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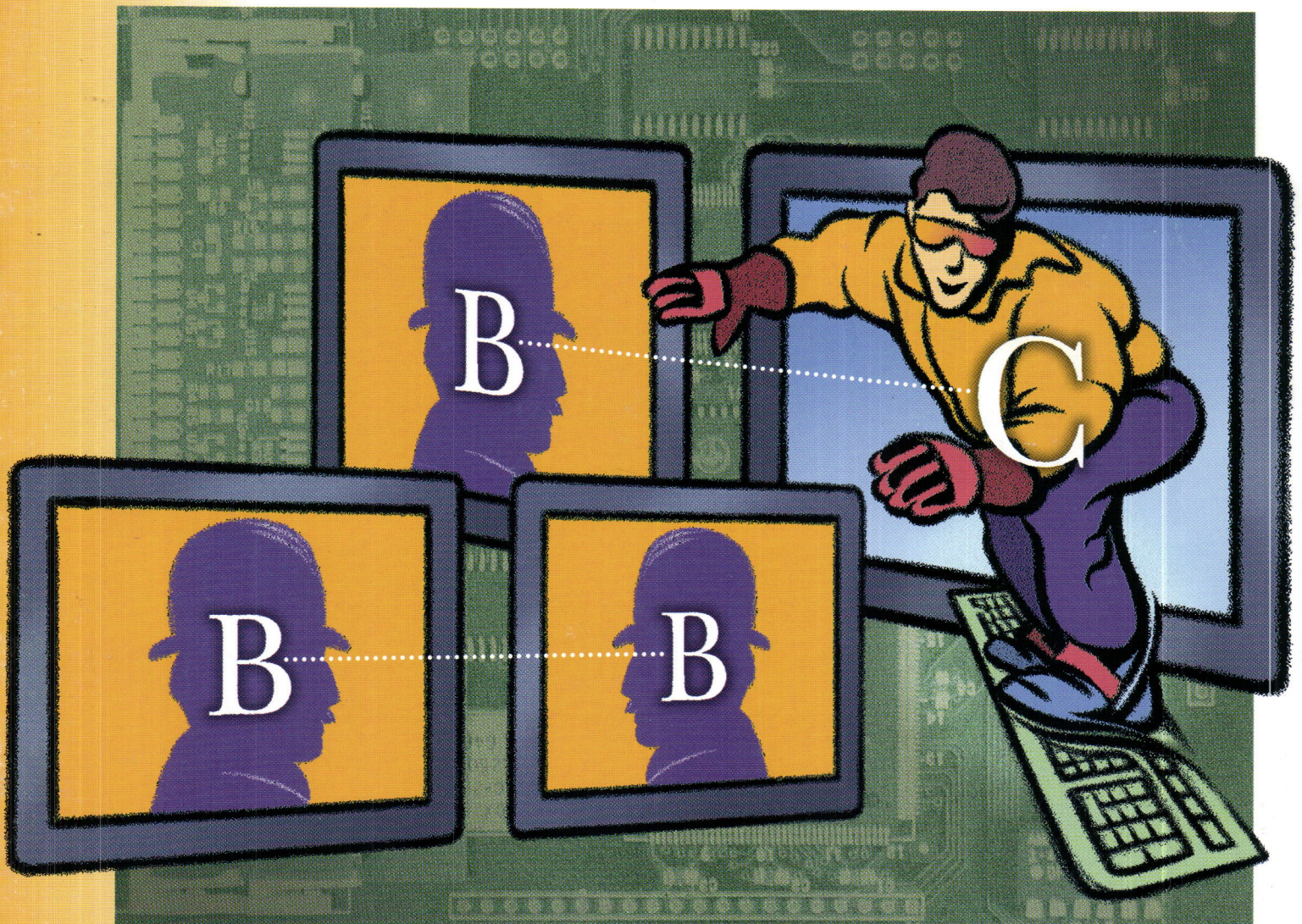
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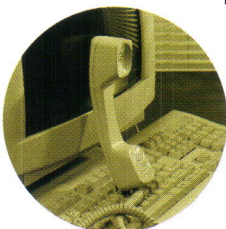
This Issue: Business-to-Business and Business-to-Consumer Applications in Higher Education

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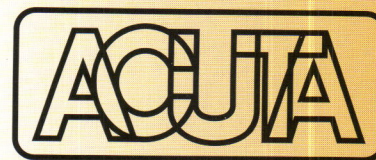
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Technology can help people
build bridges to understand-
ing and wisdom.

—Michael Zastrocky
Gartner
page 13

The ACUTA Journal

of Telecommunications in Higher Education

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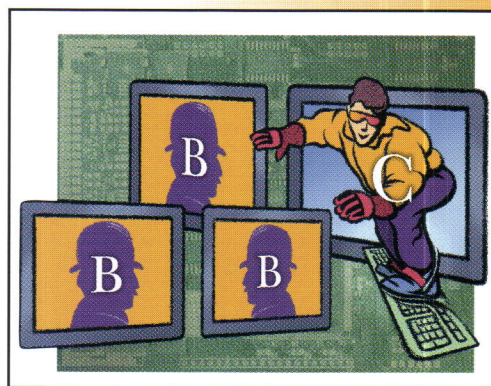
Something old became something new when UCSB returned to Centrex after operating their own switch for 13 years. E-business has customers more satisfied than ever.

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Vice President of Research with Gartner, Michael Zastrocky is well respected for his expertise in the field of e-commerce as well as his insights into technology in higher education. In this interview, Barb Renner, University of Cincinnati, and Jon VanderMeer, Western Michigan University, share an interesting dialog with Dr. Zastrocky.



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

President's Message

B2B and B2C Applications in Higher Education

E-business: Has it come to your campus yet? If not—or if so—is it part of an effective strategy that will move you into the 21st century?

Stuart Mann of Gartner suggests, "It's a case of putting the cart before the horse: Many enterprises make the mistake of focusing on e-business strategy when they need a good, old-fashioned *business* strategy in place first. While information technology is undeniably an essential component, too many organizations neglect to give other critical factors their due. Enterprises whose strategic visions for the networked economy don't take a holistic approach to strategy formulation are destined to fail."

What can we do to ensure that our institutions are ready for the worlds of business to business (B2B) and business to customer (B2C)? At Brown University, B2B is defined as *utilizing electronic means to enhance the procurement of goods and services, including educational content*. B2C is defined as *billing and collecting university receivables electronically*. Both aid in the transformation of key business processes through the use of the Internet and other enabling technologies.¹

As my institution moves toward e-commerce, we have made a conscious decision to have some guiding principles as the core platform for our transition. They include better serving customers, developing more efficient business processes, saving resources, and generating revenue, where appropriate.

Our e-business plan includes billing and collecting university receivables electronically, expanding B2B and B2C transactions, and offering a variety of electronic payment options to university customers, including debit card, credit card, electronic fund transfers, and Internet checks. Further, the business plan ensures that an e-business transaction is

handled properly from accounting, tax, auditing, and reporting standpoints. It also ensures that all e-business processes incorporate adequate security.

As we transition to e-commerce we know that we have issues to deal with including policy, security, technology, business practices, tax implications, copyright, and refinement of strategic planning.

We realize that we need to form new business alliances with third-party vendors and external service providers, raising issues of comfort and trust.

We understand that we need to assess our network's readiness, ensuring that our distributed infrastructure of servers, software, and storage systems all work well together. After all, if you cannot connect to the outside world, what good is the best e-business system?

Lastly, "we need to visit some hard questions when planning, building, and maintaining e-business infrastructure. They include asking ourselves: What platforms should we use? How do we plan for the unexpected? Will it grow when we grow? Will it work with future technology? Will it build upon my current systems? Can I link to my customers' and suppliers' systems? How do I finance all of this?"²

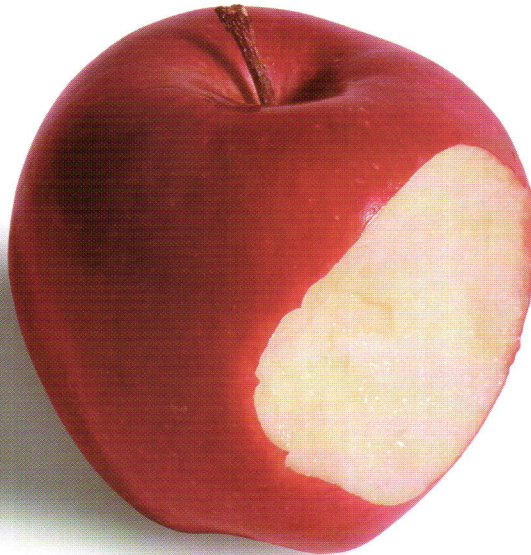
Do not be discouraged. As you read the articles in this issue of the *ACUTA Journal*, I am sure that you will find helpful information to address many of these issues. You will also find that many of us are optimistic that the results of a good e-commerce plan are worth the voyage. Enjoy the trip!

¹ Much of this article is drawn from a March 14, 2001, presentation by Ms. Terri-Lynn Thayer, executive director, Administrative Information Systems, Brown University.

² IBM advertisement, www.ecompany.com, April 2001.

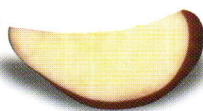


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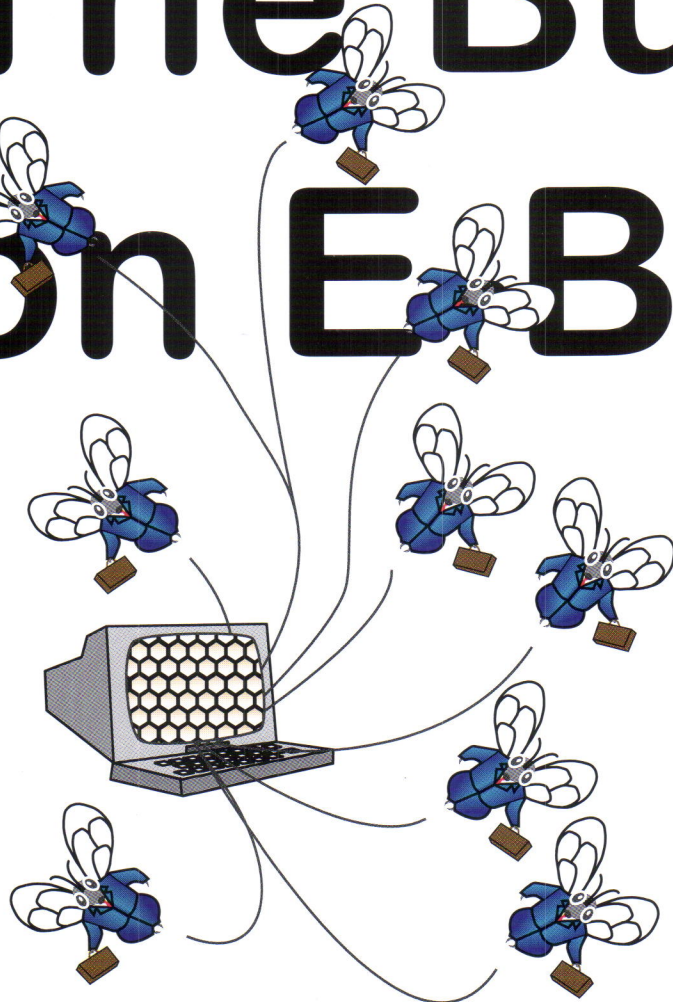
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The Buzz on E-Biz



Just when you thought you had your workload under control, a new project gets thrown at you that was due yesterday. "Right now," you are told, will be an acceptable alternate deadline.

Today, that kind of demand is not unusual in any field. Whether your job is to provision new lines, turn up Internet service, or expand the university's reach to take advantage of new business opportunities, deadlines are always immediate.

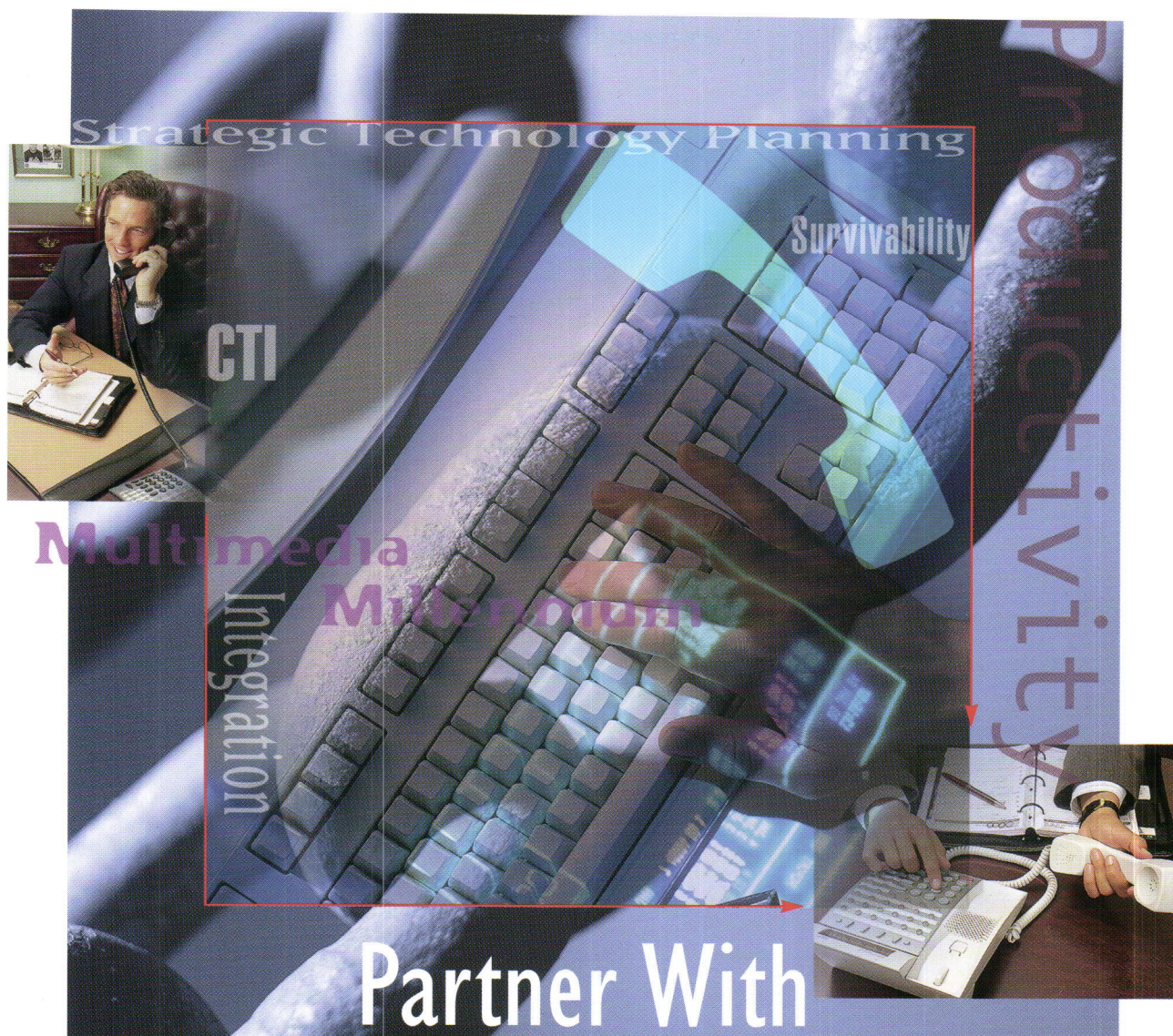
Our hurry-up world demands instant gratification. In commerce, the term we've devised is "just-in-time delivery" (JIT). Both colleges and commercial companies realize that JIT allows them to save money by eliminating financial float and to reduce the room needed to store product not immediately required. To be successful, however, it has to get customers what they want in a timely manner.

