ACUTA Journal

ACUTA: Association for College and University
Technology Advancement

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ACUTA Journal of Telecommunications in Higher Education

acuta *Journal*

of Communications Technology in Higher Education

This Issue: Supporting Classroom Technologies and Remote Campuses

Events Calendar

Even	Date	Place
Annual Conference	July 17 – 21, 2005	Gaylord Palms Resort Kissimmee, Florida
Fall Seminars	October 30 – November 2, 2005	Marriott City Center Denver, Colorado
Winter Seminars	January 8 – 11, 2006	Renaissance Esmeralda Resort Palm Springs, California
Spring Seminars	April 2 – 5, 2006	The Westin Providence Providence, Rhode Island
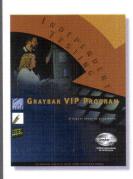
ACUTA's Core Purpose is to: Support higher education communications technology professionals in contributing to the achievement of the strategic mission of their institutions.

ACUTA's Core Values are to:

- Share information, resources and insight,
- Respect the expression of individual opinions and solutions,
- Maintain our commitment to professional development and growth,
- Advance the unique values and needs of higher education communications technologies, and
- Encourage volunteerism and individual contribution of members in support of organizational goals.

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CAMPUS

HOME

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The ACUTA Journal of Communications Technology in Higher Education

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Tamara J. Closs
Georgetown University
ACUTA President
2004–2005

Going the Distance with Education

Georgetown University is among many United States universities that enjoy a large international student population, but according to a March 24, 2005, Reuters article, the attraction of U. S. schools has waned since September 11. Reuters cites a combination of factors contributing to this decline including visa restrictions, a perceived discrimination against foreigners, and a rising antipathy toward U.S. policies.[1]

According to the Institute of International Education, foreign enrollment fell 2.4 percent in the last academic year—the first decline in more than three decades—compared to an increase of 6.4 percent in the year before the 2001 attacks. The Council of Graduate Schools reported in March 2005 that despite significant U.S. government efforts to encourage foreign students to study in the United States, foreign graduate student applications fell 5 percent from 2004 to 2005 following a 28 percent drop the previous year.

These changes are challenging us to look at the definition of "remote campus" in a new way. Georgetown University is assessing the opportunity to join Cornell, Carnegie Mellon, Texas A&M, and Virginia Commonwealth in establishing a remote campus in Doha, Qatar.

The Qatar Foundation for Education, Science, and Community Development is a private, nonprofit, chartered organization founded in 1995 that aims to develop and use human potential through a network of centers and a unique Education City, with branch campuses of some of the world's leading universities.[2]

The proposed Education City campus is conceived as a totally integrated educational environment, which will encourage synergy and interaction among the existing educational and recreational facilities on the site and those envisaged within the new academic and medical areas of the University.
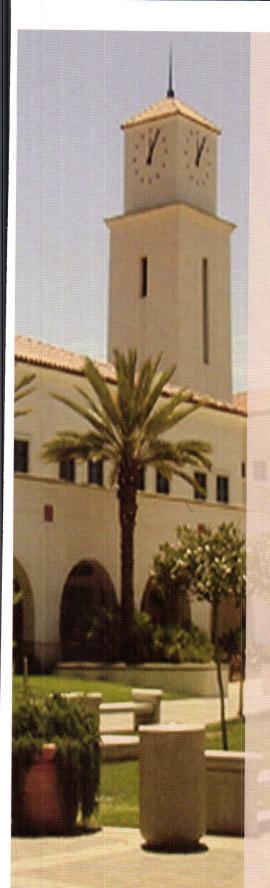
Four U.S. universities currently have a presence in Education City, and each campus proffers degrees from its U.S.-based campus.

• Carnegie Mellon University offers undergraduate business and computer science degrees.

• Virginia Commonwealth University–School of Arts offers programs leading to bachelor of fine arts degrees in communication arts and design, fashion design and merchandising, and interior design.

• Weill Cornell Medical College offers a two-year pre-med program.

• Texas A&M University offers graduate programs in engineering. Its professors will collaborate with local industry to conduct research through two interdisciplinary research centers focusing on the production and use of natural resources and on environmental sustainability.

The challenges are many, including recruiting teaching and support staff and providing not only for campus-based needs but also for personal needs including housing, religious, cultural, health, and recreational. Technologically the location is well supported, albeit through the monopolized communications services; voice over Internet protocol is currently not allowed. It is also a challenge to plan, deploy, and support the technologies that facilitate the operation of a remote campus based in a different economy with different product and service providers.

Along with the challenges comes the unique opportunity to collaborate on an international level with the Qatar Foundation. Also, Georgetown University is considering the potential to outsource some of our campus needs to the other campuses that are already present in Education City, creating an

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From the Executive Director

Jeri A. Semer, CAE

ACUTA Executive Director

It is a given that today's college students arrive on campus with high expectation levels for technology availability. However, there is a distinct difference between using technology for social interaction and entertainment and making it an integral part of the learning process. Considering the theme of this *Journal*, I thought it would be interesting to do some research on students' pre-college experiences with the use of technology in the classroom.

A quick Internet search reveals that much work is being done in the K–12 world on the integration of technology and learning. In 1985, the National School Boards Association (NSBA) formed the Institute for the Transfer of Technology to Education (http://www.nsba.org/site/page_micro_nestedcats.asp?TRACKID=&VID=67&CID=63&DID=195). The NSBA also created a special interest group called the Technology Leadership Network in 1987, which conducts conferences and provides professional development opportunities focusing on educational technology for classroom teachers, administrators, and school board members.

However, at this group's 2004 T+L² conference, Susan Patrick, the director of the U.S. Department of Education's Office of Educational Technology, stated (as reported in *eSchool News*, Jan. 2005) that students spend an average of only 15 minutes per week working with computers when they are actually in school. That is a significant disconnect with their nonschool hours, which are spent immersed in technology. Other speakers agreed that technology in K-12 schools has not been widely deployed and integrated to the point that learning has been transformed.

