ.
National Univ.
Naugatuck Valley Comm. Tech. College
New England College
New Hampshire College
New Mexico Military Institute
New Mexico State Univ.
New School for Social Research
New York Law School
New York Univ.
No. Carolina Ag/Tech. St. Univ.
No. Carolina Central Univ.
No. Carolina State Univ.
No. Central Bible College
No. Central College
No. Dakota State Univ.
No. Idaho College
Northeast Comm. College
Northeast St. Tech.Comm. Coll.
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Northeastern OhioUniv. Coll. of Med.
Northeastern State Univ.
Northeastern Univ.
Northern Arizona Univ.
Northern Illinois Univ.
Northern Kentucky Univ.
Northern Michigan Univ.
Northwest College
Northwest Missouri State Univ.
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Northwood Univ.
Norwich Univ.
Oakland Univ.
Oakton Comm. College
Oberlin College
Occidental College
Ohio Northern Univ.
Ohio State Univ.
Ohio Univ.
Ohio Wesleyan Univ.
Oklahoma Christian Univ.
Oklahoma City Univ.
Oklahoma State Univ.
Old Dominion Univ.
Olivet Nazarene Univ.
Oral Roberts Univ.
Oregon Health Sciences Univ.
Oregon Institute of Tech.
Oregon State Univ.
Ottawa Univ.
Otterbein College
Ozark Christian College
Pace Univ.
Park College
Pasadena City College
Pellissippi St. Tech. Comm. Coll.
Penn. State Univ.
Pensacola Junior College
Pepperdine Univ.
Philadelphia Univ.
Pikeville College
Pima Co. Comm. College Dist.
Pittsburg State Univ.
Plymouth State College
Point Loma Nazarene Univ.
Portland Comm. College
Portland State Univ.
Presbyterian College
Princeton Univ.
Principia College
Providence College
Purdue Univ.
Purdue Univ. at Calumet
Purdue Univ. No. Cent. Campus
Queen's Univ.
Queens College
Queensland Univ. of Tech.
Quinnipiac College
Quinsigamond Comm. College
Radford Univ.
Ramapo College of New Jersey
Randolph-Macon Woman's Coll.
Reed College
Reinhardt College
Rensselaer Polytechnic Institute
Rhode Island School of Design
Rhodes College
Rice Univ.
Ricks College
Rider Univ.
Ripon College
Riverside Comm. College
Roanoke College
Rochester Institute of Tech.
Rockhurst College
Roger Williams Univ.
Rollins College
Rose-Hulman Institute of Tech.
Rowan Univ.
Russell Sage College
Rutgers Univ.
Rutgers Univ.-Campus at Newark
Saginaw Valley State Univ.
Saint Anselm College
Saint Francis College
Saint John's Univ.
Saint Joseph's Univ.
Saint Louis College of Pharmacy
Saint Louis Comm. College
Saint Louis Univ.
Saint Mary's College
Saint Mary's Univ. of Minnesota
Saint Michael's College
Saint Norbert College
Saint Olaf College
Salem Academy & College
Salem State College
Salisbury State Univ.
Salt Lake Comm. College
Salve Regina Univ.
Samford Univ.
San Diego State Univ.
San Francisco State Univ.
San Jose State Univ.
School of the Art Institute
Schoolcraft College
Seattle Pacific Univ.
Seton Hall Univ.
Shenandoah Univ.
Shepherd College
Sheridan College
Shippensburg Univ.
Siena College
Simon Fraser Univ.
Simpson College
Sinclair Comm. College
Skidmore College
Slippery Rock Univ.
Smith College
So. Dakota Sch. of Mines & Tech.
So. Illinois Univ., Carbondale
So. Illinois Univ., Edwardsville
Sonoma State Univ.
South Carolina State Univ.
Southeast Missouri State Univ.
Southeastern Okla. State Univ.
Southern Baptist Theo. Seminary
Southern Oregon Univ.
Southwest Missouri State Univ.
Southwest Tenn. Comm. College
Southwest Texas State Univ.
Southwest VA Comm. College
Southwestern Okla. State Univ.