This is the basis for college-to-business and college-to-consumer e-business applications. The Internet has everyone looking at ways to profit from e-biz. The opportunities are huge. Universities must view and treat students buying credit hours as customers, right along with alumni buying logoware and fans buying football tickets. On the other hand, colleges are consumers, too.

Colleges approach e-biz from two points of view: as consumers, buying electronically from their many commercial suppliers; and as vendors, marketing everything from courses to alumni association memberships to T-shirts. They can do it all electronically.

In both cases, the telecom administrator has to be ready (yesterday, of course) with a range of technology to support successful e-business applications. ►

by Curt Harler
Contributing Editor



Change is the only constant. Success is fleeting. Challenges are hurled relentlessly from all directions. Today, surviving and competing effectively define the new corporate imperative.

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What's at Stake?

E-commerce is a great way to level the playing field. A small school in a remote location can compete for students with a huge campus in the big city. A supplier far away can bid competitively for contracts to supply a school—to the benefit of both parties.

Gartner (www.gartner.com, Stamford, Connecticut) says that business-to-business e-commerce will surpass \$7 trillion by 2004 in the United States alone. That's 10 times the amount of consumer spending on the Internet today.

Analysts at the Insight Research Corporation (www.insightcorp.com, Parsippany, New Jersey) list several advantages to e-commerce: worldwide market exposure for all suppliers, even the smallest; flexibility by having around-the-clock advertising and off-hours ordering capabilities; greater accuracy in electronic order taking compared with phone orders; availability of real-time information, including price and inventory levels; electronic payment/credit processes that are less risky than telephone-based credit card transactions; easier updating of information, especially pricing; and minimal support activities, potentially eliminating new call-center operations.

Unless your school is far richer than most, the administration minds its bottom line just as any Fortune 500 company does. Whether buying or selling, a university's e-biz initiative always has to reflect the budget.

Insight Research says that business e-commerce is not driven by the number of Internet-connected buyers (the assumption is that almost every college and all of its vendors have Internet access).

The most important factor appears to be the quantity and quality of the sellers online. Insight analysts say, "It is the quality (comprehensiveness, ease of use, attention to customer needs and desires, etc.) of the seller's Web site which, we believe, will be the driving force of e-commerce."

In university terms that means that some big-name schools may have lost several steps to Midwestern competitors such as Indiana University which were quicker to redesign their credit-hour marketing approach to offer online MBA programs and other distance-learning opportunities.

A Little History

All e-business applications, whether on campus or in the commercial world, trace their roots to EDI (electronic data interchange). EDI was driven by the need for businesses to standardize the forms and processes used to order from one another, confirm receipt of orders, announce shipment dates, and make financial settlement of those accounts electronically.

Just as it is today, that system was complicated by all the different computer systems being run by different companies. Imagine having to "translate" a call made from one LEC's territory on an old Western Electric phone to a protocol acceptable to a new Nokia wireless phone in another LEC's territory. That was (and often still is) the situation faced by the early movers in the e-business movement.

The solution was to standardize the forms of documents transferred by the diverse systems in place. Several standards came into use, including the ANSI X.122 suite, some ITU-T standards, and the

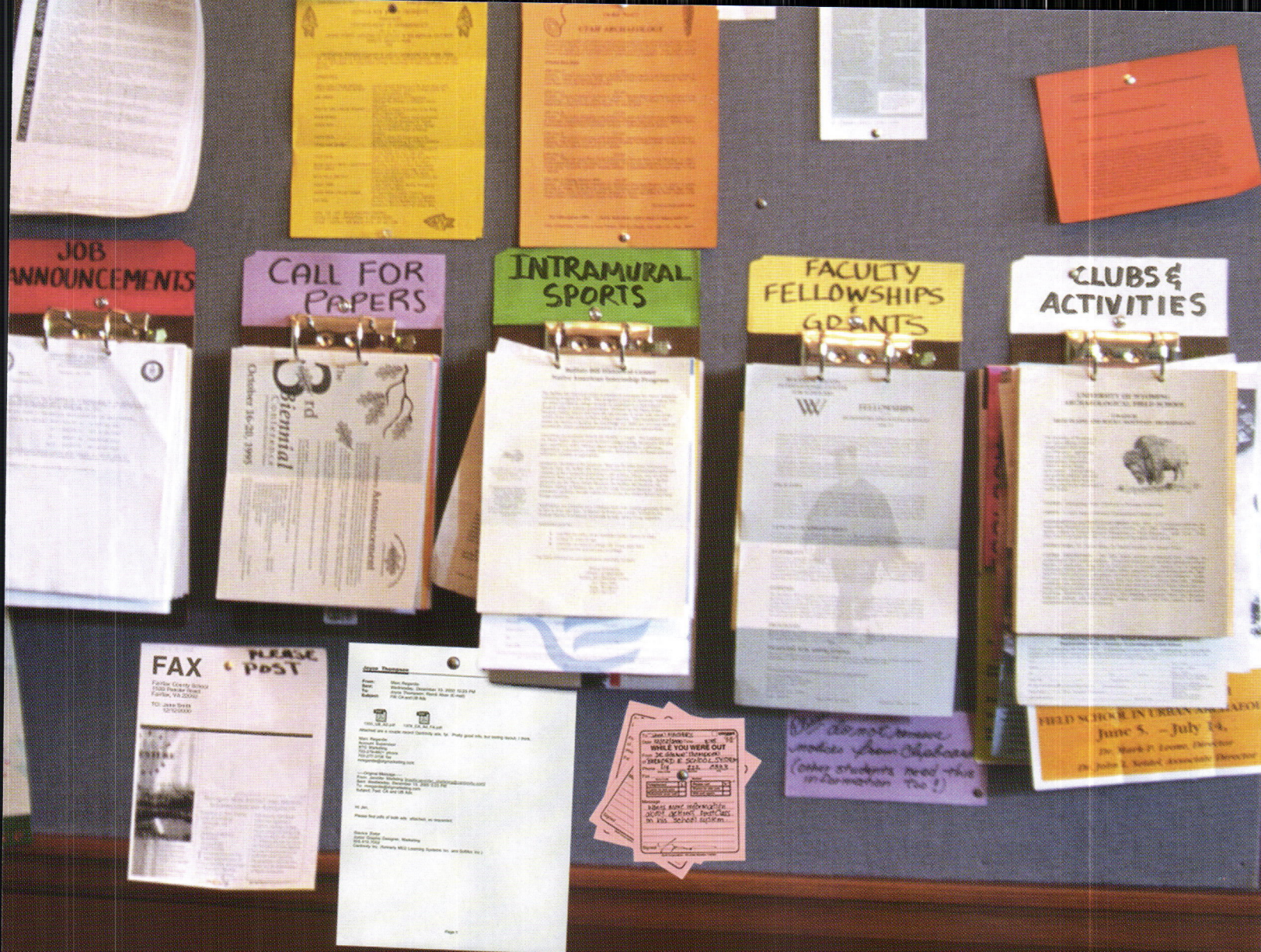
EDIFACT standard from the United Nations.

These allow computers to talk to other computers without human intervention at either end. With technology overlays such as bar code readers, the school food services department's computers could track the number of bottles of catsup in stock and the number used, and then automatically place an order for more catsup when the supply reached a certain minimum. The supplier's computer would authenticate the order, establish a shipping date, then present a bill for payment. The funds would be electronically transferred from the school's account to the supplier's.

Note there is a big difference between EDI and e-mail or fax ordering—both of which require human intervention or activity. While a human might get involved in an EDI transaction, it mainly is carried on between two computers, usually working over a value-added network (VAN) hosted by a third party.

In the mid-1990s, forward-thinking enterprises began to look at the Internet as an alternative to the EDI VANs. Some users did move away from the established EDI companies, but most decided the confidentiality and reliability of an EDI VAN, maintained by a trusted electronic commerce provider, was worth the price paid to the company running the backbone. That still is the case in mission-critical e-business applications.

Facing up to the Internet's competition, a number of EDI VANs have since migrated some of their services to the Internet, allowing firms to use a Web browser to exchange documents



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with trading partners. This only made it easier for companies to do e-biz effectively and efficiently.

Forrester Research, (www.forrester.com, Cambridge, Massachusetts) notes that EDI VANs have historically grown 25–30 percent annually. They see continued melding of EDI and Web e-commerce into a new extranet, using business-class IP services and the Internet for transport.

However, there is a lot of room to use the Internet alone for e-biz, too.

On October 1, 2000, the federal Electronic Signatures Act took effect, allowing colleges and their customers to sign contracts online, knowing that their signature is just as legally binding as one done with paper and ink.

"The Internet is considered by many to be an equalizer. I believe digital signature technology and its recent legitimization with the e-sign legislation is the ultimate equalizer," says Prakash Ambegaonkar, chairman and CEO of E-Lock Technologies (www.elock.com, Fairfax, Virginia). "We can now go beyond just the addition of signatures to content. Organizations can integrate the benefits of digital signature technology into their business processes."

Getting Paid

All of this e-biz hubbub goes for naught if the college is not paid for delivering a service or product. The SET (secure electronic transaction) specifications were the first really solid and secure ways to handle sales over the Internet.

Both MasterCard and Visa looked at the electronic payment and the security components of the SET standard and decided to make it their approved method for

transmitting bank card information over the Internet.

SET was developed by MasterCard and Visa in cooperation with GTE, IBM, Microsoft, and other big-name players. SET gives consumers, merchants, and financial institutions verifiable information about the identity of their counterparts in an electronic transaction by means of digital certificates.

"With the growing use of the Internet and other public networks in business and government communications, trust will become increasingly important in developing strong bonds with trading partners."

—William P. Crowell
Cylink

Digital certificates are a form of electronic credential issued by a trusted third party (the certificate authority) that binds information or account data to a public key stored on a computer.

Secure Technology to Help

Expect to spend a fair amount of money in the near future on e-biz. U.S. and Canadian end-user e-business expenditures will grow 171 percent, from \$4.3 billion to \$11.6 billion between 2001 and 2005, according to a market research study by Infonetics Research, San Jose, California. The

study, *User Plans for E-Business Infrastructure and Services, US/Canada 2001*, covers all phases of the end-user market.

"Whether end-users build their own e-business infrastructure or buy hosting services, the need for cost-effective, business-critical networking drives the need for ever-increasing performance, reliability, and security, and all while holding down costs," says analyst John Lawler, who directs Infonetics Research's e-business infrastructure coverage area.

"This theme is reflected throughout our study, in everything from the deployment of SSL [secure sockets layer] acceleration for e-commerce or server load balancing for scalable Web hosting," he adds.

Every reputable e-commerce application must deal with privacy and confidentiality of its transactions. The most commonly deployed components deliver SSL encryption, initiated by the enterprise's Web application.

Security should be the main concern with any college's e-biz application. Many vendors have technology to help in this and other e-biz areas.

"It's clear that with the growing use of the Internet and other public networks in business and government communications, trust will become increasingly important in developing strong bonds with trading partners," says William P. Crowell, CEO of Cylink.

His company (www.cylink.com, Santa Clara, California) and WareOnEarth Communications (www.wareonearth.com, Annandale, Virginia) have teamed to protect information transmitted over the Internet to make it less

vulnerable to tampering and exploitation. Cylink integrated its NetAuthority public key infrastructure (PKI)—which includes certificates, digital signatures, and encryption—with WareOnEarth's Hypership Trusted Information Exchange technology.

Cylink also has a 52 Mbps HSSI (high-speed serial interface) encryptor that supports X.509 digital certificates and 1,024-bit DSS digital signature industry standards.

Hewlett-Packard Company (www.hp.com/security, Palo Alto, California) offers an entire suite of products for e-security. Its line includes DomainGuard, giving authorization control over Web applications residing on a single HP, Sun, or Microsoft server; DomainGuard Enterprise, which manages multiple applications and

Web servers from a central control point; e-Firewall, which controls network access by application proxies, port filtering, and packet filtering; Virtual Vault, a security platform for connecting Web applications resident on HP, Sun, Microsoft, or IBM platforms to the Web; and WebEnforcer for Windows NT, which includes a subscription update for protection against new vulnerabilities. The package, known as HP Praesidium, offers a comprehensive suite of e-security products.

Nortel Networks (www.nortelnetworks.com, Research Triangle Park, North Carolina) wants to move its users beyond focusing on using the Internet as an online brochure or second channel to managing the whole customer relationship, not just transactions. Its Virtualized Network provides

secure IP access to precertified, preintegrated, hosted applications—with guaranteed availability and quality of service. QoS is defined by the user for each application. It allows the communications manager to track an individual department's or user's actual use of the network; remembers the user's security, service, application, and profile preferences; and permits multiple access methods for authorized users.

E-Lock Technologies markets Assured Office software, which allows workers to use certificates to sign and encrypt documents with a point/click on the desktop. This e-signature technology works with MS Word, MS Excel, and Adobe Acrobat. Its big advantage is that it allows the documents to be digitally signed and encrypted independent

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of any e-mail message to which they might be attached. Even when detached, the document remains secure.

The growing cadres of Linux users are not left out in the cold. A deal with Penguin Computing (www.penguincomputing.com, San Francisco, California) and VeriSign (www.verisign.com, Mountain View, California) puts the latter's digital certificate enrollment module into all Penguin servers equipped with accelerator boards from Nuron (www.nuron.com, Chicago, Illinois). Nuron's boards use fluid processing, integrating program-mable logic as a coprocessor in a mainstream computing system. This speeds up the Linux-based Penguin boxes running VeriSign's digital certificates.

Those schools lacking the expertise or time to go the e-biz route on their own can turn to companies such as AimNet Solutions (www.aimnetsolutions.com, Norwalk, Connecticut), which offers managed services across LAN and WAN technologies for e-business networks. Called Managed Internetworking, it focuses on secure IP networking.

Rainbow Technologies (www.rainbow.com, Irvine, California) and CyberIQ Systems (www.cyberiqsyst.com, San Jose, California) each offer e-commerce solutions that are integrated to give e-biz sites intelligent content switching and faster SSL acceleration. The result is a more responsive e-commerce site for the college—but one with data integrity and persistency of secured e-site transactions such as shopping and bill payment.

Rainbow's CryptoSwift accelerator speeds up the public-key cryptographic functions of SSL, SET, SSH, IPSec, and other common security protocols, improving server response time by up to 90 percent.

CyberIQ's HyperCommerce deals with e-commerce applications that switch between "clear text" and "secure text" in the same transaction. It maintains persistency for end users and can handle from 200 to 4,800 transactions per second. It supports SSL, TSL, and PKE and can be placed in a college's existing e-site infrastructure without major reconfiguration.

Smoothing the Path

After security, getting paid is the typical college's biggest e-biz concern. Privacy is the customer's biggest concern, surveys show. Anything that can be done to allay such concerns will help draw more customers to the school's Web-based initiatives.

According to studies by the Consumer Electronics Manufacturers Association (CEMA, www.cemacity.org, Arlington, Virginia), a sizable number of Internet users are worried about privacy—but that has not stopped them from doing business online.

Customers—whether students or business suppliers—are realistic about the outlook. In CEMA's study, half the respondents said it is likely a company would sell their information to other companies; 43 percent of consumers said it is likely the company would use data gathered from them to market other products. Yet, still they buy.

There are dozens of groups that support a wide range of e-business functions. Perhaps the

broadest reaching is the International Chamber of Commerce (www.iccwbo.org, Paris, France). A United Nations creation, ICC has consultative status with the UN and its agencies. It maintains a repository of contract terms for parties to use to build online contracts, provides alternative dispute resolution in B2C e-commerce, and maintains GUIDEC (general usage for internationally digitally ensured commerce), a set of guidelines for ensuring trustworthy digital transactions over the Internet.

ICC currently is working on its Principles of Fair Electronic Contracting and should have them available before the end of 2001. ICC also is working on a set of uniform rules and guidelines for electronic trade and settlement (URGETS). When finished, it will have rules, guidelines, and best practices for general reference in e-business transactions.