There is clearly much work to be done, and it might be risky for ACUTA members to assume that students arrive on their campuses fully versed in how to use technology to enhance and support their learning experience. There may even be opportunities to create classes or workshops on how to use technology effectively in research and learning, incorporating issues and concepts such as tutorials on the commonly used software on the campus, proper use and security of the network, how to evaluate the efficacy of information gleaned from the Web, copyright, plagiarism, and so forth. Undoubtedly, some member campuses have done this already—it would be beneficial to share examples.

In the 2003 ACUTA Member Needs Assessment survey, 17 percent of respondents reported that they are responsible for educational technology support. It will be interesting to see if that number increases when we conduct the next survey in late 2005. I hope you find the articles on supporting classroom technologies a good opportunity to learn how peers at other member institutions are viewing classroom technology, what is current and what is coming, and how classroom technology supports the learning process.

President's Message

opportunity for collaboration both here at home and in Qatar.

Supporting our advance-team communications requirements has provided valuable lessons from GSM-format cell phone requirements and the inability to use Blackberry devices to providing backup satellite phones, identifying high-speed Internet capabilities, and working with existing campuses to provide back-up support on-site—issues we would not have been concerned with if they were traveling within the United States.

This venture requires us to think beyond our regional boundaries in different ways. It is an opportunity to expand our knowledge of how to use technology to support the living and learning environment for our international student population.

1. Reuters, "US Loses Foreign Students to Post-9/11 Competition," March 24, 2005, http://story.news.yahoo.com/news?tmpl=story&cid=1896&ncid=1896&e=2&u=/nm/20050324/us_nm/security_education_dc_5.

2. http://www.qf.edu.qa/

Change the way you look at your campus network

It's a no-brainer. Campus networks see more change than any other network environment. Constantly evolving to support new users and multiple facilities, campus networks require more than their share of network moves, adds and changes. Not to mention a steady stream of trouble tickets to look into. And in a place where the free flow of information is critical, you can't afford problems that halt or hinder network performance. That's why you could use an extra set of eyes into the network to help you spot problems and solve issues faster than ever. Whatever challenge you face on your campus network, Fluke Networks has a Network SuperVision Solution™ to give you better vision and control of your network and cabling infrastructure. Like a unique tool set for certifying cable installations. For troubleshooting switched networks. Tools for spotting network drops. Testing link connectivity. Total network analysis. And of course, tools for conducting network moves, adds and changes. Our easy-to-use handheld tools will change the way you look at your network. But don't just take our word for it, see our solutions for yourself on our website.

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Classroom Technology: Practical Approaches

Linda Bogden-Stubbs and
Steve Marks
SUNY Upstate Medical University
bogdenst@upstate.edu
markss@upstate.edu

If only there were a definitive guide to choosing specific technology for teaching and learning spaces! Unfortunately, such a guide will never exist, as the parameters for each individual project, as well as for the emerging technologies, are ever changing and rarely consistent. What can exist are some timeless suggestions for those approaching the task of recommending presentation technology. These principles do not make general assumptions about budgets or room sizes or other factors over which you may have little control. Your future teaching space is unique in at least some ways, but there are some practical steps that can lead you to effective decisions.

In general, your first tasks are centered around gathering information about the future space or space to be renovated and about how that space is to be used. In addition, you'll be investigating the technology possibilities. If there are defined parameters, such as "computer projection" or "nothing can be fixed to the floor," then you have a start on expectations. If videoconferencing or distance learning are expected capabilities, the complexity of the design increases; but regardless of any goals or restrictions, the following suggestions will help you in the design of a space that will be effective for teachers and students.

Remember the goal: to allow your faculty to do what they do best—teach. The most danger lies in not understanding what teachers need to do their job. When we fail to understand that, we are likely to complicate their life and, as a result, create a support nightmare. We might also spend money on technology that isn't needed, just because it's available and sounds exciting.

Learn as much as possible about what takes place in your classrooms. Here at Upstate Medical University, we provide AV support for teaching spaces. In most cases, it is service as needed: set up of special equipment or help getting started for a guest lecturer. Our support staff is a good starting point for gaining some understanding as to what faculty do currently. What technology do they really use? What do they ignore? Why?
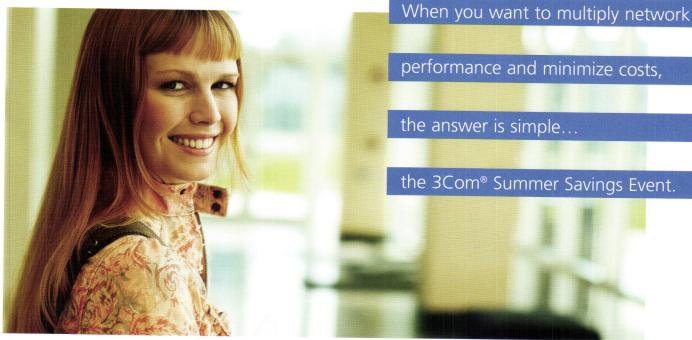
For example, if they never use the document camera, is it because they can't find it or they don't know how to use it? Or is it that they really see no good use for it? In some cases the support staff has a good feel for the answers to such questions, but it is always a good idea to seek answers from the faculty themselves. As you might expect, each faculty member may have some unique preferences.

Learn as much as possible about technology that is available and successful. The trick here is keeping in step with an always changing technology landscape. It can be tempting to be on the cutting edge, but that always comes with risk. Be diligent about educating yourself, but be careful not to focus on a single product or vendor. Find out what several other campuses are using, and ask them about any consistent issues they have encountered. Ask them what they would do differently if they could do it over again. That is a great question (if they are willing to share), because there's a lot to be learned from each installation project.

Learn as much as possible about what will take place in the new or renovated space. It is astounding to find out that some key stakeholders are sometimes left out of this conversation. Since we are being asked to provide guidance on the technology, we need to seek answers from the end users. Sounds logical enough, but oftentimes the architects and engineers have goals that do

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not initially take the end users into account, often because a campus representative with a only a vague perception of the goal ("a classroom") is the liaison. It can be tricky to intervene, but we find that when we ask to be included, the response is usually very positive. Then, our role includes becoming an advocate for the faculty and students, as we keep the original goal in mind.

Try to meet with department chairs or faculty who are likely to use the space. The main objective is to gather some information, but you will also create a partnership that they will appreciate. And if you cannot ultimately accomplish something they hope for, they will know that you were working on their behalf.