Southwestern Univ.
Springfield College
St. Charles Co. Comm. College
St. Edward's Univ.
St. Lawrence Univ.
St. Mary's College of Maryland
St. Mary's Univ.
St. Thomas Univ.
Stanford Univ.
Stephen F. Austin State Univ.
Stephens College
Sterling College
Stetson Univ.
Stonehill College
Suffolk Univ.
SUNY at Albany
SUNY at New Paltz
SUNY Buffalo
SUNY College at Brockport
SUNY College at Cortland
SUNY College at Geneseo
SUNY College at Oneonta
SUNY College at Oswego
SUNY College at Plattsburgh
SUNY College at Potsdam
SUNY College at Stony Brook
SUNY College of Tech. at Alfred
SUNY Health Science at Brooklyn
SUNY Institute of Tech.
SUNY Upstate Medical Univ.
Susquehanna Univ.
Swarthmore College
Sweet Briar College
Syracuse Univ.
Tallahassee Comm. College
Tarleton State Univ.
Taylor Univ.
Teachers College, Columbia Univ.
Temple Univ.
Tennessee State Univ.
Tennessee Technological Univ.
Texas A & M Univ.
Texas A & M Univ.-Commerce
Texas A & M Univ.-Corpus Christi
Texas Christian Univ.
Texas Tech Univ.
Texas Woman's Univ.
The American Univ.
The Citadel
The Claremont Colleges
The College of New Jersey
The College of Saint Rose
The Evergreen State College
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The Rockefeller Univ.
The Scripps Research Institute
The Univ. Center
The Univ. of Chicago
The Univ. of Findlay
The Univ. of Montana
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Towson Univ.
Transylvania Univ.
Trent Univ.
Trinity Christian College
Trinity International Univ.
Trinity Univ.
Troy State Univ.
Truman State Univ.
Tufts Univ.
Tulane Univ.
Tuskegee Univ.
Union Co. College
Union College
United States International Univ.
United States Naval Academy
Univ. of Adelaide
Univ. of Akron
Univ. of Alabama
Univ. of Alabama at Birmingham
Univ. of Alabama in Huntsville
Univ. Of Alabama System
Univ. of Alaska Anchorage
Univ. of Alaska Fairbanks
Univ. of Alaska Southeast
Univ. of Alberta
Univ. of Arizona
Univ. of Arkansas
Univ. of Arkansas for Med. Sci.
Univ. of Auckland
Univ. of British Columbia
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Univ. of Calif. Office of the Pres.
Univ. of Calif., Davis
Univ. of Calif., Irvine
Univ. of Calif., Los Angeles
Univ. of Calif., Riverside
Univ. of Calif., San Diego
Univ. of Calif., San Francisco
Univ. of Calif., Santa Barbara
Univ. of Calif., Santa Cruz
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Univ. of Central Oklahoma
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Univ. of Colorado - Boulder
Univ. of Colorado at Denver
Univ. of Conn.
Univ. of Conn. Health Center
Univ. of Dallas
Univ. of Dayton
Univ. of Delaware
Univ. of Denver
Univ. of Evansville
Univ. of Florida
Univ. of Georgia
Univ. of Guelph
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Univ. of Houston
Univ. of Idaho
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Univ. of Ill. Springfield
Univ. of Ill. Urbana - Champaign
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Univ. of Kansas
Univ. of Kansas Medical Center
Univ. of Kentucky
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Univ. of Lethbridge
Univ. of Louisiana at Lafayette
Univ. of Louisville
Univ. of Maine
Univ. of Manitoba
Univ. of Mary Hardin-Baylor
Univ. of Maryland at Baltimore
Univ. of Maryland at College Park
Univ. of Maryland System Adm.
Univ. of Maryland Univ. College
Univ. of Mass., Amherst
Univ. of Mass., Boston
Univ. of Mass., Lowell