Those new standards should be done just in time—allowing any college to meet the administration's need for e-biz applications standards which were due "yesterday."

Curt Harler is a contributing editor for the ACUTA Journal. He writes for a variety of telecommunications and technology publications and is also well respected as a speaker. Contact Curt at curtharler@adelphia.net.



Interview

Michael Zastrocky Gartner



Michael Zastrocky is Vice President of Research with Gartner. His expertise in the field of e-commerce as well as higher education and technology has earned him respect from ACUTA members and throughout the business community. ACUTA publications committee members Barb Renner of the University of Cincinnati and Jon VanderMeer, Western Michigan University, engaged in an interesting dialog with Dr. Zastrocky.

ACUTA: According to Gartner Research, the B2B e-marketplace was \$433 billion in 2000 and is expected to grow to over \$2.8 trillion by 2005. What's essential for e-business leadership in higher education? What are the key elements of a blueprint for success and what are the critical competencies needed?

Zastrocky: Gartner defines e-business as any Internet-enabled business activity that transforms internal and external relationships to create value and exploit market opportunities driven by the new rules of the connected economy. While the value of the transactions generates much interest, e-business is about more than transaction

processing or taking orders for products and/or services. It is about relationship building.

Higher education institutions were founded on the principle that education is about more than content or taking exams; colleges and universities have long invested in relationship building. The Internet was originally built to connect supercomputers and researchers. It quickly expanded to include connecting researchers in many fields of study.

An example of the value of relationship building on the Internet is demonstrated by a question I often ask at conferences. I ask the audience how many have bought an automobile online. Occasionally one or two hands will go up. But when I ask how many of them have shopped for an automobile online, almost every hand goes up. The point is that both of those are e-business activities.

When we look at e-business in higher education we need only look at how most institutions use the Web for marketing to prospective students and how the Web is used to conduct many of the

primary activities of the university. In higher ed, we look at both B2B (business to business) and B2C (business to commerce) as important activities.

Several years ago B2C was the darling of the investment world; today B2B has stolen the spotlight. In higher ed, faculty, staff, and students use the Web to build relationships and do the business of higher education, including teaching and learning and management of resources. Institutions also use the Web to deliver services to our customers, both internal and external customers. We have not been afraid to use the Web to build relationships and conduct the business of the institution.

ACUTA: Would you say those critical competencies needed are the same type of thing, such as research?

Zastrocky: The core competencies of a university include teaching and learning, research and community service. All are important. When we view e-business in higher ed, we must look at how e-business can support and advance our core



competencies. E-business for higher ed institutions then must focus on how to use the Internet to advance teaching and learning, research and community service. Its not just about disseminating information or content or even knowledge, and it's not just about the creation of knowledge. The mission for higher education is about advancing wisdom and understanding, which is a human experience. Technology can help people build bridges to understanding and wisdom.

ACUTA: Gartner predicts that through the year 2002, 60 percent of all enterprises will approach e-commerce as an IT project, rather than a strategic business initiative, and that 60 percent of these projects will fail to achieve a significant return on investment. What is the evidence that supports this prediction and what are some of the steps that business can take to eliminate the obvious implication?

Zastrocky: Historically organizations (not just higher ed institutions) have built vision statements or mission statements, then gone on to strategic planning, tactical planning, and finally looked at how IT can fit into those plans. Institutional visioning must be accomplished with sufficient knowledge of technology's capabilities, capacities, and limitations to understand how technology is redefining competition and the competitive marketplace.

Well-formed institutional strategies should be structured around the institution's ability to use technology to create new markets and provide new services, as well as its ability to align the institution with a rapidly and continuously changing global marketplace. Institutional processes must be designed concurrently with technology to optimize their

performance in the new, technology-enabled college or university of 2005. Information and the technology that manages it will now be as much a critical component of enterprise visioning as capital, labor, materials, and competencies are today. However, all that being said, most organizations are still viewing B2B and B2C as IT projects, and only the leaders in an industry understand the strategic nature of what is taking place.

What's the evidence? When it comes to projections, most of our research deals with survey information as well as daily contact with our numerous clients across many industries. We take the hard data and integrate it into our anecdotal information and often a gut check. Our clients want and expect us to balance what we see (our hard research) with what we think about the future, and traditionally our projections have been pretty solid based on regular independent audits.

During the ACUTA Senior Leadership Forum a couple of years ago, I presented a slide that talked about bricks and mortar versus the virtual university. We suggested that it was going to be easier for bricks and mortar organizations to go into the virtual world than it would be for virtual organizations to build bricks and mortar. Ultimately, most business require both.

As an example, Amazon.com was the darling of the dot.com world. People talked about how they were going to take over the business of distributing knowledge resources. Well, the bottom line is that they're struggling. They have to deal with the same problems others deal with regularly including supply chain management. They've had to build warehouses and deal with managing physical resources,

not just virtual resources. That's true of any organization and it's certainly true in higher education.

The major portion of e-learning today is done by traditional institutions who have planned for and embraced the use of the technology to deliver instruction and services. Virtual-only institutions, such as Western Governor's University or Jones International University, are niche players.

ACUTA: Is e-business shaping up to be the top dog in the evolution of the Internet and the Web that hold it together?

Zastrocky: I think that if you look at e-business being relationship-building, no question, that is true. If you're looking at it from the point of view of transaction processing, then it's not true. In the future, you're going to see more business transactions done on the Web, both B2B and B2C. However, the greatest growth will continue to be in the B2B area, and for higher ed that is certainly true. Our growth will not just be based on transaction processing, we will continue to see great use of the network to do research, promote our institutional mission as well as communicate with our vendors and suppliers. It's not an advantage to a college or a university to have a portal or a Web site that brings people into their community. It's a disadvantage if you don't do it.

ACUTA: If e-business is shaping up to be this top dog, what should we expect in terms of who will ultimately get the credit or the blame for the result?

Zastrocky: I don't think there is going to be a blame or a credit. I think it's just going to be natural evolution that is taking place in the business. Higher education is business, and we are doing business on the Web.

For example, at the University of Cincinnati, you're already doing a lot on your Web site that would encourage prospects to become students at the University. You couldn't all of a sudden stop that activity or go back to an earlier time. It's already been embedded into the way the institution and the student think about the business of marketing and recruiting for higher education.

In Gartner terms we talk about every technology having a "hype" cycle, with a technology trigger leading to a peak of inflated expectations which descends into a trough of disillusionment before ramping up to a plateau of productivity. In B2C, we have seen the trigger, the peak, and the trough; however, we are also beginning to see a plateau. People are beginning to get the stars (and dollar signs) out of their eyes and look more toward long-range planning.

In higher ed we have seen this phenomenon in our registration process. We used to put students through a "rite of passage" when registering for classes that included long lines and inefficiencies. Students are saying, "Not only will I not stand in long lines to register, I don't even want to wait on the phone for the IVR system to free up!" While IVR was a bridge, now they're saying, "Give it to me on the Web. I want it on the Web. Let me register when I'm able or want to register on the Web." And once institutions provide that level of service, they can't go back—and our customers want even more!

ACUTA: That's true. Is there sufficient talent among the first generation Web analysts to make what seems to be a giant step, or should we expect the process to evolve over an extended period of time as the expertise becomes available?

Zastrocky: I don't think there's enough talent, but we already have made giant steps. If you think back even ten years ago and how we did many of our business processes, what we are doing with intellectual property and e-content has been radically changed by the Internet. We're not going to go back, so we've made what I think are giant steps. But we're still short of talent, and I don't see that pool of talent increasing sufficiently to meet global demand as long as I'm alive. I don't see it changing in the next 10–20 years. I think we're going to continue to find technology evolving faster than we can keep up with or support.

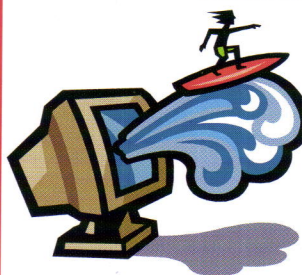
In the keynote at the Educom conference in 1988, John Kemmeny, the president of Dartmouth said, "I would almost like to see us have all technology development stop for five years so that we can catch up and learn

how to use what we already have." If that was true in 1988, how much more is it true in 2001? Moore's law and Gilder's law are still real and apply today.

The big challenge for higher education institutions is how you begin to build within our young people the idea that managing technology resources, whether it be networking or administrative or academic resources, is a career to aspire to. Colleges and universities are good places to work. We have to start competing for that talent, and while we may train them, we aren't keeping them, and we need to do a better job of that. We need to start taking those relationships that we build through work-study and build some into permanent jobs. Some institutions are doing a very good job, but most of them, by and large, don't keep their top IT student talent working on campus.

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ACUTA: A number of business and market forces are driving the rapid growth of e-marketplaces in higher education today. What are the key higher education marketplace drivers in the e-business explosion?

Zastrocky: Key marketplace drivers in the e-business explosion in higher education have been tied to e-learning and distributed learning. People are asking themselves, "How do we extend the classroom beyond traditional boundaries? How do we take technology that's now becoming pervasive and build online learning communities?" Again using common definitions, we define distributed learning (DL) as the distribution of the learning environment. Learning can be delivered anytime, anyplace or anywhere, and with any technology. E-learning is that component of DL that includes digital content, experienced through a technology interface; it is Internet-enabled. Collaboration is a desirable feature of e-learning, but is not a requirement.

In a recent Gartner survey on distributed learning, we asked higher ed institutions around the world about the graduation/course completion rate for on-campus versus distributed learning. Was it as good as, better than, or not as good as the traditional classroom graduation/completion rate?

We cross-indexed the results against another question asking how distributed learning was organized. If it was completely separate from the institution, in other words, if distributed learning was its own organization with its own faculty, its own academic policies, its own support mechanisms, etc., 33 percent said it was as good as or better than the traditional. Sixty-seven percent said it was not as good as the traditional classroom.

For institutions where the content and the teaching and learning was under the traditional academic side, but marketing, registration, billing, and the management was under a separate DL organization, 83 percent said the graduation/completion rate was as good as traditional programs. If DL was completely under the traditional academic side and treated as just part of the normal teaching and learning process, then it went up to 92 percent who said graduation rates were as good as or better than the traditional classroom. We think this reflects a good business case for distributed learning e-learning. Teaching and learning is a core competency of the higher ed institution and DL should not be treated as a separate activity but part of your teaching and learning environment.

ACUTA: Is e-commerce effective in the mindshare arena, which is the chat-collaboration arena?

Zastrocky: We believe that many institutions and instructors are effectively using the technology to build and strengthen the human relationships. Waikato University in New Zealand has long invested in distributed learning. They regularly do student satisfaction surveys for the DL courses/programs. Their survey results show that students rate the relationship between student and instructor and student-to-student relationships of greater value than the content or any other single factor.

We think that in this online learning environment the real value of the experience is how you use the technology to allow more interaction than what would take place in a traditional classroom. So chat collaboration can be used effectively to build or strengthen even a traditional learning community. However, it takes a great deal

of work to teach in this environment. If you force the chat collaboration by forcing students to participate without monitoring what they are adding, the value is not so great.

For example, one DL student suggested that when the professor monitors the chat collaboration and activities and keeps the dialogue flowing along a particular question or thread of discussion, it works well. But if it was not monitored, students have learned that just sending a message with no concern for adding value to the discussion says they are participating, but they clog the discussion with nonsense and serious students have to wade through these messages to get value.

Does that mean face-to-face isn't important or won't be around? I don't believe so. I think we'll always have a human need for face-to-face teaching and learning. In the '60s, '70s, and even into the '80s, people said as interactive technologies evolved, the need to come together for meetings and such would diminish and the travel industry would collapse. The reality has become that while we have more and more opportunity for e-communication and e-learning, we have an even greater need to come together, and the travel industry continues to grow. Look at attendance at association meetings like ACUTA. Not only is your attendance at conferences growing, but you are doing more conferences each year as well. That's true of every association, not just of higher education.

ACUTA: All too often e-commerce is measured by price and return on investment and not by the more tangible and long-lasting benefits. What are long-lasting benefits and how long until they benefit the implementer? What are the final outcomes desired for e-commerce?



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Zastrocky: When we talk in higher education we often will say we're nonprofit and we don't have a bottom line. But I worked for a university where our president was quoted on the front page of the *Wall Street Journal* as saying, "Just because we're not-for-profit doesn't mean we're for loss."

Now, we do have a bottom line in the nonprofit world or we go out of business. ACUTA would go out of business if you can't pay your bills. So does a university. So we do have a bottom line, and when you look at return on investment with these technologies, you do have to look at not only can we get a return on investment. However we need to always tie our investments to the greater mission or vision of the organization and not look at investments in a piece-meal fashion. For example, most institutions have information systems that can provide some understanding on the cost to deliver a credit hour by academic department. Natural science courses cost more than business courses to deliver, but would that knowledge mean we drop the natural sciences and only teach business courses because of our financial analysis? Not hardly. The mission of a university or college would no longer be the same if that were the case. Higher ed is not and should not be driven solely by financial analyses but must look at how to support the mission of the institution and still stay in business

ACUTA: What's the single greatest problem encountered by campuses you've worked with in developing a first-time Web-based financial aid, admissions, and registration process?

Zastrocky: The biggest problem is still based upon having the proper technical support to build interfaces to the institution's information systems. For some campuses there has been heavy reliance upon the

ERP vendors. Vendors, however, are also doing this for the first time, and getting systems working has been a trial for some institutions. Networking problems have also added to some of the institutional woes, including bandwidth limitations and concerns over security and privacy. The architecture in some of the older systems, whether they're homegrown or proprietary or a mixture of both, can cause some major problems when integrating the Web and portal applications.

The analogy that I use regularly is that it's much like the Roman bridges that were built in Europe 2000 years ago. They're still strong, they're still working for the traffic that was intended when the bridge was built; that is, foot traffic and horse traffic, and maybe even small automobiles. But if you were to put a loaded semi across these bridges they would collapse because they can't handle the pressure.

I think that the biggest problem that most institutions face when they take their legacy application suite and add portals, access to learning management systems, and other Web-enabled activities is that it places a lot more pressure on the system. Many of them are finding that they're starting to collapse. Good planning can help, but I think that IT leadership at some institutions just said sure, we'll be able to provide some access to some stuff, and they did fairly well with some minor tweaking to allow Web access and course information, and so on.

Yet as their systems advanced and the demand began to grow, we find the both the vendor and the homegrown systems are often not strong enough to support that pressure. That's where you have to deal with how to build a different interface, or in some cases start the

architecture over and build a different bridge.

When we evaluate the vendors within Gartner, we look at where the vendor is today and also where they are going. Do they have a good vision, and can they pull it off? Can they execute it for that particular market group—in this case higher education? That is absolutely essential.

ACUTA: Digital and smart classrooms have steep price tags across campus for initial start up and often do not include ongoing upgrade costs. Where do you see the greatest return on investment when configuring which technologies to place in a classroom, and can you cite any success stories?

Zastrocky: I think this needs to be dealt with as an institutional issue. Many campuses set up these very high-tech classrooms that instructors have to sign up to use. The problem with that strategy is that if I'm teaching a course and somebody asks me a question and I'm trying to build a bridge to understanding, I need the resource when that question is asked. I can't say, "Oh, let's wait two or three weeks until I'm scheduled in our high tech classroom. Then I'll show you." I need it right then and there.

In my opinion, every classroom must have a connection to the Internet, and as the professor I must have a projection device and a computer, preferably a powerful notebook. I don't know when I'm going to need that access, but I may need it today, and I may not need it today.