In addition, once you have a plan, consider creating a "mock-up" of a room being designed. Do the best you can to simulate the use of the technology. Even if it is impossible to obtain exact demonstration equipment, you can often find a creative way to simulate the functions of the technology being proposed. Concentrate on how the room would function: how the user would make something happen. Present an overview and some rationale for decisions or compromises that were made. Then demonstrate some common uses, concentrating on accessibility of important features. Follow with a question-and-answer session, taking notes on comments and suggestions. End by stating your original goal (making it possible for teachers to do their job), and assure them that you will continue to do what you can.

Accept the fact that the budget is likely to be out of your control. Isn't the first question on any such project always "What's the budget?" Certainly the budget sets some very specific parameters as to what can be done, but a large budget doesn't guarantee a successful room. There are many examples of high-tech spaces that faculty would love to see bulldozed. The truth is, you can do a great deal without even knowing the budget.

Once you understand what the faculty need to do their job, there are two main goals that a bigger budget will help you accomplish. One of those goals is to provide the best quality that you can. A data projector that can't provide enough resolution or light output is useless, so set some minimum standards. At the other end of the spectrum, there are limits to what would be useful and worthwhile. Without losing sight of other goals (goals of other stakeholders, i.e.: aesthetics, long-term fiscal responsibility, etc.), use the budget to increase the quality of the picture and sound for the students. In most cases, the point at which another step up becomes overkill becomes obvious. Choose equipment that has a better warranty and reputation. Avoid wiring plans that diminish quality (forcing high-resolution devices to use low-resolution connections).

The second goal is to provide the most friendly user interface that you can. Even on a shoestring, you can usually provide a way for faculty to change sources to the projection equipment without unplugging cables or climbing a ladder. The minimum standard is a way to project any source without having to call for help, even if a quick reference card needs to be posted.

A step up from minimum is a single control panel of push buttons that switch inputs. The installer wires the source devices to a switching system operated at the push-button panel. These are considered user-friendly, and they provide reliable basic capabilities.

An additional step up is a programmable touch-screen or button control system. These provide the same functions as the button panel, but can also be programmed to do several things at once (lower a screen, dim the lights, and power on the projector) and also do some tasks automatically. These systems can be enhanced in many ways, with additional costs involved. Are such systems user-friendly? The key here is collaborating with a qualified programmer. Such control systems have great potential if the programming and screen layout are well thought out and designed.

Accept the challenges of the physical layout of the room. Like the budget, this is likely to be out of your control. In most cases, you are asked to enhance an existing space or a space being renovated. The dimensions of the room are what they are. Even with new construction, it is unusual for us to be involved before most, if not all, of the room blueprints are developed.

Do what you can to be involved as early in the process as possible. There is always a possibility that you can suggest a design change to enhance the teaching environment before it is too late. If not, look at the problem as an opportunity to be creative! (See page 13 for some helpful tips.)

Keep the realities of ongoing support in mind. When making decisions about equipment and the functionality, remember that the technology will continue to need some level of support.

Obviously, a primary concern is financial support. What will it take to keep the new equipment working? How expensive are replacement bulbs for the data projector? How long do the bulbs last? How can you avoid having a data projector bulb burning all night long or over an entire weekend?

Unless you have a large support staff, avoid creating a system that requires continuous set up or breakdown by support staff. Provide easy-to-understand instructions for users on the wall or podium.

Examine your current practices and survey other campuses for positive experiences. Many new projectors have

Tips for the Conference Coordinator or Technician

These may seem obvious but are often overlooked:

• Identify a technical contact at the remote site and review policies and procedures. Perform test connections and investigate the equipment available at the site.

• Identify a facilitator at the remote site who will handle logistical issues such as distribution of materials for students.

• Meet with the teachers prior to the start of the classes. They need to be oriented to the equipment in the room, as well as to the limitations of videoconferencing. Determine their teaching style, and consider an approach that will work well with videoconference technology. Insist that they change their "routines" as little as possible, but realize that some adjustments may be inevitable.

A recent statistics class here at Upstate was taught via distance learning to students at two remote sites. One of the requirements was a hands-on lab where the students would work on a computer using specific statistical software. The teacher was to demonstrate use of the program, and the students were to emulate on their own computer. As we knew, spreadsheets and other small

details would not be legible in standard video, especially video compressed for videoconferencing. The solution was to accompany the videoconference with an Internet connection and a Web-based application-sharing program that would allow the remote sites to project the teacher's screen in high resolution. After a single practice session, the teacher was comfortable with the methodology, and the students could see what they needed to see.

• Be prepared with a backup. What if there is a problem with connecting to the remote site? As we all know, equipment fails; but you may be surprised to know that most of the "failures to connect" we encounter are not technology related. Scheduling conflicts, weather problems, or miscommunication are some common reasons why the local class and the remote class cannot be present at the same time. And most of the time, adding an additional class for a site that missed out is not an option.

We have made it a routine to at least videotape classes in case a recording is needed to replace the actual session for the remote site. Classes encoded and stored on a video-streaming server can be tied to a course management system (we use Blackboard) to enable students to review the session on their PC.

IP connections so that the status of the projector can be inspected and changed from a computer connected to your LAN. Programmable control systems can be directed to power off equipment at specific times or after a specified period of inactivity.

The faculty will need some help and confidence building when the new equipment is ready for use. Why not continue the good relationship you began by involving them in the planning? Consider having an orientation session for faculty and administrators. Also, plan to do individualized or small group sessions as additional users foresee needing to teach in the space. You may also want to prepare a "quick-start" guide for users that can be given to faculty, and keep an extra copy handy in the room at all times.

As mentioned at the outset, interactive rooms such as distance-learning classrooms or videoconference facilities have many additional factors to consider. However, the goals of effective presentations and ease of use are consistent. Switching audio and video sources to be displayed at remote sites can be done in several ways and at several cost levels, for example. There are also unique concerns related to presenting effective teaching materials via videoconferencing systems.

Again, training sessions and support materials can be created to assist the faculty.

Conclusion

It can be both exciting and daunting to be asked to recommend equipment. The technology and associated costs change so fast that new products are often available before the initial purchase requisitions are processed. That's why it is all too easy to be bogged down by announcements of new products and forecasts of changing standards.