Univ. of Med. & Dentistry of NJ
Univ. of Memphis
Univ. of Miami
Univ. of Michigan
Univ. of Minnesota
Univ. of Mississippi
Univ. of Missouri System
Univ. of Missouri-Columbia
Univ. of Missouri-Kansas City
Univ. of Missouri-Rolla
Univ. of Missouri-Saint Louis
Univ. of Nebraska - Lincoln
Univ. of Nebraska at Kearney
Univ. of Nebraska at Omaha
Univ. of Nebraska Medical Center
Univ. of Nevada, Reno
Univ. of Nevada-Las Vegas
Univ. of New England
Univ. of New Hampshire
Univ. of New Mexico
Univ. of New Orleans
Univ. of No. Carolina, Chapel Hill
Univ. of No. Carolina, Charlotte
Univ. of No. Carolina, Greensboro
Univ. of No. Carolina, Pembroke
Univ. of No. Carolina, Wilmington
Univ. of North Dakota
Univ. of North Florida
Univ. of North Texas
Univ. of Northern Colorado
Univ. of Northern Iowa
Univ. of Notre Dame
Univ. of Okla. College of Med.
Univ. of Okla. Health Sci. Center
Univ. of Oklahoma
Univ. of Oregon
Univ. of Otago
Univ. of Penn.
Univ. of Pittsburgh
Univ. of Portland
Univ. of Puerto Rico System
Univ. of Puerto Rico, Mayaguez
Univ. of Puget Sound
Univ. of Redlands
Univ. of Rhode Island
Univ. of Richmond
Univ. of Rochester
Univ. of Saint Thomas
Univ. of San Francisco
Univ. of Saskatchewan
Univ. of Scranton
Univ. of South Alabama
Univ. of South Carolina
Univ. of South Florida
Univ. of Southern Calif.
Univ. of Southern Maine
Univ. of Southern Miss.
Univ. of Tampa
Univ. of Tenn., Chattanooga
Univ. of Tenn., Knoxville
Univ. of Tenn., Martin
Univ. of Tenn., Memphis
Univ. of Tex.- SW Med. Ctr, Dallas
Univ. of Texas Health Sci. Ctr.
Univ. of Texas Med. Branch
Univ. of Texas, Arlington
Univ. of Texas, Austin-Telecom.
Univ. of Texas, Dallas
Univ. of Texas, San Antonio
Univ. of the Pacific
Univ. of the Sci. in Philadelphia
Univ. of the South
Univ. of the Virgin Islands
Univ. of Toledo
Univ. of Toronto
Univ. of Tulsa
Univ. of Utah
Univ. of Vermont & State Ag. Coll.
Univ. of Victoria
Univ. of Virginia
Univ. of Washington
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Univ. of Wisc., Madison
Univ. of Wisc., Milwaukee
Univ. of Wisc., Stevens Point
Univ. of Wisc., Stout
Univ. of Wisc., Superior
Univ. of Wisc.- Oshkosh
Univ. of Wyoming
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Virginia Institute of Marine Science
Virginia State Univ.
Virginia Tech
Wake Forest Univ.
Walla Walla College
Washburn Univ. of Topeka
Washington & Lee Univ.
Washington College
Washington State Univ.
Washington Univ.
Waukesha Co. Technical College
Wayne State Univ.
Weber State Univ.
Webster Univ.
Wellesley College
Wells College
Wentworth Institute of Tech.
Wesleyan Univ.
West Chester Univ.
West Texas A & M Univ.
West Virginia Univ.
Western Carolina Univ.
Western Illinois Univ.
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Western Maryland College
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Western New Mexico Univ.
Western Oregon Univ.
Westminster College
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Westmoreland Co. Comm. College
Wheaton College
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Whittier College
Wichita State Univ.
Widener Univ.
Wilberforce Univ.
Wilfrid Laurier Univ.
Wilkes Univ.
William Paterson Univ.
William Rainey Harper College
William Woods Univ.
Williams College
Winona State Univ.
Winthrop Univ.
Wittenberg Univ.
Wofford College
Worcester Polytechnic Inst.
Wright State Univ.
Xavier Univ.
Yale Univ.
Yavapai College
Yeshiva Univ.
York Univ.