The point is that these very expensive, high-tech classrooms that we set up as demonstration projects may be good as a kind of preview of the future. However, I think that the institutions that are going to be successful in the long run will take that money and

spread it out and make sure that first off, every professor has a PC or a notebook that they can carry into class, that every class is connected to the Internet, and that every classroom has some kind of a projection device. That is absolutely essential. You'd be wiser beginning to take that money and move in that direction first, and then worry about high-tech demonstration classrooms later. Unless you have the funding to do a demonstration project, I would avoid that. I'd start dealing with baseline needs, with the tools that I'm going to need to teach today.

ACUTA: There's been much discussion in the news lately about identity theft and the need to protect secure transactions that involve social security numbers. What are the key elements that ensure that a Web business transaction will be secure, and how can a first-time client verify that the Web screen is presented as protected?

Zastrocky: We need specialists to deal with security. More and more institutions are asking these questions and starting to look at things like PKI. Twelve months ago, nobody called us and said, "What are we doing in higher education with PKI?" In the last six months we've had literally dozens of institutions beginning to look at that. Security and privacy are becoming important to our institutions.

When we move from collaboration and discussion lists for a course and begin to register students and do grading and transcribing and paying bills online, those activities require a different level of security. I think that institutions are going to have a need to invest in security officers or have consultant teams come in and help them define what level of security we can live with and is this going to be both according to the legal definitions and for our own requirements.

ACUTA: Do you have any advice for our members who may be new to e-business?

Zastrocky: I believe that the majority of institutions need to begin to prioritize: What are the things that we need to do in this environment and where do we make our best assessments at this time? Where would we get some distinct advantage by doing the activity or technology or where can we avoid being at a disadvantage by *not* doing it? Those are the questions that the institution has to begin to address.

For many institutions, the traditional boundaries have been redefined by the use of distributed learning. Students now have the potential to take a course from the University of Cincinnati or maybe a course from Oxford online that would compete with the courses I'm offering on campus. That's a

different world, and peer pressure and competition are being defined differently from the recent past.

It's absolutely essential for an institution which isn't serious about e-business or hasn't done much to look at it from a competitive advantage. How can we best support our mission to serve others in teaching, learning, research, and community service using Net-enabled technologies? We need to focus on our mission and set priorities. We need to plan what we can and should do and make sure our investments bring the best bang for the bucks that we have. Most institutions don't have a lot of dollars or IT talent, and mistakes can be costly. Institutions need to follow closely technology advancements and higher ed best practices.

Contact Michael Zastrocky via e-mail to michael.zastrocky@gartnergroup.com.



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Eliminating the Paper Trail

by Angel Dronsfield
Duke University

In the spring of 2000, Duke University assembled a team charged with identifying the business, legal, and technical issues surrounding doing e-business at an institutional level. Although there were pockets of small "e-business-like" applications already on campus, they were all established under the SOHO (small office, home office) model. At that time, no enterprisewide infrastructure was in place that could support and link institutional e-business systems or applications. As part of their charge, the team was asked to recommend and establish the business and technical framework necessary to support enterprise applications, including establishing relationships with key internal and external service providers (Internet banking, legal, hardware, and software providers). To initially test the framework and relationships, the team was asked to conduct a

flexible pilot application that would guide future applications.

The team initially comprised eight people from the Office of Information Technology (OIT) in the following roles:

- Project manager
- Systems programmer
- Applications manager
- Applications developer
- Data administration analyst
- Functional/business staff (3)

Representatives from the offices of IT security, investment/treasury, DukeCard, and legal affairs served in ad hoc or advisory roles.

Additionally, a steering committee was appointed that consisted of senior management in applications and business/finance and an outside consultant from IBM. The steering committee's role was to oversee the project, authorize resources as necessary, and interface with Duke senior administration regarding general e-business activities at the university.



The application chosen to pilot the business practices and test the technical infrastructure was the telephone and communications services invoicing, payment, and customer service system. Since the ownership of this system, both technical and operational, was internal to OIT, it was an ideal pilot area.

The Pilot

The pilot includes four phases. The scope for the first phase is to provide electronic bill presentation and payment options for OIT's student customers, thus allowing them to view and pay their telephone and cable television bills via the Internet. The second phase will provide students with an electronic method of registering for OIT's services. The third and fourth phases will be mirrors of the first two, only targeted at departmental, rather than student, customers and services. To date, only phase 1 is underway, although we are in the planning stages for phase 2.

OIT's Residential Services division provides telephone and other communications services to approximately 3,000 on-campus students. The functions of this office include marketing and registering students for services, rendering monthly invoices, and accepting and posting payments. In many respects, OIT's Residential Services operates as an independent small business would, therefore serving as a good candidate for a pilot. The billing and accounts receivable system used by OIT for this area is a vended telemanagement system (the Mysoft product from Compco, Inc.) with which the e-business application would need to interface.

As the first step, the team produced a brief document that detailed the business case justification for this phase of the pilot. In addition to the desired enterprise benefits, the business case included points about developing internal skill sets for future e-business applications, reducing the cost of producing monthly telephone and communications services invoices, reducing the cost of collecting payments, enhancing customer service, and reducing delays inherent in the "paper" invoicing process. Based on current monthly expenses of \$12,300 for lockbox fees, credit card fees, and printing/distribution costs, the anticipated savings of the e-business application was \$5,500 per month.

Current Process

The existing invoicing process for student phone and communications services was cumbersome, labor intensive, expensive, and slow. On the fifth of

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each month, our staff would run the billing cycle, which resulted in paper bills being printed at our Data Center in a different building. Once the print job was completed, Data Center staff would box up the invoices. A courier would deliver the bills to our Residential Services office, where a staff of three people would spend the better part of a day sorting the bills into stacks of one-page bills, two-page bills, three-page bills, and so on. Once that process was complete, another courier would pick up the bills and deliver them to Duke's bulk mail office, where the bills would be put into envelopes along with the return envelopes and any inserts, sealed, and stamped with the appropriate postage. Then the bills leaving the campus would be mailed via U.S. Mail while the ones destined for campus mailboxes would be delivered to the campus mail room to be placed in the students' boxes.

As one might expect with such a multiple-step process, there were many points of failure and several opportunities for delays. Many times, the bills were not boxed in the same order as they printed, thus separating multiple pages of the same bill. Often the bills would sit in the Residential Services office for up to two days waiting to be delivered to bulk mail. Once arriving at bulk mail, the bills would sit for a couple of days before being stuffed into envelopes. Similarly, the delay in campus mail could be two to three days, depending on the volume of first class mail (our bills do not require postage and therefore are prioritized after any mail with postage). It was very common for students to receive their bill on or after the due date (the 25th of each month).

Not surprisingly, our collections process was equally cumbersome

and subject to error. Several years ago, Duke contracted with Bank of America (then NationsBank) for lockbox services. Included with the students' paper invoice was a return envelope bearing the address of Bank of America's lockbox operation in Charlotte. If a student wanted to pay with cash, credit card, or the DukeCard, payments would need to be made in person at our Residential Services office. Otherwise, checks would be mailed to the lockbox, where they would be copied, deposited, and processed. Each night, Bank of America would FTP a file to Duke containing the detail of the batch deposit and mail a hard copy, which Duke would receive via overnight mail the following morning. Every morning, a member of the Residential Services staff would download the file and merge it into our payments file in Mysoft. Inevitably, there would be kickouts or reconciling items that often took days to resolve, a difficult process since we had only limited information with which to work.

Payment-posting kickouts were not our only problem. Confusion resulted from the fact that we were located on campus and could receive mail via campus mail with no postage; but since the lockbox operation was in Charlotte, that mail required a first-class stamp. More than once, students mailed their payment to Charlotte on the day the payment was due, thinking it was going to a Duke office and would thus arrive on time. Additionally, the Bank of America staff did not have access to our accounts receivable file, so they were not able to validate account numbers or amounts due, and were therefore "keying blind." Also, because the lockbox charged for copies of the checks and per keystroke, using that service ended up being more expensive than we had anticipated.

Therefore, in the e-business solution, we sought a much faster, reliable delivery of the invoice, a less confusing and more flexible payment method, streamlined and automated processes for both invoicing and payment, improved customer satisfaction, and overall reduced costs. From what we have experienced thus far with our pilot, we have succeeded.

E-Business Process

The e-business solution is simple: Present students with their OIT invoice online via the Web, accept payments (credit card, DukeCard, and check) via the Web, and interface online payments with our Mysoft application. To do this, we needed one to two boxes (RISC 6000s running AIX), a database engine (Oracle), a Web server (Netscape), application software (IBM's Websphere), and security software (Snareworks). To test this pilot, OIT, with the help of Duke Student Government officials, selected a group of approximately 70 students to serve as the "pilot of the pilot" group for a three-month period.

We began by focusing on the delivery of invoices online. To keep it simple, we parsed the print stream for the paper invoices and added only a few enhancements. Therefore, the online invoices look much like the ones students are accustomed to seeing. Once the billing cycle runs each month, students are notified via e-mail that their invoices are ready for viewing and are given the site address. When students go to the site to view their invoice, they are prompted to log on to the secure site using Snareworks, a security package the University already had in place for its student information system (checking grades, register-

ing for classes, etc.). Once they have authenticated, students can view their current invoice, along with up to three previous months' bills. Along with the simplicity of this system, one of the benefits to the students is the speed; bills are viewable online the day after the cycle runs, leaving them ample time to pay before the due date.

Once students have accessed their online invoices, they can pay at any time. The system is flexible enough to allow them to pay using multiple methods (checks, Visa/MasterCard, DukeCard) or on multiple occasions throughout the month. Wachovia Merchant Services processes all credit card and check payments for our e-business application. TeleCheck authorizes payments made by check, while credit card payments are approved by First Data Corporation. Once a transaction is authorized, Wachovia Merchant Services receives notification via the SurePay payment gateway (a Wachovia product) and, in turn, sends Duke transactional information that is automatically posted to OIT's internal system (Mysoft). SurePay creates a management report file whereby OIT staff can review payment activity to ensure alignment with our internal accounts receivable ledger.

The Results

In March 2001, we ran our first e-business cycle, which included 46 invoices to the 70 pilot users, generating \$1,534.19 in accounts receivable. (Those who did not receive an invoice had no activity for the month). Throughout the month, the pilot users made payments using MasterCard, Visa, and the DukeCard. Interestingly enough, no payments were made by check. For the first month of the pilot, 25 payments were made

totaling \$1,492.26. When the second e-business cycle ran in April, we created 44 invoices totaling \$2,044.70, for which we had received 16 payments totaling \$898.43 by May 1.

Feedback received to date has been very positive. In general, the pilot users are very happy with the look of the invoice, speed of delivery, payment options, and reliability of the system. Areas mentioned for improvement include adding a log-off button and updating the online invoice to reflect payments made (online or otherwise) during the month. Prior to the third cycle, we sent a formal survey to the pilot users asking them to evaluate the system on specific areas and overall functionality of the system. At the time of this article, those results are still being received.

One of the key lessons learned in this pilot was that e-business applications require as much focus on the business or transactional aspects as on the technology. Once we were close to having the technical functionality in place, we were still trying to work through the legal and banking requirements. One of our team members spent weeks researching those areas on the Internet, meeting with Duke's legal counsel, and reviewing contracts from external service providers. What we discovered is that there are very specific requirements for Web presentation, disclosure information, and payment receipt notifications. Fortunately, we were able to incorporate those in our Web interface and notification system without delaying the project.

Since we are still in the "pilot of the pilot" phase, it is too early to assess or quantify any specific cost savings resulting from reduced use

of paper, envelopes, postage, contract labor, or lockbox fees. Once e-billing is used by a much larger percentage of our user base, we will be in a better position to substantiate our savings.

Our plan now is to incorporate the lessons learned from the pilot into a broader offering for the fall. At this time, we still intend to offer online bill presentation and payment as an option rather than a requirement but hope over time to completely eliminate the paper process. Of course, we will continue to maintain a customer service interface for receiving cash, check, or credit card payments in person (and to process checks received in the mail). We are considering providing an incentive to our users to convert to e-billing by initially offering a discount on services for those who elect online billing. Later on, barring any legal or ethical restrictions, we may add a "surcharge" to those who choose to remain with our traditional paper invoice system (much as the airlines do).

For now, though, we are very happy that our pilot has been successful in both achieving the specific goals of online bill presentation and payment and establishing the enterprisewide architecture necessary to support further e-business applications at Duke.

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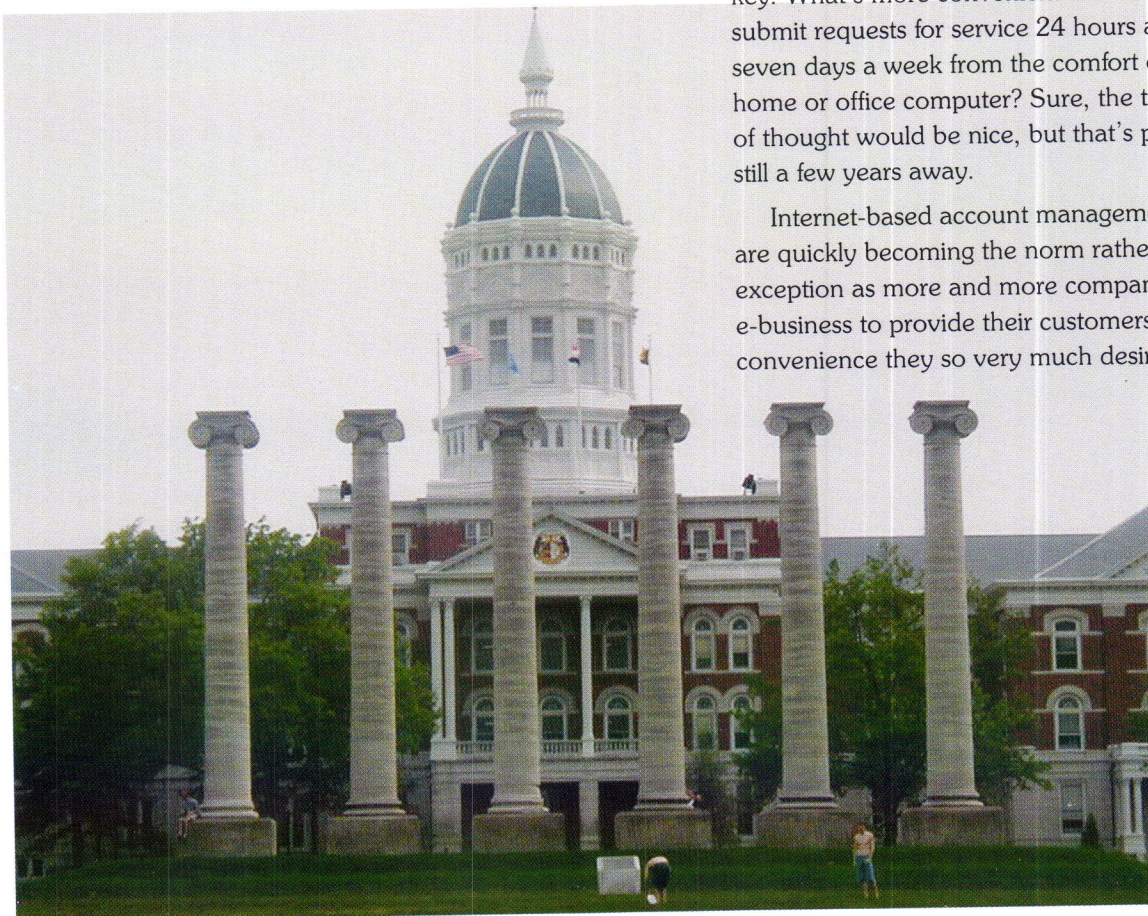
SAM Comes to UMC

Online Service Account Manager Will Provide
Efficiency and Customer Service

by Nathan Eatherton
University of Missouri, Columbia

The Internet and e-business technologies are changing how businesses operate and provide customer service. Convenience is particularly key. What's more convenient than being able to submit requests for service 24 hours a day, seven days a week from the comfort of your home or office computer? Sure, the transference of thought would be nice, but that's probably still a few years away.