Regardless of the technology coming out tomorrow, it is always important to have a consistent goal of providing effective technology. That means a system that will enable the teacher to teach and the student to learn. The system must be something the faculty can operate, and it must work reliably, at a quality level that meets their needs. If we focus on those issues, the many variables of budget and physical limitations cease being roadblocks and simply become factors to work with. The administration and faculty will understand that, and they will appreciate your help and expertise.

Linda Bogden-Stubbs is teleconferencing/distance learning coordinator and Steve Marks is associate director, educational communications, at SUNY Upstate Medical University. Reach Linda at bogdenst@upstate.edu and Steve at markss@upstate.edu.

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Synchronous Blended Learning Using Videoconferencing over IP

Dennis Glenn

Northwestern University

dglenn@northwestern.edu

For the first time in the history of Northwestern University, the School of Communication now offers a master's-level program via distance education. This program began in fall 2004 after two years of extensive market research and planning. The School of Communication used a very successful, traditional, face-to-face master's program—the MSC Systems, Strategy and Management curriculum, in place since 1994—to base its synchronous blended distance-education component. This component uses the latest videoconferencing technologies to allow students to interact with each other and work on group projects and class assignments, both

during and outside of class hours from their home or office in real time.

The difficulty of replicating the rich communication and the trusted pedagogical tradition of face-to-face instruction that our University was built on made Northwestern reluctant to invest in distance-education ventures. Northwestern University was founded in 1851, and today it is the only private university in the Big Ten. Several years ago, when its board of trustees investigated what the field of distance education had to offer a highly reputed brick-and-mortar university like Northwestern, it determined that no model or medium yet existed that could provide

instruction on par with Northwestern's sesquicentennial tradition of face-to-face instruction delivered by world-class faculty.

The Right Program at the Right Time

New advances in technology and leadership by the Northwestern's Information Technology Department in Internet2 initiatives allowed the School of Communication to develop a program that represents the first fully committed distance-education course in the University's history. The Communication Systems Strategy and Management Program is a two-year master's program designed for the working professional seeking the advanced skills and expertise needed to effectively bridge the "strategy gap" that separates corporate technical experts and nontechnical executive decision makers. The program is interdisciplinary and draws on the faculty from Northwestern's renowned School of Communication, Kellogg School of Management, McCormick School of Engineering and Applied Science, Medill School of Journalism, and Information Technology Department. Upon completion of the program, students earn a master of science in communication.

Our market research determined that this program was ideal for distance education for numerous reasons:

• Quality students had high levels of technology expertise.

• Corporations outside the metropolitan Chicago area wanted employees invested with the program's knowledge.

• Students were now working in virtual teams at their jobs or would be in the near future and needed the skills to implement these programs at their organizations.

• Cost of the technology needed to implement the program was now reasonable.

Features and Benefits

The distributed-learning component of the program provides students outside the Chicago metropolitan area with a real-time classroom experience via videoconferencing over the Internet. In an environment of collaborative learning unparalleled in other remote classroom programs, they participate in and learn from group projects with local and remote learners. Students enrolled in the program interact with Evanston-based instructors and students using technology that allows videoconferencing over Internet protocol (IP) via individualized videoconferencing units.

The distributed program has the following attributes:

• On-campus instructional meetings during the year. In the first year, all students, local and remote, attend a new-student orientation and technol-ogy "boot camp" in the fall and a weekend meeting at the beginning of the winter term and the spring term. Second-year students meet at the beginning of the fall and winter terms and then attend final presentations and graduation.

• Synchronous learning via videoconferencing. The program provides each student with equipment and software so that he or she can attend class from home or an office.

• Asynchronous Web-delivered learning modules. All class lectures and presentations are streamed live and archived for student review.

• Multilocation team projects enabled by videoconference. The program uses a 24/7 conference bridge for all partici-pants. This unique feature will permit all learners, no matter where they reside, to create virtual working groups. While not uncommon in the corporate world now, such virtual teams are certain to be a ubiquitous feature of work life in the near future.

• Classrooms specifically designed for videoconferencing that have four cameras to capture all faculty and student interactions. A student consultant uses a nearby control room to select the appropriate camera angle and record and distribute the live stream.

• Additional instructional resources to facilitate communities of practice for both interactive synchronous and asynchronous communication.

• Classes that meet one full day a week on alternating Fridays and Saturdays for 30 weeks per year.

• Students who take two courses at a time. Class times are 9:30 a.m. to 12:30 p.m. and 2:00 p.m. to 5:00 p.m.

• A technology support team that monitors all classes and is available to faculty and students alike. This team assists the faculty in the preparation of all class materials, PowerPoint presentations, PDF files, videos, and illustrations.

The benefits of the new program have been seen by both resident and distant students. One of the major concerns

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associated with traditional executive education is that due to work and travel constraints of their employment, students occasionally need to miss class. Now students can take their videoconferencing equipment with them and connect using a DSL or cable modem. Additionally, a live streamed videocast is available, and a capture of the class is posted to the Web at the end of each day for students' review.

One of this year's students was required to work from Tokyo and Hong Kong for eight weeks. He was able to attend class and interact with his group for discussions and presentations without having to drop or delay his progress in the program. (See http://www.communication.northwestern.edu/mscstrategy/testimonials/#; click the Shannon Giblin image.)

Addressing Faculty Concerns

The first of many steps in implementing this program was to meet the standards of the faculty review committee. Their insistence that all students attend class in real time was a hurdle that technology advances on our campus were able to overcome. Videoconferencing over IP using a Radvision bridge allows up to 72 simultaneous users to connect to a conference. Our class size, 20 resident and 10 distance students, would not create an undue burden for the University's bridge for classes, and it permits distant students to set up their own conferences on an anytime/anywhere basis. More important, the connection charges for the distance students were reduced dramatically over previous ISDN technology. (See: http://www.communication.northwestern.edu/mscstrategy/overview/# and click the the image to view a class.)