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nies to update the list of products and services they offer. This should be a better tool than ever to help you distribute RFPs or find products you are looking for.

We continue to offer audio and video highlights of the ACUTA seminars and conferences on the Web at no charge. I hope you will encourage your colleagues and staff members who couldn't be in Washington to check out the site to enjoy some of the general sessions and breakout sessions.

In the educational arena, Donna Hall, manager of professional development, and Lisa Cheshire, meetings manager, have worked hard (along with the Program Committee) to create four educational events this past year that were rated outstanding by the members who attended. In addition, they provided the support necessary to conduct three very successful audio conferences on topics of immediate interest.

In the publications arena, Pat Scott, communications manager, reports that, with the support of the Publications Committee, she redesigned the newsletter to a format that's easier to read and more visually attractive. Working closely with Eleanor Smith, our business manager, Pat also published the annual report in electronic format for the first time, saving several thousand dollars in printing and mailing costs. The *ACUTA Journal* continues to be self-supporting and well received by members.

In the corporate relations and marketing area, Kevin Adkins, corporate relations and marketing manager, and marketing assistant Amy Burton implemented major enhancements to the benefits for Gold, Silver, and Bronze corporate members, designed to increase the attractiveness of the higher membership levels. Working with the Marketing Committee, Kevin also produced a CD-ROM containing slides and multimedia information about ACUTA that can be used by members who speak to other organizations. In addition, working closely with the Vendor Liaison Committee, we developed a framework for corporate affiliate members to hold focus groups with ACUTA coordination and support. This activity is designed to encourage the development of products and services that meet the needs of the college market.

For the first time, exhibitors and sponsors were able to access all of the information they needed to participate in our expositions online, saving significant ACUTA staff time and making it more convenient for exhibitors. These Web-based exhibitor resources, designed by Kevin and Amy with Aaron's help, are being adopted by a major national exhibit-services company as a model for their own Web site. Inspired by the success of these exhibitor materials, the staff team is creating an entirely new section of the ACUTA Web site for corporate participation.

Last but not least, in a year of turmoil in the vendor community with several mergers and acquisitions involving ACUTA members, we have exceeded the combined projected exhibit-sponsorship income budget.

As usual, our business manager has been busy ensuring that the financial and administrative operations of the ACUTA office are running smoothly. This year, she successfully implemented new accounting software and completed the dues billing cycle with our newly upgraded membership database and association-management software. She worked closely with the secretary/treasurer and myself to research improvements to the employee benefit package that were approved by the board of directors. In addition, she is supervising the renovation of space in the ACUTA headquarters building that is available to be leased to new tenants and for ACUTA's own use.

In the always active legislative and regulatory arena, we introduced a new monthly publication—the "ACUTA Legislative/Regulatory Update." This Web-based newsletter contains timely information on federal regulatory and legislative developments that may directly affect your campus. Its goal is to help you become better informed and able to advise your campus on important regulatory issues that will affect your way of doing business and your bottom line. Members of the Legislative/Regulatory Affairs Committee and staff also held several meetings with FCC commissioners and staff, and other federal officials, on issues including Calling Party Pays, telephone number conservation, and fraud and abuse. Whenever practical, we have collaborated with other higher education and telecommunications associations, including NASTD, the Ad Hoc Telecommunications Users Committee, ICA, Educause, NACUBO, and others.

The ACUTA professional staff team is committed to helping our members succeed in a dynamic higher education and technology environment. I would be happy to answer any questions about this report or other ACUTA staff activities. Feel free to contact me by e-mail at jsemer@acuta.org or by phone at 859/278-3338, ext. 25, if you have any questions or would like to discuss anything in this report.

Advertiser Index

By advertising in the *ACUTA Journal,* these companies are not only promoting products and services relevant to telecommunications in higher education; they are also supporting our association. As you have opportunity, we encourage you to mention to these companies that you saw their ad in our journal.

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Jeri A. Semer, CAE

From the Executive Director

2000 Executive Director's Report

Each year, I have an opportunity to make a report to the annual business meeting regarding activities of the ACUTA headquarters office during the preceding year. Since not all members were able to attend the annual conference in Washington, D.C., I would like to share this year's report with you.

The year since we met in Nashville has been another active one for the ACUTA headquarters office. We have continued to add to the services we offer to ACUTA's institutional and corporate affiliate members.

I would like to highlight some ongoing efforts and new developments introduced in the last few weeks. As in any busy and successful operation, any accomplishments really belong to a team rather than to one individual. So, in preparation for this report, I asked each member of our professional staff to highlight a few things they thought were major accomplishments.

Kellie Bowman, ACUTA membership development manager, reports that the ACUTA membership has grown during the past year. As of June 30, we had grown by 23 institutions above the previous year to a total of 836. This is actually three times the net increase that we had during the prior year. Just as importantly, we retained over 90 percent of ACUTA institutional and corporate members from the prior year—evidence of satisfaction with the return on your dues investment. Thanks to the Membership Committee for its role in this success.

We have continued to strengthen relationships and information exchange with other professional associations in higher education and telecommunications. ACUTA exhibit booths were staffed by members of the ACUTA staff and volunteers at meetings of CUMREC, MiCTA, and CHEMA (the Council of Higher Education Management Associations) for the purpose of promoting membership and participation in ACUTA. Through these activities, we have increased ACUTA's visibility as the best resource for information on telecommunications technology in higher education. Several new institutional memberships and corporate participants are a direct result of those efforts.