Internet-based account management systems are quickly becoming the norm rather than the exception as more and more companies turn to e-business to provide their customers the convenience they so very much desire. While



colleges and universities do not compete in the true private sector, they do compete for students and research dollars. They are also looking for ways to cut costs. Colleges and universities are, therefore, adapting their business processes to enhance both efficiency and customer service.

UMC Introduces SAM

The University of Missouri, Columbia's Information and Access Technology Services (IAT Services) division is meeting the e-business challenge. IAT Services has begun development of a series of e-business applications that ultimately will give customers the ability to manage their technology service accounts on the Web. A prototype of the online Service Account Manager, or SAM, was demonstrated to internal customers in the Spring of 2000. The demonstration elicited tremendous excitement. Clearly, SAM's time had come.

To describe the benefits of this new e-business model we must first talk about the shortcomings of the current account management model. "Account management" at IAT Services refers to the customer's ability to request new services or modify or disconnect existing services including voice, video, and data.

Currently students, faculty, and staff requesting personal services, such as long-distance and dial-up ISP service, must physically visit one of three sign-up locations on campus. Only one of those locations can actually process the requests. The other two forward the paper request to the main location, extending the cycle time for order completion and risking loss or misrouting of the paperwork. Not only is this inconvenient

for customers, but it also adds overhead costs to departmental operations.

Departmental requests such as telephone adds, moves, and changes are communicated to a customer service representative (CSR) via phone call, e-mail, facsimile, or campus mail. While this is more convenient than having to visit an on-campus location, it can still be inefficient and extend cycle times. Most requests for service arrive via e-mail. E-mail requests typically arrive incomplete and lead to an inevitable back-and-forth electronic conversation until all the required information has been obtained.

Additionally, an authorized signer on the departmental account must approve and send the request. Authorized signers are those individuals responsible for each department's budget.

Once the CSR has all the information necessary to process a request, he or she completes a job ticket through IAT Services' Epiphany Telemanagement System (ETS). ETS ties a series of databases to a single job ticket. The CSR can reserve equipment and materials from the warehouse, schedule technician time, and attach billing items to the job ticket. All service-specific information—such as DMS-100 line equipment numbers (LENs), cable pairs, and even IP addresses—are assigned through separate programs. This service-specific information is then manually placed on the job ticket, which is routed to the service specialists or technicians for completion.

Looking at the new model, the SAM project is broken into a series of smaller projects:

1. Authentication/Security

The SAM Web server is capable of 128-bit encryption, and uses this encryption to conceal login, fiscal account, and personal information. The first time a customer visits the SAM Web site, he is instructed to enter his Social Security number so it can be matched with the login information. If the two match, SAM sends a confirmation message to the customer's university e-mail account. Once the confirmation log in is complete, customers simply authenticate to the SAM Web site using their university single-sign-on (SSO) ID and password.

2. Customer Information

Each time a customer authenticates to the SAM site, SAM checks to see which services he or she is authorized to request. The first check looks for the customer status: student, faculty, staff, or any combination of these three. The second check determines whether the customer is an authorized signer on any departmental accounts. At the same time SAM checks whether the customer has been delegated account permissions. (Account delegation is described below.) Finally, a check is done to see if the customer has a pending request that has not been submitted. SAM completes all these checks in just a couple of seconds.

Once the checks are complete, the SAM site is customized for the customer. Services for which the customer is not authorized are not listed on the Web site. For example, if a student without any account permissions enters the site, only those services available to students are listed. Likewise, if a staff member with departmental



account permissions enters the site, he or she will see a list of personal services available to staff along with all the services available to departments. Under the current account management model, the process of obtaining information and completing a job ticket can take several hours to several days to finish depending on the type of request. SAM will automate these order processing tasks so they are completed in a matter of seconds rather than hours or days.

3. Account Delegation

As mentioned above, the current account management model requires that an authorized signer submit requests. Since authorized signers are typically too busy to manage this day-to-day activity, SAM gives them the ability to delegate account permissions so that trusted subordinates may request services on their behalf.

4. Tech-Free Services

For services that don't require physical implementation, such as long-distance and dial-up ISP service, SAM takes data entered by the customer and sends it directly to the back-office application. That eliminates the overhead associated with data entry and reduces cycle time by processing the request almost instantaneously.

The service tracks described from this point forward have not yet been added to the SAM Web site; they are currently under development.

5. CPE-Based Services

CPE-based services connect to customer provided equipment

(CPE) such as cable television and Ethernet. The typical request for these services will include a detailed location for the desired communications outlet and all relative account and contact information. If facilities already exist for the service, customers will simply submit the outlet number they need activated.

6. Equipment-Based Services

Equipment-based services require leased equipment, such as telephones, key systems, and two-

way radios. These service requests will include the type of equipment needed, desired features, specific locations, and the appropriate account and contact information.

Both the CPE- and equipment-based services require a job ticket. SAM will form-fill the job ticket with customer-provided information, reserve equipment and materials from the warehouse, and even schedule technician time. Additionally, SAM will route the requests to a CSR using specialization routing.

7. Specialization Routing

The last module of the SAM Web site includes plans for an application that will evenly distribute customer requests to CSRs based on their current workload and specialties. For example, a request for two-way radio service will be sent to a CSR trained to program radios based on his or her current workload.

SAM is putting control over account management where it should be, in the hands of customers. Customers will have the ability to modify services from the comfort of their home or office, regardless of time or location.

For IAT Services, SAM will reduce overhead by eliminating walkup traffic, reducing the number of paper records, and automating processes throughout the department. With SAM, all the required information is displayed on the Web site. Customers simply complete the request form, submit, and (bingo!) the request is on its way to being completed.

Customers and CSRs will no longer have to suffer the back-and-forth communication to establish exact service requirements.

The Internet connects colleges and universities to the world, and e-business uses the Internet to give customers control over their service accounts. SAM, like other online account management systems, is certainly a product of the times.

Nathan Eatherton is business technology analyst at University of Missouri Columbia. Reach him at EathertonN@missouri.edu. For additional information regarding SAM contact IAT Services at 573/882-2177.



B2B and Directory Services: Opportunities and Challenges

by Todd C. Piket and Mick McKellar

Michigan Technological University

We're all familiar with directories, and we use them every day: the phone book, a catalog (online or on paper), your local TV guide, and so on. They provide the means to find what we want and need to know. The advent of computers expanded the need for and capabilities of directories beyond anything envisioned in the precomputer era.

Just when we were getting comfortable with the computer, enter the Internet. Suddenly, our computing environment consisted of not only our local machine and/or local area network but also of a diverse, nonhomogeneous ocean of possibilities. We needed to connect in a user-friendly way to

people, applications, and resources across an environment diverse in terms of protocol, implementation, and administration. And we wanted to connect from anywhere at any time.

With this development, we've added three new terms to the language: intranet, extranet, and B2B (business to business). Businesses and organizations now want to connect across intranets, extranets, and the Internet, sharing appropriate and useful data with peer institutions at the proper times. How can we accomplish this monumental task? What are the new opportunities and ramifications of implementing B2B in a campus environment?

Corporate B2B Architecture

When technical professionals hear the acronym B2B, they tend to hear the word extranet right along with it. Truly, the two are inseparable, unless you want to give the entire Internet access to all your private data. Although extranets provide quite a challenge to build and maintain, they also provide the key infrastructure abstractions that allow for building the trust and data exchange relationships between institutions that facilitate B2B transactions.

Figure 1 is a diagram of a typical extranet model. Internet traffic is initially filtered by a frontline firewall that controls

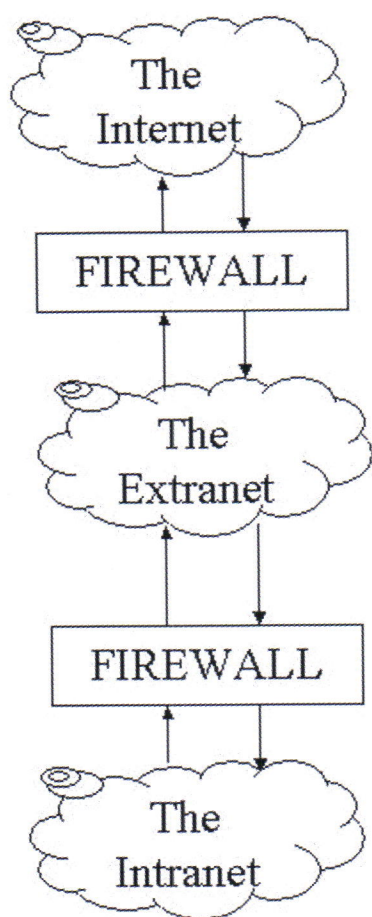


Figure 1. A model extranet.

access to the extranet. The extranet contains the servers and services that present information to other sites and peer businesses. The second firewall layer controls access between the extranet and the corporate intranet. These abstraction layers provide a mechanism to define fine-grained access control to external and internal data and services.

Corporations that implement B2B architectures can leverage this flexible infrastructure model to facilitate data synchronization and transactions with other corporations. Business deals and agreements are implemented as trust

relationships between extranet services, allowing for dynamic supplier chains and more efficient resource management and planning. These benefits translate directly into higher profits for a multitude of reasons. For example, often less paperwork, faster order-filling times, and less warehouse storage space are needed, and resource planning is more fine-tuned. The only drawback is that as extranet relationships are established, interdependencies are formed between companies that can become mission critical for the smooth operation of all parties involved.

B2B in a University Environment

An extranet provides opportunities for those on an intranet to share data while maintaining a great deal of security by restricting access by those on the Internet. University environments typically need reliable collaboration mechanisms, often with academic, government, and corporate institutions. An extranet provides a means of collaboration, because it can selectively provide access to data and applications on your intranet for colleagues on the Internet. For those wanting to share data and yet protect intellectual property rights, or just to keep prying eyes from an unfinished project, this granularity of access control is critical. By modeling university infrastructure as just another B2B environment, universities can enjoy the same flexibility and benefits and easily integrate with other academic and corporate institutions.

Access Control Mechanisms

Access control mechanisms are critical when it comes to a B2B/extranet environment. The latest solution to this formidable problem has been the introduction of a

directory service that typically communicates via the lightweight directory access protocol (LDAP). Because a directory service provides a central repository for storing data about almost anything (e.g., people, computers, printers, applications, etc.), it also tends to be extremely adaptable to new types of data. This data often must be modified (items deleted and/or added) in real time without affecting other systems, thus allowing system managers to add and delete access for clients and customers without interrupting the flow of business information.

A directory service for this kind of environment is usually replicated. The entire data set, or a subset thereof, can be replicated to another location, which means one can protect data that should reside only on the intranet while simultaneously providing the sharable, pertinent data to the extranet and Internet. Because all the data is from the same source, it is always exactly the same across the Internet, extranet, and intranet, providing the consistency and continuity so important in B2B transactions.

Data Sources and Synchronization

The data that resides in the directory service tends to come from existing legacy and other database systems. So yet another challenge is determining what data should reside in the directory service and where (and how) to get it from the database systems.

Frequently, the questions asked at this stage force people to look at database systems that have become far too complex and data that is outdated or out of sync with other systems that maintain the same data. Eventually, a process emerges that takes data from appropriate locations in these

systems, formats and configures it, and finally stores it in the directory service. Generally known as "feeding the directory," this stage often requires considerable cooperation between data custodians and the creators of the directory service.

Leveraging Data Integration

With all the data we've just collected, we can begin letting people into the extranet from both the Internet and intranet. The data collected should allow an application to authenticate someone requesting access either via username and password, digital certificate, biometrics (fingerprint, voiceprint, etc.), or other method.

The collected data could also provide an application with a means of authorization, meaning the application can determine whether an authenticated user can perform a

certain operation. Thus, we can determine who gets in, and what they can do once they are in, based on the data in our directory service.

Now that we know who someone is and what that person can do, we can start doing some e-business. In an academic setting that could happen in various ways:

- Donating money online via credit card or direct debit
- Buying books online (we could even have the students' books for those classes waiting for them in the dorm room when they arrive at school)
- Registering for classes online from off-campus
- Paying for tuition online via credit card or direct debit
- Accessing student's grades
- Purchasing tickets for performances online

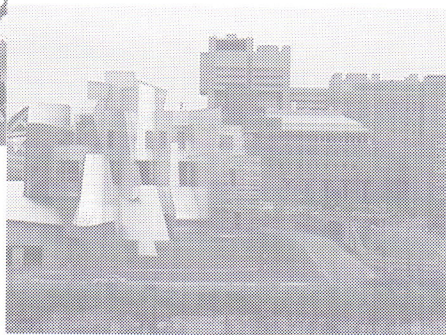
This is a very brief but rather exciting list. Once an application can know who someone is, and what they can do, the possibilities for e-business open up like a floodgate.

Authorization and Distributed Management

Who decides who has access to what and what a person can do in various applications? As the number of business applications and users grows, this is far too much work for one person or even a small, centralized group of people. The solution has typically been to delegate this responsibility to those departments or divisions within the organization who are requesting access for their customers, clients, and colleagues. For instance, if you have an alumni services department requesting that certain alumni be able to donate



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money online, the alumni department should decide who can and who cannot donate online.

Most likely, there will be a small group of *superusers* who grant one (or more) alumni services employee the ability to grant privileges to people of the type *alumni*. This person, in turn, can delegate responsibility within his or her department to others as he or she sees fit. This type of delegation is good for several reasons:

- Fewer superusers make it more difficult to compromise an entire system by guessing/hacking a superuser account, as they can be watched very closely.
- If a *semi-superuser* account is compromised (i.e., an alumni department delegate), then only that person's users are affected while the rest of the system stays intact.

Such delegation can be used to design a better type of directory service in order to improve performance, thus enhancing the usability of the system.

Roles of Directory Services and Relational Databases

Typically you would not use directory services if what you need is a general-purpose database. A relational database system is more appropriate for transaction-based service with large numbers of updates.

A directory service is not a file system. If you need to store huge objects, put them in file storage and create a pointer in your directory service to find the stored objects.

Finally, you need to judge whether you really need the complexity and overhead of implementing an extranet to achieve your goals. If you access

data only from one site to one host, there is little to be gained.

Conclusion

The process of abstracting the layers of networking to accommodate B2B and creating an intranet can be complex and difficult, the path to success narrow and cluttered with obstacles. Yet for university and college campuses desiring some measure of control over the open doors of their Internet presence, increased opportunities for colleagues to collaborate and share data, and the ability to conduct business with other institutions, directory services offer a contemporary solution to a critical issue.

To learn more about directory services and LDAP, please see these resources:

- *OpenLDAP*
<http://www.openldap.org/>
- *A System Administrator's View of LDAP* by Bruce Markey (Netscape)
<http://people.netscape.com/bjm/whyLDAP.html>
- *LDAP RFC1777*
<ftp://ftp.isi.edu/in-notes/rfc1777.txt>
- *An Internet Approach to Directories*
<http://developer.netscape.com/docs/manuals/ldap/>

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Telecommunications and the Digital Campus

by John Dunn

Campus Pipeline, Inc.

Developing a campus portal ranks among the top four strategic issues facing campus IT departments according to the Campus Computing Project Survey¹, and Dataquest estimates that 80 percent of U.S. colleges and universities will adopt a higher education portal by 2005².

A variety of technologies have been categorized as campus "portals," including those that provide course tool technology, those that form student community centers with chat and e-mail capabilities, and those that unify the aforementioned technologies to form a single-sign-on digital campus with access to a variety of school services and e-business technologies. (See Figure 1.) Companies offering unification technology products include Blackboard, Campus Pipeline, TimeCruiser, Jenzabar, and ECollege.

What are these technologies and what impact will they have on the way a campus does business?