Another reservation of the faculty committee was to provide a history of research on classroom assessments of distant students. I prepared a white paper with references to research studies that compared resident with distant student assessment data. I also

conducted surveys of our current and future students to ascertain students' interest and acceptance. Our faith in the program was rewarded when a distant group of students from California and Arizona received top honors for their work during the fall quarter. Their ability to meet collectively anytime made their papers and presentations top notch. They also appear to be more highly motivated and self-directed, which is a trait found in most successful distance students. (See http://www.communication.northwestern.edu/mscstrategy/testimonials/#; click the P.J. Hazelton image.)

From Vision to Reality

Once the program received its blessing from the faculty committee, I produced a business plan that covered marketing, education, and technology costs through a 10-year cycle. Included in this plan was the construction of two special classrooms with the latest technology, faculty distance-teaching bonus (faculty are teaching 33 percent more students), increased administration costs, and course-preparation expenses. Once the budget was approved, the plan received the blessing of the dean, and she forwarded the plan to the provost for final approval in December 2003.

During winter quarter 2004, a classroom was configured with the new technology. A faculty support team began preparing two instructors who were to teach in the spring quarter, using the latest methods for integrating videoconferencing technology into their courses. During spring quarter we conducted a test of the technology and surveyed the students on best practices for group participation.

The program began in the fall with 21 resident and nine distance students. Within the first week, one resident and two distance students dropped the program. While disappointing, there is some attrition in every program.

The success of the program can be attributed to the following factors:

- Highly selected and technology-savvy student body

- A very advanced IT facility infrastructure and support network

- New advances in videoconferencing equipment for desktop systems

- Higher connectivity throughout the country

- Technology-savvy faculty with an interest in advanced technologies

- Budgeted faculty support for training and curriculum development

- Budgeted on-site technology support for every class

- A tenacious program director promoting this new initiative

- And most important, a mandate from the dean to make this the best School of Communication with global recognition

Conclusion

The distance-learning component of our residential master's program has exceeded all initial projections. The faculty are pleased with how the new technology has enhanced their teaching styles. Additionally, the program is now recognized nationally and available to qualified students from a more diverse corporate environment that brings a more varied level of corporate governance with new industries and practices to our existing student base. The use of this technology better prepares our students for the latest communication methods needed in our rapidly changing global society.

As assistant dean for distributed education in the School of Communication at Northwestern University, Dennis Glenn builds interactive learning environments that individualize instruction over broadband networks and distance-learning courseware. He created and is currently the director of the Distributed Learning Center in the School of Communication. Visit his website at http://www.communication.northwestern.edu/about/administration/dlc/Dennis_Glenn/.

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Planning for Classroom Audiovisual Technologies

Richard Bussell

Vantage Technology Consulting Group

www.vantagetcg.com

Audiovisual technology is an essential component of teaching in the lecture hall and is making its way into the classroom, the seminar room, and even the group workroom. But on most campuses "audiovisual" is often still a technology stepchild.

It is time to plan, manage, and support audiovisual in a professional manner. The people with experience in planning and managing technologies such as telephone and data services must become familiar with the requirements for audiovisual technology and play a significant role.

To promote the development of such skills, this article provides a broad background on issues involved in planning for classroom audiovisual technologies, without dealing with the ever changing minutiae of individual product and model numbers.

It looks at how best to involve users of the systems to enhance successful implementation, and how to ensure that the facilities contribute to the success of the audiovisual installation. It also looks at how to set appropriate standards to ensure continuity of approach and how to envision and incorporate features that will reduce the cost and downtime associated with enhancement of the technology in the future.

Involve the Users

Implementing audiovisual technology that faculty and staff cannot, or will not, use is a waste of everyone's time and money, so involving them (even—especially—those who claim to have nothing to contribute) in a formal planning effort is essential.

It is not enough to ask the group what they want. Most can talk only about what they have seen in the past; and by the time your new systems are up and running, they will be one to two years behind current technology. But choose your approach carefully when talking about new technology. A technician's enthusiastic description of the new features incorporated into the latest model of XYZ device will simply help convince your staff and faculty that their time is not well spent in meetings discussing technology.

As an alternative, to engage a broad-based user group, discuss technology in terms of functionality—what is possible today and what will be possible as we envision the future. Start out in that direction, even if the initial implementation will fall far short of the long-term dream.

One technique for discussing this includes discussing functionality in two classes: (1) that which is essential on day one and (2) the provisions needed to add this later. Another technique is planning to install basic systems in most rooms while selecting one room as a technology "sandbox"—that is, a room where new technologies will be installed regularly for trial, demonstration, and assessment before being rolled out to the wider campus classroom environment.

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At some point it will be necessary to decide with this group how to deal with obsolete technologies. Overhead projectors and 35 mm slides come to mind immediately, but you may have others to deal with. Providing the functions of devices like these is not difficult with new technologies. If absolutely necessary, 35 mm slides can be displayed on the video screen using a slide-to-video converter, and the functions provided by an overhead projector can be duplicated by a document camera and/or an annotation tablet. Both devices provide a multitude of new capabilities such as annotating PowerPoint presentations and annotating video (just like they do on *Monday Night Football*!).

Plan or Adapt the Facilities to Suit the Technology

Successful audiovisual teaching technology installations depend heavily on integration between the technology and the physical environment—a situation often overlooked by a technician or contractor installing the system. The following are important considerations:

- **Display location and sightlines.** The front wall of most classrooms includes a writing surface (blackboard or whiteboard) and a projection screen. Usually both elements are centered on the front wall, and as a result the projection screen obscures the writing surface when in use.

As an alternative, consider the front wall of the room as two side-by-side presentation "zones." Each zone has a writing surface, but only one incorporates a projection screen, so both components are available simultaneously and side by side. In this arrangement the projection screen is not aligned with the center of the room so checking on sightlines from each student seat is essential. The two-zone arrangement also provides an option to install a second projection screen in the future to accommodate a faculty member who is teaching with multiple media displays (and many advanced users are already requesting dual simultaneous displays).

The quality of the sightlines is determined by (1) the maximum distance from the screen at which fine detail can be perceived (usually established as six times the height of the screen); (2) the maximum vertical angle to the top edge of the screen that ensures an ergonomic neck position (most people are comfortable with an angle up to 45 degrees); and (3) a minimum horizontal angle to the far edge of the screen for seats with an acute view of the screen. Far less light is reflected to viewers at acute angles than to viewers with a direct view of the screen, and the viewing angle to the far edge of the screen should be not less than 30 degrees.