We have also focused on improving your electronic access to ACUTA resources by expanding and improving the ACUTA Web site. ACUTA's home page on the World Wide Web was introduced July 1, 1995. Since that time, we have had over 90,000 separate visits to the site. That's an increase of over 25,000 visits since this time last year.

Aaron Fuehrer, computer services manager, reports continuing improvements to the totally redesigned ACUTA Web site that was unveiled last year. The new site is designed to be more interactive and easier to navigate. The membership directory information for both institutional and corporate affiliate members is now kept constantly up-to-date by drawing directly from the association's main database.

Another recent improvement provides online access to important data on the telecom equipment and services that are in use at member campuses. This facilities and services information is designed to help you instantly network and benchmark with other campuses with similar equipment and services, or of similar size and type. You can access the survey form online to provide or update your institution's data. Nearly half of ACUTA campuses have responded to the survey so far. However, we are still aiming for a higher response rate, so please complete the survey online if you haven't already. Our office can supply you with directions to your campus's unique URL.

We also totally revamped the "Guide to Products and Services," refining the list of product categories and requiring compa-

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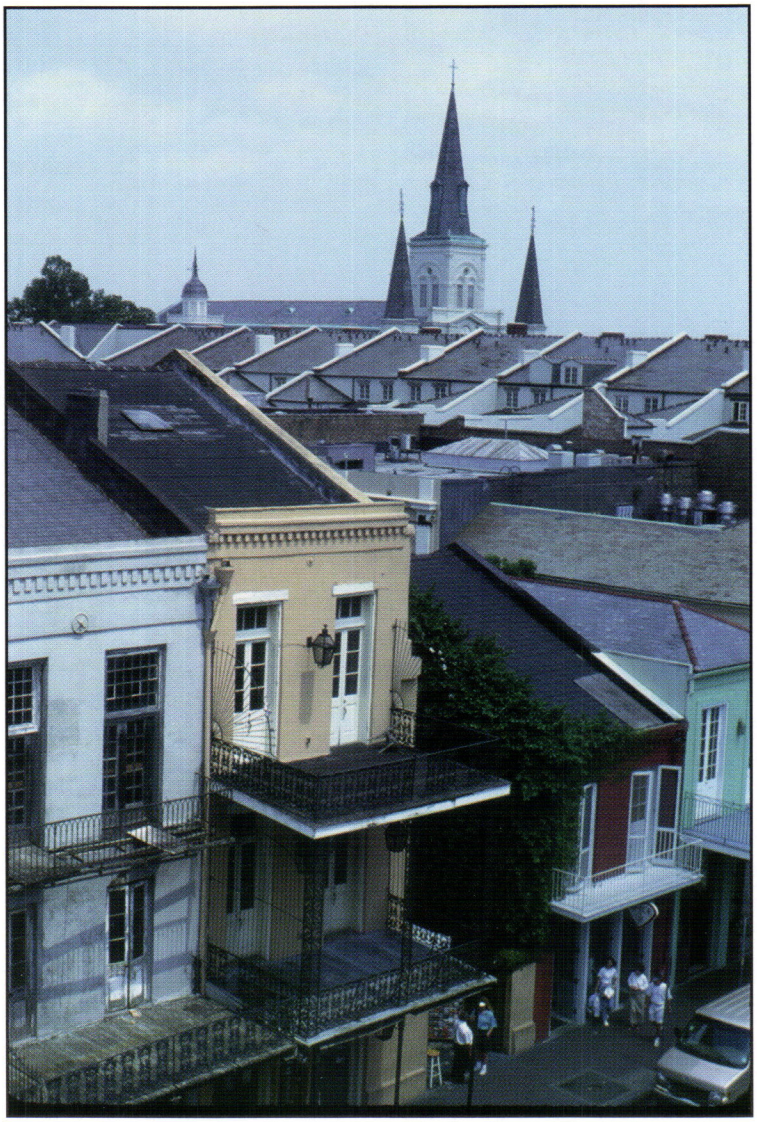
ACUTA Winter Seminars

January 14–17, 2001

New Orleans



I. Cybersecurity

Safeguarding the network infrastructure, transport, and the applications is a high priority for all universities. Being pushed to provide open access, more flexible communications, and 24-hour service while maintaining the security of our resources is fast becoming a daunting challenge. Possible sessions include:

- Web-based transactions
- Hacking
- Network stress
- Copyright & liability issues
- Acceptable use policies
- Security for e-transactions
- Cabling, grounding, protection from lightning and other natural disasters
- Middleware
- Developing security policy
- Intrusion detection
- Firewalls
- Digital signatures
- Event forensic analysis
- Digital certificates
- IP telephony security issues