Portal Technology	Primary Information Owner	Primary Audience
Community Portals	Administration Student Affairs Offices Student Organization Heads	Students
Online Service Portals: Student Info Systems	Registrar Bursar	Students Staff in Specific Depts. Faculty
Online Service Portals: Distance Learning Systems	Faculty	Students Faculty
Unification Technologies: Enterprise-wide Platforms	Administration Faculty Staff Students	Administration Faculty Staff Students

Figure 1. Community portals, online service portals, and unification technologies represent the basic floor plans available for digital campuses. They are differentiated by the bricks-and-mortar offices represented, the campus audience served, and benefits provided to the school as a whole.

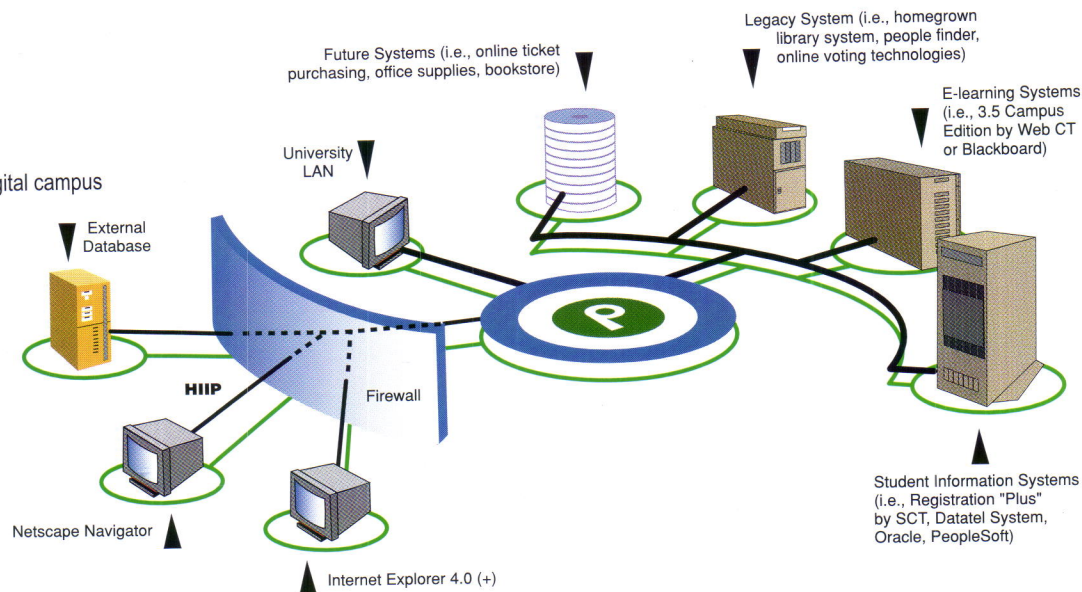
The Unified Digital Campus

Unification technologies provide the "soft" infrastructure for a digital campus, akin to the "hard" infrastructure of servers and T1 lines that support an institution's Web initiatives and affect the broader campus culture. (See Figure 2 on page 32.) Unlike a school Web site, a digital campus focuses on the inner life of the campus and is accessible only to those within the campus community.

A digital campus, ideally, is as unique to a campus as its bricks-

and-mortar structure, and the technologies it unifies should reflect the needs, goals, and preferences of the institution it represents. Although specific capabilities may vary according to the technologies used, digital campuses typically incorporate registration, grade access and tuition payment, communication tools such as e-mail and chat rooms, news distribution, and distance learning and course tools. As the digital campus facilitates the automatic communication of data

Figure 2. Campus Pipeline's digital campus



among these service technologies, it profoundly affects day-to-day campus life.

Effects of Digital Campus Usage

The results achieved through effective use of a digital campus can help a college or university address key challenges faced by higher education today, including the creation of a learner-centered environment and the encouragement of faculty technology use.

Thirty percent of students report feeling frequently overwhelmed by all that they have to do, and many expect to work through their college careers, according to a UCLA Higher Education Research Institute study.³ By increasing the accessibility and availability of necessary administrative services and enabling communication (such as a professor sending a syllabus prior to the beginning of class or an alert that class will be canceled on a particular day), digital campuses save time for busy students.

By providing a consistent mode of access and navigation, a digital campus provides an easy way to introduce new technologies to constituents, which can alleviate the stress faculty associate with technology. And if the digital campus automatically creates

course tools, faculty have class sites without a need for HTML or IT training.

In addressing these common challenges, unified digital campuses predictably stimulate significant changes on campus by improving operational efficiency through the automatic communication of data between technologies. As this automatic communication takes place, the unified digital campus eliminates some long-standing processes and increases the speed and accuracy of others, significantly affecting the services to campus constituents.

For example:

- Hawaii Pacific University in Honolulu reports enhanced staff morale, increased faculty use of technology, and greater student participation in campus life resulting from use of a digital campus.
- Pepperdine University in Malibu, California, delivered grades to students an average of five days faster after encouraging faculty to submit grades through the digital campus.
- Alumni of the University of Idaho in Moscow now have selective access to the student information system, allowing them to locate former classmates and update their contact information.

- Okanagan University College in Kelowna, British Columbia, has saved approximately \$15,000 per term in postage associated with grade mailings since its student information system has been integrated into a digital campus.

Digital campuses spark significant change—not only in technologies but in people and processes across the institution. As a key contributor to Web initiatives, as well as an audience served by a well-deployed digital campus, the telecommunications office of such an institution must embrace change as it identifies ways in which the technology can increase efficiency and improve service across the enterprise.

Case 1: The University of Idaho

At the University of Idaho, the creation of a digital campus to serve internal constituencies was part of a much broader strategic plan to ensure the university maintained its standing in the Yahoo! Internet Life "Most Wired University" rankings.

The University of Idaho serves an average of 11,000 students on campuses located throughout the state. It experienced significant surges in Internet usage when students discovered Napster.

At the same time the Napster phenomenon took hold, the University was building its digital campus designed to provide consistent access and experience for each constituent seeking University services. The digital campus included registration, course information and class lists, campus and world news, and Web-based e-mail. The university also expected the digital campus to stimulate an increase in Web traffic.

"We wanted to create a networking environment that would enable everyone—faculty, students, staff, and alumni—to do all their work from the desktop, and to provide an environment for students from any location to experience academic life as if they were sitting in a class on the main campus," noted Jerry Wallace, vice president of finance and administration at the University of Idaho. "Our digital campus allows us to provide just that level of service."

The campuses' telecommunications and IT teams worked hand-in-hand to design and build the architecture of the digital campus.

"The sheer magnitude of the information being pushed and pulled across the infrastructure was expected to require greater and greater bandwidth; so of course the telecommunications team played a large role in making the project a success," noted Chuck Lanham, associate director of information technology for the University.

The telecommunications department chose to upgrade to a Gigabit EtherChannel technology (a 4-GB backbone) facilitating one of the fastest networks in the nation.

"This is a far bigger infrastructure than the typical digital campus requires," stated Tony Opheim, associate director of information technology, University of Idaho. "The network enables us to exploit

the benefits of fast-changing technology without continually needing to upgrade our hardware and wiring."

He added, "When we chose the EtherChannel, we had an institutional imperative to maintain our status as one of the most wired American campuses. Our strategic vision for the digital campus included building and integrating technologies to enable a variety of e-business functions, including bookstore, library, ticketing, food service, and photocopying. We were already processing more than 330,000 e-mails daily, and we wanted a little breathing room."

Case 2: Pepperdine University

Those who manage constituent-facing telecommunications systems and processes also reap rewards. The same improvements to operational efficiency that affect the rest of the campus are likely to affect the daily lives of telecommunications professionals.

For example, PepperdineXpress, the digital campus of Pepperdine University, was designed to serve as a one-stop shop for all of the university's stakeholders.

"We literally want all University transactions and communications to take place through PepperdineXpress," notes Pepperdine's manager of special project development, Dan Kelo.

Since the fall of 2000, Pepperdine students, faculty, and staff have been able to review their overall accounts, and telecommunications charges are viewed as a line-item on the overall account invoice and summary. They can also pay account charges with a credit card through technology housed within the digital campus.

Terry Wallace, manager of telecommunication customer service at the University, looks forward to the time when the

broader telecommunications service technology is integrated into the digital campus.

"Once our telecommunications technology is integrated, students will be able to view their invoice and then quickly and easily access billing charges in great detail," notes Wallace. "They will also be able to see rating information, so they can more effectively manage their budgets for the term."

Right now the University still sends paper invoices in addition to communicating telecommunications charges through PepperdineXpress.

Candace Jones, PepperdineXpress system administrator, notes that sometimes providing a transition period between on-line and off-line service offerings is necessary. "Taking the time to assess how each technology we integrate with PepperdineXpress is likely to affect the people and processes involved helps us prepare the campus for change."

Summary

The digital campus has an impact on every aspect of campus life, and telecommunications plays an integral role in facilitating these next-generation connections. As more and more schools identify developing portal and platform technologies as a key strategic initiative, telecommunications teams are on the front line helping schools and universities achieve their goals.

John Dunn is vice president of consulting services and training programs at Campus Pipeline, Inc.

¹ Campus Computing Survey 2000. Campus Computing Project.

² Ronald Yanosky, "Competitive Analysis: Higher-Education Enterprise Portals: Profiles of an Emerging Provider Class" Gartner Group Research Report, March 20, 2000.

³ The American Freshman: National Norms for Fall 1999. Higher Education Research Institute, UCLA.

Managing E-Business at UCSB

by Paul Valenzuela
University of California,
Santa Barbara

The need for an e-business tool for communications services at the University of California at Santa Barbara dates back to 1997. Our 13-year-old switch was aging fast, and rumors were circulating that the technology was changing. Rather than invest in a technology that would soon be obsolete, we decided to return to Verizon (then GTE) to provide Centrex telephone service for the campus community of approximately 30,000 faculty, students, and staff.

Doing It Right from the Start

The return to Centrex at UCSB created the need to establish new business procedures. Having become accustomed to handling their own move, add, and change activity, UCSB's staff now faced having to pass order information to Verizon via traditional fax, e-mail, and written correspondence, and to establish the usual follow-up activity required for working with a traditional phone company.

After assessing the impact those activities would have on

telecom department resources, we decided to require the establishment of an online order and management process as part of the contractual negotiations. In our experience with Centrex, most of the problems with orders were the result of a misunderstanding as instructions were relayed to the local exchange carrier (LEC) or a simple error in order entry. By implementing a system in which a customer's order was entered only once, UCSB expected to have fewer errors. We wanted this as part of our agreement so that if the company were sold (it merged instead), we would have a formal document to ensure that this system would continue. We did not formally accept the installation of the new Centrex system until this order system was in place.

UCSB not only had to identify what activities needed to be accomplished by moving to an online environment, we also had to outline our interactive business processes and understand what systems would interface with Verizon and in what formats. This

assessment resulted in the specific requirements of the contract.

Under the terms of the contract, Verizon initially agreed to support the integration of UCSB's telemanagement system if UCSB would provide a mutually agreed upon number of copies of the client software and access to the telemanagement server. When this approach proved unfeasible due to Verizon's network security issues, the company agreed to put the resources in place to develop a machine-to-machine interface to integrate the transfer of data between the two computer systems.

A New Web-Based System

Building on a strong business partnership, UCSB and Verizon joined forces to codevelop a more efficient Web-based system which would handle service order activity and include modules for repair and billing issues. Those efforts resulted in a system called ORBIT—a UCSB Communications Services' acronym that stands for order, repair, billing information technology.

Because this was a new development effort, the initial process took several months to complete. Verizon contracted with an outside consulting firm to make sure this product was compatible with both UCSB's and their own network security systems and to develop a friendly graphic user interface that was easy for both campus and company staffs to understand.

UCSB collected data files from its telemanagement system that were supplied to the Verizon development team, conducted joint requirements reviews and updates, coded the file layouts, and, of course, performed user-acceptance testing (UAT). UCSB learned that time to implementation in any e-commerce application is based on the relative complexity of the application and accuracy of systems information.

How It Works

The outcome of the partnership was the creation of a Web-based system, offering 24/7 availability and a streamlined process for initiating service order activity. Communications services staff take orders and enter them into the telemanagement system, Pinnacle Axis. Then that information is passed electronically to Verizon for action. Once Verizon completes its part of the work, the order is posted electronically to the extranet, where UCSB can view and complete the transaction.

Additionally, UCSB has the luxury of querying and viewing all past transactions. Building on the ultimate success of this first e-business tool, user-friendly modules for repair and billing subsequently were created and are now used by communications personnel.

A customer profile and entitlement process developed by Verizon for the secured extranet ensures that access to account records is provided only to authorized personnel. Unique passwords and IDs are assigned to authorized users, allowing them to see only those records they are entitled to view. This security feature is particularly important for communications staff members who interact with several University departments and organizations.

Impressive Benefits

The benefits of online account management have been significant. In fact, the results have been nothing less than tremendous. Over the past four years we have placed hundreds of orders using this process. Our success rate for getting orders in service on time exceeds 98 percent annually. Trouble reports (where Verizon services are involved) are also cleared within one business day in excess of 98 percent annually, and billing issues are cleared within one billing cycle more than 95 percent of the time. This has increased the efficiency of our existing staff by at least one full-time person. More important, we are able to provide service to our customers faster and with more confidence that the service will work right the first time and will be billed accurately. In addition, our rework on such order activity has dropped to almost nothing, thereby increasing the quality of the service we provide to our campus customers.

Service order information is entered into the telemanagement system only once, which has reduced transcription errors. The paperwork sent between UCSB and Verizon has been greatly reduced, as faxes and e-mail are only used intermittently. In addi-

tion, billing errors have been significantly lowered, since order and repair information is comprehensive and inconsistencies are identified early in the process rather than after implementation. Best of all, there is consistent historical documentation for each order that allows one staff member to pick up an order right where another left off.

The billing feature provided to the University allows us to download our Verizon bill and create reports for analysis. This feature has also been useful in managing the communications budget.

The successful development and implementation of this e-business application paved the way for a GTE product called B2B ORBIT. Features from this product and a Bell Atlantic product called Business at Once are currently being revamped, and a new product called New Business at Once is expected to be released this summer. The new product will be an integrated portal application that offers more functionality including easier access to customer records, direct link to legacy systems, online collaboration and contracts, and more. (Watch the Web site for product announcements at http://www.bellatlantic.com/largebiz/cc_business_at_once.htm.)

UCSB is pleased that not only are we being served more efficiently, but we can also provide our customers with a higher level of satisfaction.

Paul Valenzuela is associate director, Communications Services, at the UCSB. Reach Paul at ptv@comm.serv.ucsb.edu. For information about Verizon, contact Marcy Irons at marcy.j.ironson@verizon.com.



Binghamton Installs a High-Speed Optical Fiber Network

Reflecting on the recent transformation of the network infrastructure at Binghamton University, Richard McCarthy, associate director for systems programming, computing services, offers an update on an old joke among network administrators on this upstate New York campus.

"At one time," recalls McCarthy, "people here said if there were an earthquake, the campus would be held together with copper. Well, not anymore. Now it would be held together by fiber."

by Mark Hutcheson
Corning, Incorporated

McCarthy's comment may be somewhat exaggerated—optical fiber is invulnerable to some but not all natural disasters—yet it underscores a truth about changes made at Binghamton over the past several years. Although

Binghamton began pulling optical fiber between some buildings in the 1980s—"mostly to solve distance problems," says McCarthy—as recently as 1997 the university relied heavily on a patchwork of networks with copper backbones, as well as on some interbuilding copper cables. Recognizing that this infrastructure would not meet the needs of the university for long, Binghamton began the process of rebuilding and expanding the campus network. They replaced all the interbuilding copper with optical fiber and installed fiber extensively within buildings, as well as to a limited number of desktops.

Network managers at Binghamton have proceeded



prudently and with good financial sense as they have extended and improved their cabling system. Today, the new fiber network is successfully responding to ever-increasing bandwidth demands, solving technical problems that had plagued the campus for years, enabling collaborative research, and preparing the way for universal availability of a host of information technology resources.