- **Image brightness.** It is well known that a bright image is required to provide good viewing conditions, but in fact, it is the contrast between the projected image (the "brightness" of the projector) and the ambient light falling on the screen that determines the image quality. Therefore, control over the ambient light in the room is as important as the overall brightness of the source. The control over ambient light reduces the light output required from the projector and therefore reduces the initial cost of the projector and the ongoing cost of replacement bulbs.

So, don't economize on the window coverings. Vertical blinds have proved inadequate as window covering for audiovisual rooms over and over because they inevitably result in vertical bars of bright light on the screen at some time of the day.

Mechanical blinds are an absolutely necessary component in audiovisual rooms, and the simple response (often the audiovisual technician's response) is to provide blackout blinds. But full blackout conditions are not conducive to a good learning environment, and full blackout is not always necessary if heavy, close-weave shading material is provided. A dense fabric contributing to an overall facade visible transmittance ratio of less than 0.05 is a good starting criterion.

Blackout blinds will still be required in rooms with extensive windows or skylights, or rooms where the screen is exposed to direct sunlight at certain times. Full blackout is also critical in rooms set up for videoconferencing or distance learning to accommodate the cameras.

Control of room lighting to suit audiovisual purposes is achieved by (1) zoning the light fixtures to dim the light falling on the screen while retaining adequate light over the student seating area, (2) using highly directional lamps to illuminate the writing surface without spilling light onto the adjacent projection screen, and (3) using dimmable fixtures.

Establish Standards for Classroom Audiovisual Systems

Campuses achieve stability and continuity, and promote efficiency in new work, by establishing standards for technology. It is time to develop standards for classroom audiovisual systems as well.

That's not to say that each room or each system will have identical functionality or components. A set of carefully crafted standards will, however, serve to start the discussion with users, system designers, and installation contractors from a common baseline. Each will get a quick overview of the whole and use a common vocabulary to discuss areas

where a variance from the standard might be appropriate. In addition, the campus may realize additional benefits from consistent maintenance, a longer term relationship with a particular manufacturer, and/or a reduced spares inventory.

The standards should incorporate the requirements for integration with the environment presented above and might also include some or all of the following:

• **Source devices.** Develop a list of "standard" audio and video source devices and their functionality. Typically the source devices comprise a fixed-podium-mounted computer, a laptop input port, and a combined DVD, CD, and VHS player. This list can be enhanced by a series of "optional" or "future" source devices including a document camera, annotation tablet, slide-to-video converter, access to campus video or cable TV distribution, and provision for videoconferencing or distance learning.

• **Equipment location.** Equipment that the users touch (e.g., to insert a tape or DVD) should be located in or immediately adjacent to a fixed teaching lectern. The teaching lectern is connected to remote system components via a floor box or a robust umbilical cord. Other system equipment may be located in an equipment rack somewhere in the room but remote from the lectern.

• **Control system.** The system should provide a simple intuitive control system designed to make users feel familiar and comfortable with the technology.

In simple systems, this can be achieved with a set of push buttons to select the source. In more complex systems a programmable touch-screen control system is usually required to simplify the operation for non-technical users. A campus standard for the touch-screen control systems enhances the users' familiarity and comfort level as they move from classroom to classroom across campus.
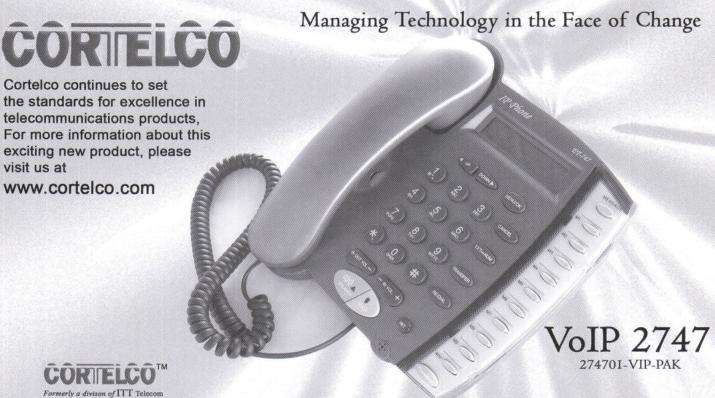
• **Data network ports dedicated to the AV equipment.** Audiovisual equipment is becoming more and more dependant on the data network to provide options for remote control, monitoring, and maintenance. To accommodate

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current and future requirements, data ports should be provided for connection of the audiovisual system at the audiovisual equipment rack, at the projector location, and at the podium.

Table 1. Minimum Light Output Required

Image size, up to	Projector light output, not less than
45 in. by 60 in.	2,500 lumens
60 in. by 80 in.	3,500 lumens
72 in. by 96 in.	4,500 lumens

All values assume an ambient light level less than 20 lumens.

• **Appropriate projector resolution and light output.** Projectors come in a wide variety of image resolution, light output, and price ranges. Detailed selection depends on many functional, system, and environmental factors, but the following guidelines suit many typical classroom installations.

The minimum projector resolution required to show the detail on a typical spreadsheet should meet or exceed the native XVGA standard (1,024 by 768 pixels). The minimum light output required depends on the size of the image. *See Table 1.*

• **Appropriate projector location with respect to the screen.** The appropriate projection distance (distance between the projector and the screen) is determined by the image size and the focal length of the projector lens. Most projectors come equipped with a "standard" zoom lens allowing some variation in the projection distance usually within the range 1.8 to 2.4 times the image height.

Optional lenses are available to deal with extreme situations but at a cost that increases dramatically, sometimes with the cost of the lens approaching the cost of the projector.

Plan for the Future beyond the Initial Installation

Classroom technology is not complete when the system is installed and commissioned. Planning for technology inevitably means keeping options open and expecting and planning for change. For example:

• Make provision for all those devices the faculty said they didn't need. Faculty members often talk down their need for technology beyond the basic display system. Perhaps asking for little and getting most of it is better that asking for a whole lot and risking losing the funding for all of it. However, once technology is in place, requests for additional system capabilities will occur. Plan systems with input capacity ready to accept additional devices, and teaching lecterns with space to accommodate them.