II. Telecom Auditing Secrets

Whether performing a self audit or managing an outside auditor initiative, learn where to look and what to look for including how to review customer services records, conduct traffic analysis, and spot fraud. Possible sessions include:

- Auditing
- Bill verification
- Competitive price analysis
- Regulatory analysis
- Telecom tariffs
- Negotiating
- Line item charges

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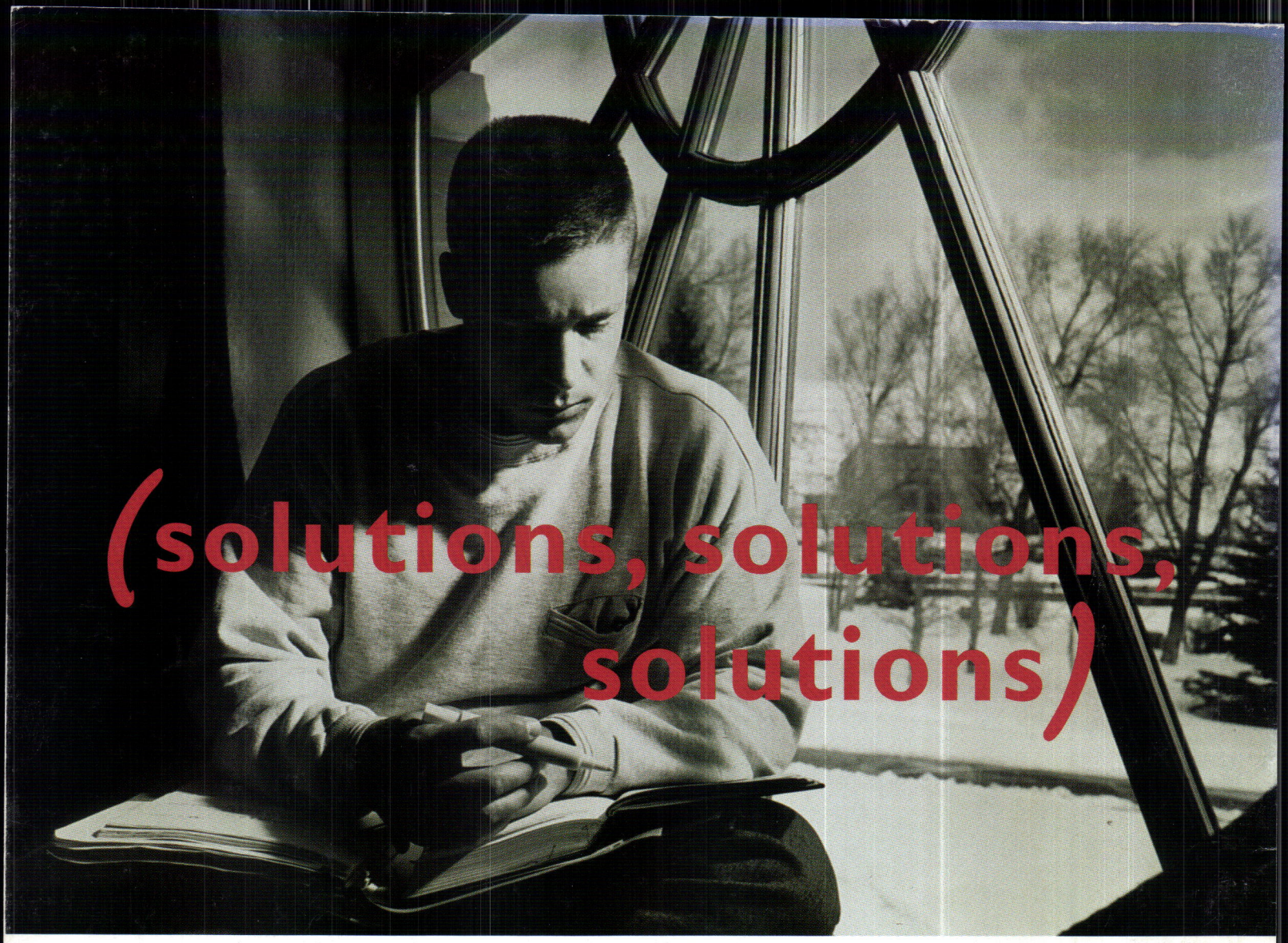

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