Staying Ahead of the Complaint Curve

With approximately 12,000 students and 2,500 faculty and staff, Binghamton University is among the largest schools in the State University of New York system. Its size alone places unique burdens on network resources already straining to keep up with user requirements. Bandwidth demand is going up "exponentially," according to McCarthy. For example, the number of e-mails received each day has doubled in only three years, from 50,000 in 1997 to 100,000 last year.

Much of the pressure on network resources is the result of the rapid and often unpredictable adoption of devices and applications, particularly by students. Napster, the MP3-sharing application unheard of only a few years ago, regularly constituted 30 percent of Binghamton's outgoing traffic on the Internet in 2000.

"In many ways," says McCarthy, "we're not in control of devices that will demand our services. Corporate networks can make choices. In a university environment we have to be more open, prepared to support the entire spectrum of devices."

The university's upgraded network also must keep up with faculty demands for capacity. Binghamton recently joined Internet2, the partnership of universities, industry, and government that is developing and deploying advanced technologies over a high-speed network. These remarkable network applications allow Binghamton researchers to access information at previously unheard-of speeds and to collaborate in innovative ways with their peers at distant institutions.

In fact, Binghamton has been experiencing something of a bandwidth explosion, says Mark V. Reed, associate vice president for computing and educational technology. "Four years ago we used 7 percent of our T3 line [at 45 Mbps]," says Reed. "Three years ago we used 15 percent to 20 percent. Now we're at 100 percent of the T3."

Their new optical fiber backbone provides Binghamton with the needed capacity to satisfy this



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growing bandwidth hunger and “to stay ahead of the complaint curve,” as McCarthy puts it.

In addition, installing fiber has solved a long-standing problem, network disruptions caused by electromagnetic interference (EMI). Located just across the Pennsylvania border in south-central New York, the Binghamton campus sits in a lightning-strike alley, where for years electrical storms routinely disrupted network operation. On several occasions storms actually destroyed copper connections: A direct strike once took out a large portion of the thick Ethernet cabling in the fine arts building—people there could smell smoke—and the network was down for days. A couple of years ago a storm destroyed some student computers in dormitories. Now, because optical fiber is immune to EMI, disruptions and damage caused by electrical storms are a thing of the past.

Fiber to Dorms and Desktops

“A lot of our network has been built with the future in mind,” says Reed. Given rapidly growing demand for network services, Reed says that in the not-so-distant future, networks will include the deployment of gigabit speeds to buildings across the campus.

To prepare for those network speeds, in 1997 Binghamton began installing optical fiber to connect every building, a process that is now complete. Fiber

cables also are used for closed-circuit television and other security-related applications. Because fiber cables are very small in comparison to other media, using fiber solved another problem: tight space in existing conduit.

Hybrid cables of multimode fiber (MMF), single-mode fiber (SMF), and copper were used for interbuilding links, although in nearly all cases the SMF remains “dark.” Because adding unconnected SMF to the cabling mix is relatively inexpensive, network planners often decide to pull it, especially since they cannot know for certain what tomorrow’s demands on the network may be.

“A lot of our older network was based on coaxial cable technologies,” says Eric Backlund, Binghamton’s director of telecommunications. “What we’ve been able to accomplish is economical deployment, greater throughput, and a broader service base, including closed-circuit TV, fire alarm, environmental controls, and security systems. Fiber has made this possible more reliably. Now we are able to provide services the way you’d expect a worldclass university to provide them—on a sustainable basis.”

Up to Speed

Future-proofing notwithstanding, the workhorse of the Binghamton network backbone is MMF, which uses cables designed for gigabit networking applica- ▶

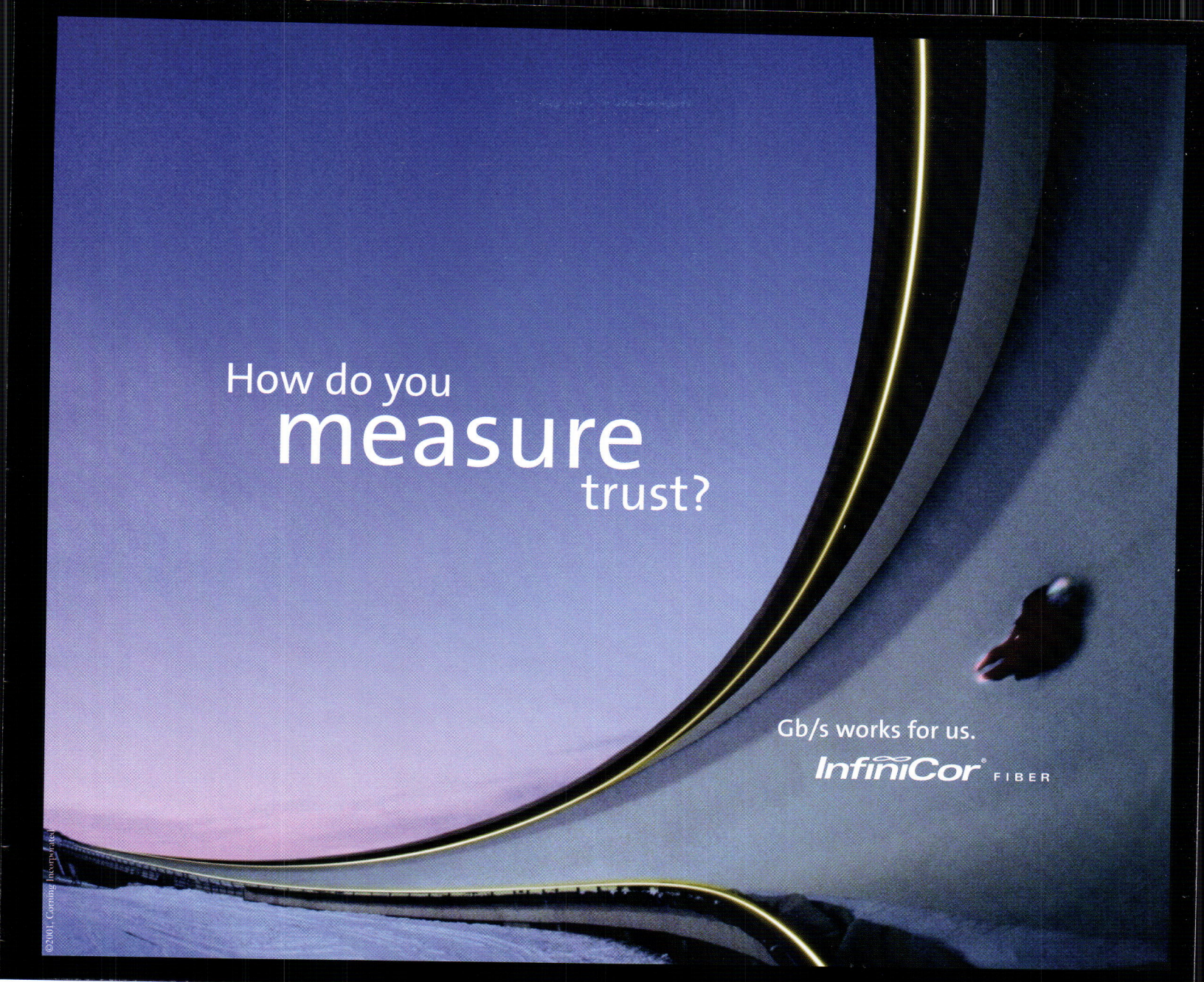
More Benefits of Fiber for Binghamton

The workhorse of the Binghamton network backbone is MMF. The cables used are AdvanceLite™ 1000 fiber-optic cables from Mohawk/CDT. These cables, which are designed for use with gigabit networking applications, each contain multiple counts of Corning® InfiniCor CL™ 1000, a 62.5 µm MMF offering guaranteed 1-Gbps transmission at link lengths of 500 meters at 850 nm and 1,000 meters at 1,300 nm in Gigabit Ethernet-compliant systems. InfiniCor CL 1000 can also operate at significantly longer distances—up to 2,000 meters—with less demanding protocols such as Fast Ethernet, FDDI, and 155-Mbps ATM. In addition, the fiber is fully compatible with legacy LANs.

One element that has helped Binghamton achieve fiber to the desk cost-effectively is the Corning Cable Systems’ MT-RJ UniCam® field-installable optical fiber connector. A large obstacle to full-scale deployment of fiber-to-the-desk network cabling designs has

been the cost of electronics and connectors. Connectors alone make up roughly 35 percent of total optical fiber cabling costs (“Fiber Fights Back,” *Data Communications*, May 1999). Also, the bulk of fiber connectors such as the popular ST and SC models, which are twice the size of copper connectors, has made port density impossible and kept costs relatively high.

Half the size of an SC connector and with half as many components, the MT-RJ terminates two fibers in a connector that snaps in like an RJ-45 phone jack. Cheaper and easier to install than traditional fiber connectors, the MT-RJ has a compact design that increases port density on network hubs and switches and reduces electronics costs. Greater port density also decreases the number of telecommunications closets, which require power and air-conditioning, as well as devices for fire detection and security.



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tions. These cables can also operate at significantly longer distances—up to 2,000 meters—with less demanding protocols such as Fast Ethernet, FDDI, and 155-Mbps ATM. In addition, the fiber is fully compatible with legacy LANs.

“When we heard there was a fiber that is optimized for gigabit speeds, we decided to use it,” says McCarthy. “Even though we were not deploying gigabit equipment at that time, we felt sure that it was in our future.”

In most places, optical fiber extends to building intermediate distribution frames only, although it has been installed in riser spaces selectively. Network planners are constrained by the buildings themselves and must wait for renovations before considering new cabling in the horizontal segments. When renovation occurs, Binghamton has favored pulling hybrid MMF/CAT 5 copper cables to desktops.

However, Reed sees extensive fiber-to-the-desk installations in Binghamton's future. “My expectation is that we're all going down that path, because generally we will need more bandwidth and greater throughput,” he says. “We'd like to have the capacity that fiber brings to the desktop. Besides, we had heard from a couple of sources that fiber to the desk isn't expensive.”

To better understand the ins and outs of a fiber-to-the-desk network, Reed and McCarthy decided to install one in the Computing Center, where their offices are located. The all-fiber network connects 128 desktops on four floors, with only two telecommunications closets.

With Corning's MT-RJ optical fiber connector, port density is doubled; however, doubling ports does not multiply by two the cost of electronics. Most of the cost is for components that are required regardless of the number of ports. Therefore, greater port density on hubs and switches lowers the cost per port, making fiber-to-the-desk solutions more competitive with copper.

“Not only has the price of optics come down,” says McCarthy. “With the MT-RJ a higher density of interfaces can be put in a chassis. Fewer chassis mean a lower per port cost and less rack or wall space needed.”

According to McCarthy, installation of fiber to the desk was neither difficult nor expensive. “The main expense was the hourly rate for the electricians,” he says. “But after they did a floor or two, the installation time was close to that for copper.”

“We want to be careful with fiber to the desk,” says Reed. “We want to be sure of the economics. Still, we expect to see fiber to the desk generally deployed in a few years.”

Fiber Looks to the Future

Reed and McCarthy agree that their approach to developing and expanding the Binghamton network has been cautiously creative. They are experimenting, pushing various technical envelopes to determine what is possible and at what expense. For example, they are piloting IP telephony, laying the groundwork for ubiquitous wireless access to the network and looking ahead to more wired classrooms.

Network planners cannot be certain what devices and network requirements the next cohort of students will bring with them when they arrive at school in the fall. Installing optical fiber as extensively as they have is seen as a cost-effective means of providing ample bandwidth to satisfy user demands for a long time to come.

Mark Hutcheson is senior market analyst at Corning, Inc. Reach him at HutchesoMF@corning.com.

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Amherst Takes to the Air

by Stephen Judycki

Amherst College

Amherst College was founded in 1821 as a nonsectarian institution for "the education of indigent young men of piety and talents for the Christian ministry." Today, Amherst is an independent liberal arts college for men and women with approximately 1,650 students from most of the 50 states and many foreign countries.

Residential and academic life at Amherst, as at many collegiate institutions its age, has undergone significant change because of technological advances. Historically, the advent of public utilities has been responsible for profound changes in the evolving residential and academic experience. As evidenced in the "Historical Perspective" on page 42, those who came before us faced similar issues and probably dealt with them in similar ways as they decided which new technologies to adopt and when to adopt them.

The progression to wireless LANs on a campus once lit by lanterns and heated by firewood is evidence of Amherst's maturity. That her first flight



Frank Ward/Amherst College

with wireless LANs was not the first flight ever is evidence of her wisdom.

The Information Age

While Amherst's mission does not require it to blaze a path on the leading edge of information technology, it doesn't lag very far behind. Amherst has been a wired campus since the 1980s. The administrative data system, which was installed on an IBM main-frame platform in the 1960s, continues to provide service today. Amherst College had installed a "port per pillow" long before that term became popular. Its first network platform was a proprietary CSMA/CD network that operated on a broadband coaxial system. For two or three years before converting to a fiber-based Ethernet network in 1995, Amherst used 10-Mbps broadband Ethernet bridges to transport data across the campus. That technology was the predecessor to the cable modem service marketed today under such names as Roadrunner and Pipeline.

Ease of use and ease of access rank high among the challenges confronting the information technolo-



Historical Perspective

Witness to Invention and Innovation

On the cutting edge, the city of Boston adopted gas lighting in 1822; but it was another 45 years before Amherst College considered gas for its buildings. Then in 1877 the Amherst Gas Company was formed with Amherst's president and treasurer serving as directors. Amherst learned that piping gas into the 64 rooms and 16 halls of its two west dormitories was going to cost \$612. This cost included fitting meters in each room but not the cost of the meters themselves, which the company would probably furnish by charging rent for their use. Amherst's buildings were fitted with gaslights from 1878 through 1885.

According to an 1849 alumnus, bathing in the early days of Amherst College involved a 10'-by-12' outdoor bathhouse with no roof. A trough was built from the college well, and a student poured as many buckets of water from the well as he wished into his trough. The water flowed to a tank at the bathhouse. The student then crossed the grove to the bathhouse, disrobed, and pulled a cord, which released the water from the tank and provided a cold shower. Public water was introduced to the town of Amherst in 1880. Upon completion of renovations in 1891, water was piped throughout the first of two Amherst dormitories.

In 1911 Amherst College signed a five-year, \$242 annual contract with New England Telephone and Telegraph for its first telephone system. The system consisted of a switchboard arranged for intercommunication between stations, an operator's station, two trunk circuits connecting the switchboard to the telephone company exchange, and 12 telephone instruments.

gist in higher education today. While Windows OS, Mac OS, and the Web browser have accelerated computer and network use by simplifying the user interface, the ease of accessing networked data has largely been a function of the proximity of the data jack to where someone wanted to work. In February 2000 Amherst director of information technology Philip Fitz was trying to read the wireless tea leaves. He wondered if the evolution of wireless standards and technology would keep pace with bandwidth-

hungry applications, and whether wireless LANs could replace their wired counterparts in time to avoid the expense of another major wiring upgrade.

The installation of data wiring to the desktop was, for us, an evolving process. Computer resource centers and employee offices were wired first, followed by libraries and dormitory rooms, and finally classrooms and laboratories. Shortly after becoming a "wired" campus, it was time to upgrade our wiring to accommodate faster data transmissions.

During building renovation projects we added many more data jacks. As the number of data jacks increased, so did the number of hub ports and switch ports that were required to support them. Over time we had installed enough live data jacks for every member of our community to have somewhere between two and three network-attached devices plugged in and operating simultaneously. This, of course, is not a practical capability since many of the data jacks are located in public areas. But the end result of all this wiring was the creation of an "anytime, anywhere" model of network access—a model that will be very costly to duplicate if and when wiring has to be upgraded to accommodate faster data transmissions once again.