• Make provision for a transfer to a 16-by-9 display format. Many institutions are considering the implications of a future change from the conventional 4:3 (width to height) screen aspect ratio to the increasingly popular 16:9 widescreen format. Develop a strategy for dealing with this coming change.

• Make provision for the future of videoconferencing and distance learning. Many forward-looking institutions are already using or piloting videoconferencing and distance-learning technology in the classroom. If you are not yet using these technologies this is the time to make small and cost-effective provisions in both the room and the system for future adaptation—for example, by identifying future camera locations in order to provide power and signal conduit at those locations, and by considering the room lighting requirements for videoconferencing.

• Make provision for central monitoring and control of the equipment. Audiovisual systems have embraced data network technology to provide the capability to report on current status, proactive maintenance issues, and fault conditions over a network connection. For example, a projector can report a light source nearing the end of its life, system controllers can report disconnected or faulty devices, and technicians can troubleshoot system faults and correct them from a central control location thereby saving much time spent traveling around campus. Investigate the opportunities provided by implementing a central campus audiovisual control system.

Conclusion

As classroom technologies become more sophisticated and mainstream on your campus, the challenges to do it right—and within budget—become more critical. As with other campus technologies, it is imperative that user needs be heard, that room design be accomplished effectively, and that standards be developed. And like other technologies, the network is playing an expanding and important role. The classroom technology future is now. Good luck in planning for it.

Richard Bussell is a principal with Vantage Technology Consulting Group. You can reach Richard when you visit the group's website at www.vantagetcg.com.

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Optimization Tools Improve Bandwidth Bottom Line

Paul Korzeniowski

Higher education is a growing business, and many colleges have been increasing the number of students served. In numerous cases, universities are expanding their campuses beyond their original footprints and opening new classrooms and dorms a few blocks, or even a few miles, down the street. Students expect the services offered at these remote locations to be the same as those found on the central campus, but meeting that expectation can be a difficult proposition for communications managers.

The challenge stems from the nature of wide area network (WAN) bandwidth. Like any other enterprise, universities want to pay as little as possible for their WAN links, which can represent as much as 20 percent of the total IT budget—in many cases, WAN communication costs trail only personnel expenses as a university's most significant IT budget line item.

To get good deals from carriers, higher education institutions collect their WAN traffic, which is often Internet access, and send it to the local carrier over one, or a few, high-speed lines. Typically, such lines are stationed in the heart of the main campus. The users who sit close to these links receive rapid response time, but the farther away students, teachers, and administrators are from the central connection, the slower their response time becomes. This becomes problematic if teachers sit in remote classrooms and wait for Web pages to download. That can lead to dead time in class, and they can lose the students' attention.

Addressing the problem can be difficult. Buying more bandwidth is the most obvious solution, but it is seldom the most practical one. During the Internet boom, WAN bandwidth pricing was dropping as a slew of start-up carriers rushed into the market, so adding more WAN bandwidth was quite possible. Since the boom went bust, WAN bandwidth pricing has been steadily rising.

"A few years ago, there was a belief that bandwidth pricing would plummet and router technology would advance so organizations would maximize use of their network bandwidth," said Peter Sevcik, president of the market research firm NetForecast (http://www.netforecast.com). "As the volume and variety of traffic flowing over enterprise networks increased, that assumption has proven to be false."

Vendors[1]—such as ActivNetworks Ltd.; Allot Communications Inc. ; Artera Group Inc. ; Converged Access Inc.; Expand Networks Inc. ; Packeteer Inc.; Riverbed Technologies Inc.; Swan Labs Corp.; and Tacit Networks Inc.— developed products to help address the problem. These companies sell devices that manage and compress WAN information in a couple of different ways, so customers can pack more information onto their existing communications lines and maximize their use.

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Traffic Shaping to Boost Performance

There are two primary approaches the WAN optimization products use to boost performance. The first is *traffic shaping*.

"Through the years, I have found that no matter how much bandwidth you provide to users, they always want more," joked Ted Roberge, manager, residential network services at University of California, Irvine. Traffic-shaping products monitor information generated by individual users and allow telecom managers to set policies to ensure that bandwidth "hogs" do not chew up all of the network resources.

Limiting user access to network bandwidth is gaining popularity. Telecom managers now have tools that help them examine what is happening on their networks down to the individual port level, so they have a clearer picture of what information users are transmitting.

"When users sign up to use the campus network, we outline the maximum bandwidth policies that are in place," explained Ryan Mendel, property technology manager for Place Properties Inc. "Initially, a few voice some resistance, but once we explain that the policies are in place so all users can gain access to the network, they seem to understand."

Place Properties, which manages off-campus housing for 16 universities, says interest in WAN bandwidth tools stemmed from an encounter with network overruns caused by an unwelcome user. "In the summer of 2003, the Blaster virus infected a large number of the computers connected to our network and effectively shut down our Internet access for a few days," said Mendel. To better monitor and control what was happening on its network, the company purchased PacketShaper from Packeteer.

The University of Miami, which supports 25,000 users spread out over three campus networks, also needed to limit user bandwidth usage. It outfitted many of its classrooms and residence halls with 10Mbps Ethernet connections in 2002, and new WAN network bottlenecks were expected to arise as users took advantage of the improved network access.

"We have a 70Mbps link to the Internet, and it could be overloaded if students downloaded a lot of music and videos," noted Carlos M. Diaz-Silveira, IT security engineer at the University of Miami.

About a week before school began in the summer of 2003, the University decided to install a WAN optimization tool. The University opted to purchase Allot Communications' NetEnforcer to optimize WAN bandwidth for 10,000 devices at its Coral Gable campus.

"Once we put the Allot product in, we found that 80 to 90 percent of the traffic flowing over the network was file-sharing products, such as Morpheus," stated Diaz-Silveira. "If we did not have a tool like it, there is a distinct possibility that a number of our users would have been complaining about performance problems."