The concept of connecting a computer to the LAN without a wire initially gives hope to the prospect that we may never have to install another data wire to the desktop. One of the more perplexing problems encountered in the installation of data wiring arises from the dynamic nature of the desktop: Few desks are bolted to the floor, which makes them moving targets. Buildings under construction don't yet have any desks, which makes planning difficult. Old buildings that are renovated or repurposed add new desks and move old ones. And people like to move their desks for various reasons—often to the opposite side of a doorway, which creates problems, including tripping. If wireless LANs are ready for prime time, they could put an end to this costly practice of wiring and rewiring!

There is also, more importantly, a utility aspect of wireless LANs. Some people need to work away from the desktop. Wireless LANs enable mobility—the freedom to move around untethered and unrestricted. The first barrier to this kind of access has already been removed by the laptop and the PDA. In a library, dorm room, or classroom, wireless networking adds a new dimension to the anytime, anywhere model of network access.

OK. Let's Try Wireless

In early May 2000 I accepted the assignment of getting a wireless LAN pilot up and running by the start of the fall 2000 semester. My technicians and I began with a sort of wireless brainstorming session that quickly produced a list of topics that included standards, security, management, interference, compatibility, interoperability, manufacturers, vendors, documentation, and testing. This list provided a simple but effective framework for launching our project.

We began by surfing the Web in search of useful information. My first stop was the IEEE Web site, where I thought I would peruse the 802.11 standards. (I didn't know that you had to buy them before you could read them, but it makes sense.)

The Wireless Andrew pages of the Carnegie Mellon University Web site were very helpful with respect to design considerations. It was there that I first saw the term "airspace policy" and realized its potential importance.

As a Gartner client, we read their reports and spoke with one of their wireless analysts. They provided planning assumptions that helped us decide between direct-sequence spread spectrum (DSSS) wireless LANs and frequency-hopping spread spectrum (FHSS) wireless LANs, both of which operate in the unlicensed 2.4-GHz band. Other planning assumptions helped us to size up the interference threat posed by Bluetooth wireless LAN technology. Additionally, Gartner identified which vendors were likely to be dominant in the future. We also spoke with a handful of ACUTA members who had already installed wireless LANs on their campuses.

One ACUTA member had an extensive fabric of wireless LANs but couldn't recommend a vendor, because they ordered their wireless equipment directly and performed most of their design and installation themselves. As we weren't staffed to do much beyond post-installation maintenance, we educated ourselves in the area of radio design, equipment specifications, and installation techniques, and then set out to find a vendor who knew more than we did.

June 14, 2000

Direct Network Services is to provide a wireless LAN site survey for Amherst College that will include the following for each specified building:

1. Perform RF scan and spectrum analyses to determine noise and interference levels.
2. Perform client testing for radio fall back and overlap coverage to provide total roaming capability.
3. Determine access point locations for a minimum of 75 percent coverage at 5.5 Mbps and the remaining balance at 2 Mbps.
4. Document access point locations on College provided floor plans, and annotate floor plans with survey results measured in dBm.

Product-specific radio rates are shown below.

	Cisco	Cabletron	Lucent
<u>Radio Rate</u>	<u>AiroNet</u>	<u>RoamAbout</u>	<u>WavePoint II</u>
11 Mbps	-83 dBm	-84 dBm	-82 dBm
5.5 Mbps	-87 dBm	-87 dBm	-87 dBm
2 Mbps	-88 dBm	-90 dBm	-91 dBm

Figure 1. DNS submitted a proposal that enabled us to purchase a wireless LAN design that did not lock us into a single product or vendor.

The first two vendors we tried did not know more, and even though they came highly recommended, I couldn't be convinced that they could do a good job. The third vendor we tried was Direct Network Services (DNS) of Ayer, Massachusetts. In just five minutes of telephone conversation with Dan Kirkland of DNS, I knew we had found the right vendor for Amherst.

Our first meeting took place on June 5, 2000. Kirkland spoke with extensive knowledge of industry standards, including the status of 802.11 subcommittees charged with developing the next standard, and he was well versed in market-share statistics. He explained that Lucent Orinoco (formerly Wavelan) had sold 80 percent of the client cards on the market worldwide, and added that all wireless access point manufacturers except Cisco Aironet (formerly Aironet) utilized cards made in the same factories off-shore, using the same chipsets.

It was about this time that I realized that access points also use client cards, and the client cards for laptops and access points are interchangeable. The

data rates available with 802.11(b) client cards are 11, 5.5, 2, and 1 Mbps. While early adopters of this wireless standard could purchase only 2 Mbps client cards, today's cards operate at 11 Mbps. The standard provides for a fallback algorithm that throttles an 11-Mbps client card down through those four data rates as distance from the card to the access point increases. Throughput remains at about 70 percent of signaling as the card falls back, but its linear loss is not greater at the lower signaling rates.

Roaming between access points with a laptop using an 802.11(b) client card is achievable when implemented properly, but this feature is not covered by the standard. Roaming is easily implemented with single-vendor installations, but it is sometimes impossible with mixed-vendor installations. Several groups have been formed to ensure greater future compatibility and interoperability with such features as roaming, load balancing, and bandwidth management. Among them are WLANA (Wireless LAN Association), WECA (Wireless Ethernet Compatibility Alliance), WLIF (Wireless LAN Interoperability Forum), and WIFI (Wireless Fidelity Standard).

The similarities between the DNS and Gartner data were close enough that when DNS offered information in areas that lacked a Gartner reality check, I perceived that information to be credible. This was especially helpful with predictions about the availability of 802.11(c) product and the likelihood of downward compatibility with 802.11(b) product.

Defining the Project

By mid-June, we decided that our pilot would involve the installation of wireless LANs in the libraries and public areas of five academic buildings: Robert Frost Library, Music Library, Merrill Science Center, Webster Center, and Keefe Campus Center. The chosen equipment would comply with the 802.11(b) standard, and we clearly understood that this equipment might have a useful life of only 12 to 18 months. For the wireless LAN connections to be useful from the client perspective, we wanted the maximum 11-Mbps data rate available in as much of the designated coverage areas as possible. We didn't want coverage gaps within a coverage area, and we didn't want interference between overlapping coverage areas. We had design criteria that needed to be established somehow, so that results could be measured and documented. An RFP would do the trick, but a high level of contractual specificity can be a double-edged sword, and it tends to drive project costs up. I wrote the RFP, but I held on to it while

DNS was asked to submit a proposal and statement of work.

The DNS proposal was only missing a few of the important points from my RFP, which DNS added. The final document enabled us to purchase a wireless LAN design that did not lock us into a single product or vendor.

DNS completed the site surveys during the week of June 19, 2000. The following week, with the access point locations identified on the floor plans, we hired an electrical contractor to install data jacks for the access points.

We were leaning toward Lucent equipment, but Cabletron was the only 802.11(b) access-point manufacturer that did not require local collocated power for its access points. That was an important consideration for us since it would reduce installation time, cost, and disruption. Cabletron access points use transformer-based DC power that is inserted onto the two unused pairs of the data cable that serves the access point. Since existing data-wiring closets already have AC power, no additional expense is required to power the transformers. We considered having power insertion and extraction devices manufactured for us locally, to be used with Lucent access points, until we were advised that Underwriters Laboratories would require \$36,000 to certify and "list" them. This cost far outweighed the cost of the additional electrical outlets we had sought to avoid, and it was nothing compared with the potential liability we might face from using an electrical device that did not carry the UL listing. We decided to go with Cabletron access points.

Another feature that seemed unique to Cabletron access points was its simultaneous flash upgrade capability. We could upgrade all our access points' software from a single location with a single command.

Cabletron access points support the Lucent-hybrid client cards that Apple was shipping with its laptops, as well as the 64-bit (WEP) Lucent client cards that we would be recommending and supporting for use with Dell laptops. Dell was shipping Aironet client cards with its laptops that were purchased with a wireless option. Because the Aironet client cards would not roam between two Cabletron (or Lucent) access points, we would have to advise our community to order Dell laptops without the wireless option, and advise them of procedures for having a Lucent card installed locally. The access points themselves would be using 128-

bit Cabletron client cards for the enhanced management features and the additional security they could provide.

Implementation

On June 23, 2000, we signed a contract with DNS for the wireless equipment purchase and installation, which included acceptance testing and "as-built" drawings. As the electrical contractor installed data jacks, DNS followed behind them with the access point installations.

The lowest level of the Robert Frost Library, a 100-by-190-foot space with movable stacks throughout and limited clearance between the stacks and the ceiling, presented a unique problem. I initially thought we would need four to six access points and would receive a mix of poor coverage and no coverage, depending on the position of the movable stacks relative to access points and the wireless laptop. DNS used the aluminum HVAC ductwork that traveled along the ceilings as a wave guide for signal propagation and covered the entire area with only two access points.

Furthermore, acceptance testing indicated that the weakest signal to be measured anywhere on the floor, even between and behind the book-laden metal stacks, was -80dBm. Looking back to Figure 1, you will see that -80dBm falls well within the requirements for the 11-Mbps data rate.

On the second and third floors of the library, banks of metal patron lockers were blocking the wireless signal, causing a total coverage gap in a fairly small area on their far sides. My expectation was for second access points to be dedicated to these small areas. DNS added omnidirectional ceiling antennae to the access point client cards, and positioned them approximately 30 feet away on the other side of the lockers. The cost of an external antenna is roughly 15 percent of the cost of an additional access point.


In our music building, a bank of metal lockers is built into an interior wall. These lockers were used to reflect the wireless signal back into the space to cover an area that otherwise would have required another access point or an external antenna.

In our Merrill Science Library, which has a drop ceiling, the plans called for two ceiling-mounted access points. When access point locations are identified on a site survey, they are usually considered to be approximate locations. The final location isn't determined until the installation is performed,

and sometimes it is installed a slight distance away from where it was anticipated. DNS realized at Merrill, for the first time, the unique opportunity presented by ceiling tiles. They mounted the access point to the topside of a ceiling tile in the area identified during the site survey, rather than mounting it to the structural ceiling above it. This technique would enable them to simply move the tile to any other location in the drop-ceiling grid if adjustments were required to provide optimal coverage.

By mid-July, the installation and testing had been completed. Every test point throughout the coverage areas was capable of achieving the maximum 11-Mbps data rate, which greatly exceeded expectations. During the following week, access points were configured with IP addresses and connected to the network backbone. During this time, the network technicians also became familiar with the Cabletron management software.

By mid-August, our Desktop Computing Services department, which would be responsible for supporting the wireless clients, had completed its testing of client card configurations in both Apple and Dell



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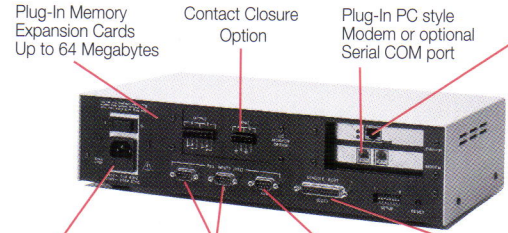
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laptops. With the knowledge they gained, the staff developed end-user documentation and prepared letters that announced the availability of wireless networking to both students and faculty. With a team effort, we met our goal of having a wireless LAN pilot up and running by the start of the fall semester.

Update

In the short time that has passed since the implementation of Amherst's wireless pilot, a few things have changed. Cabletron has broken up into four separate companies. Cabletron is now the name of a holding company for the four new companies, one of which is Enterasys, which manufactures and sells wireless products. Lucent Technologies has spun off its enterprise networking to Avaya. Their wireless family of products is still called Orinoco. The successor to the 802.11(b) standard is going to be 802.11(g), which will define a >20-Mbps wireless product that operates in the 2.4 GHz range.

Lessons Learned

The feedback we received from those faculty and students who participated in our wireless LAN pilot has been generally positive. There also were comments about how useful it would be to have wireless LAN capability in faculty offices and dormitory rooms. Our pilot project only covered public areas in five academic buildings.

Participation in the pilot thus far, which is voluntary, has been somewhat less than we anticipated.

We think people will be more apt to volunteer to use wireless LAN access when it becomes as ubiquitous as its wired counterpart. Unfortunately, this is one of those chicken-and-egg situations: Ubiquity will be achieved by deploying wireless LANs throughout the campus; however, while we are committed to this task, prudent management of financial and human resources requires us to move slowly. We will pick up the pace as soon as the IEEE formally adopts the next standard and product manufactured to that standard becomes available.

I still hold out the hope that wireless LAN data rates will one day meet or surpass those of their wired counterparts. When that happens, and as long as wireless data security is at least as effective as its wired counterpart, the practice of installing wires and fiber within and between buildings will begin to wane.

Steve Judycki is director of telecommunications at Amherst College. He is a member of ACUTA's Legislative and Regulatory Affairs Committee and chairman of the Cable TV Advisory Committee for the town of Wilbraham, Massachusetts. He can be reached at sajudycki@amherst.edu.

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Jeri A. Semer, CAE

The ACUTA Spring Seminar in April offered a wide variety of presentations on the general theme of e-education, focusing on the many ways that e-business can be used to support and transform the way in which colleges and universities carry out their academic missions. From expert consultants to ACUTA members sharing their “real-world” experiences, there was a wealth of knowledge and experience to absorb.

What struck me the most about these fascinating presentations was that most of them were as much or more about the human aspects of e-education as they were about the technical side. While a good understanding of what is technically possible is important, it was apparent that those who ignore the human side of the equation will face frustration at every turn.

It occurred to me that the successful implementation of an e-education initiative requires a marriage of technical vision and a big-picture view of how people and systems can be orchestrated to operate in totally new ways. E-business isn't about applying technology to the same old systems and procedures—it is about rethinking customer needs, organizational objectives, and

From the Executive Director

E-Business Is about People

possibilities, and about developing totally new ways to get there via technology.

Our presenters shared stories about their own experiences in leading or participating in the e-business transformations taking place on their campuses. One example was about combining the offices of treasurer, bursar, and financial aid, so that students and parents could transact their financial business in a more seamless and customer-friendly way. Those departments had been silos of the worst kind, creating a bureaucratic maze for students. It took a couple of retirements, but the e-business team on campus was able to sell the need for reorganization, with encouragement and participation from high-level administrators.

Another interesting story was about the campus bookstore that uses a creative new approach to compete with the mega-giants of online bookselling. When students register for their classes online, a book list appropriate for their courses is automatically generated, and the students receive notification that the books can be charged to their student account and picked up or delivered at no charge to their dorm room or apartment within a day or two. No gathering individual course book lists, no standing in line, no writing a separate check, and no carrying heavy books across campus. If the prices were at all competitive, I'd take advantage of the service—wouldn't you? This e-business application went far beyond just putting the store catalog up on the Web and created a system that made students' lives significantly easier.

Another campus leader shared his secrets for the successful rollout of new programs, including e-business initiatives. The secrets to his success include:

- a well-thought-out system of encouraging creative ideas;
- evaluating ideas at the unit manager level;
- research and development;
- developing a tentative and then final business plan;
- pilot testing with the target market; and finally
- implementation and evaluation

These project management methods are his key to making highly technical projects fly.

There were many more case studies and examples of successful implementations, all pointing to the fact that while an understanding of software and hardware, networks, security, and other technical issues is essential to a successful project, cultural intelligence, leadership, project management, communication, and even political skills are equally important. While that can be a bit unsettling to a manager who has spent a career accumulating a vast store of technical knowledge, it was clear that ACUTA members in attendance “got it” and were able to benefit from each other's experiences and insights on both the technical and human issues.

ACUTA will continue to offer educational programs that emphasize both the technical and the management and leadership issues that we believe are important to a successful higher education technology manager.





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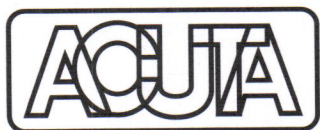
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