The traffic-shaping WAN optimization tools offer another benefit: Higher education institutions are able to allocate bandwidth to sensitive applications. The nature of the applications supported on collegiate networks has been shifting from strictly data to multimedia, which includes voice and video transmissions. Data applications are easier to support. They will sit patiently and wait for information to be delivered, so they are quite capable of successfully delivering data during high-usage periods. Voice and video applications are not as accommodating. Any noteworthy delay in transmission time can cause these applications to drop packets, which results in garbled transmissions, in a best case scenario, and failed transmissions, in the worst case. The WAN optimization tools enable universities to provide voice and video applications with higher priority to network resources and therefore lower the likelihood that they will encounter any significant delays.

Using Compression to Boost Performance

The second WAN optimization approach relies on *compression*. Squeezing more data into existing connections has been a common desire since the days of dial-up modems supporting 300 bps connections. Compression products have been a popular technique to meet that goal; this technique squeezes more information into each connection by relying on sophisticated algorithms that eliminate redundant or repeated information from packets. At the sending station, a product converts data into shorter streams of symbols for transmission, and a table (dictionary) is used to translate these symbols back into their original form at the receiving end.

Data compression has become so common that router vendors include this feature in many products, with a common technique now being TCP/IP header. Usually, compression techniques are designed for generic applications and do not maximize performance for specific traffic patterns.

Recently, WAN optimization vendors designed special data compression techniques that do more than just shrink packet headers: They also dramatically compress packet payloads for specific applications.

Limitations

While the WAN optimization systems include alluring features, they also have some limitations. The products may not work with all types of traffic. For instance, Riverbed's Steelhead does not support Microsoft's SQL Server.

Security checks represent a significant challenge. Since encrypted packets no longer contain recognizable bit patterns or protocol formats, the products cannot pinpoint redundant data. A workaround is to apply bandwidth optimization before encrypting the data, which requires stationing WAN optimization gear on the LAN side, rather than the WAN side, of each connection. This approach works with IPSec encryption typically used for site-to-site virtual private networks but does not function as well with secure sockets layer encryption, which usually implements encryption at the endpoint devices.

Justifying the Cost

WAN optimization products come at a cost, with each low-end system (typically two are required on each link) priced at a few thousand dollars and more sophisticated systems reaching the $25,000 mark. In the current tight economy, it has become imperative for network managers to justify such purchases, and they can follow a few paths to make their case.

The most obvious payback is a comparison to adding more WAN links. Wellesley College in Wellesley, Massachusetts, has 6,000 users connected to a backbone network that links 50 buildings. In the fall of 2002, Wellesley looked at WAN optimization products.

"We had a T3 line to the Internet and were not in a position where we could put in another one simply because network traffic increased," noted Tim Cantin, director of system networks at Wellesley, which relies on Converged Access's QoSDirector to maximize its WAN bandwidth. "Installing a WAN optimization tool enabled us to avoid taking that step."

In other cases, WAN optimization tools are the only way that educational institutions can increase bandwidth. Many universities connect their remote campuses via fractional and full T1, frame relay lines, or broadband Internet links. As the volume of traffic passing from location to location grows, so does the number of network bottlenecks. While some universities want to replace their WAN links with DSL lines, they are not available in all locations.

In most cases, the WAN optimization tools were designed to work at T1 speeds or lower, so universities that want to optimize T3 lines or greater can have difficulty finding a suitable system.

"We have a Gigabit backbone network and found that few of the WAN optimization vendors supported that transmission speed," noted University of Miami's Diaz-Silveira.

The devices require some time and effort to configure. The WAN optimization products are not plug-and-play systems that you simply drop into the network. Telecom managers need to determine the traffic flow on their networks, outline the places where the bottlenecks arise, and then determine the proper configuration.

"Initially, we set user limits too low, 256K bps," stated Diaz-Silveira. "We found that many users were having trouble ▶

staying within that constraint. We have now given them all a 4M bps maximum and there haven't been any network problems."

The benefits received depend on the applications a university is running.

"Vendors have developed a number of ways to enhance performance, and not all work well with every application. So users have to understand what information is flowing over their networks and which of the WAN optimization products does the best job supporting their applications," noted NetForecast's Sevcik. As a result, the improvements that the new WAN tools deliver to universities vary by configuration. On the low end, colleges will see improvements of 30 to 40 percent, while boosts of as much as 400 percent are possible on highly saturated connections.

Configuration is becoming more complex as vendors bundle more WAN optimization techniques in their products. As is typically the case, the additional features are a step or two ahead of the products' management and monitoring tools functions. WAN optimization tools' ability to sift through the often complicated set of products and services on corporate networks and illustrate how well data is flowing on each link

is usually limited because new application types are constantly being introduced. "It would be helpful if our system had peer-to-peer application updates on a timelier basis," said Diaz-Silveira.

This request underscores one of the challenges vendors face.

"A number of the new peer-to-peer systems are being designed by programmers who deliberately try to hide how their applications operate," explained Azi Ronen, executive vice president of technology and marketing at Allot Communications. "In effect, they act like viruses by running out of unassigned ports and encrypting their transmissions, so they are very difficult to decipher." As a result, there can be a time lag between when these applications are put into use and when vendors develop techniques to monitor them.

To date, the WAN optimization products have been developed by niche network equipment vendors rather than established WAN equipment suppliers.

"It seems like the router vendors think they would be admitting that there are limitations with their products if they added WAN optimization features to them," said NetForecast's Sevcik. In addition, the large companies may not have an incentive to develop these devices because their purchase results in fewer sales of their routers.

Increased sales could force them to change their outlook. NetForecast found that WAN optimization vendors sold $1.2 billion of equipment in 2004, and that represented a 30 percent increase over 2003's revenue figures.

"With the number of WAN carriers dwindling as the market continues to consolidate, it seems likely that pricing for WAN bandwidth will at least stabilize and will probably increase," concluded NetForecast's Sevcik. "The WAN optimization tools will continue to be popular because they offer telecom managers a viable option for enhancing network performance without increasing their telecom expenses."

Paul Korzeniowski is a freelance writer in Sudbury, Massachusetts, who specializes in networking issues. He is also an adjunct faculty member of the Massachusetts College of Pharmacy and Health Services and the University of Phoenix. Reach him at paulkorzen@aol.com.

1. ActivNetworks Ltd., http://www.ActivNetworks.com; Allot Communications Inc., http//www.allot.com; Artera Group, Inc., http://www.arteragroup.com; Converged Access Inc., http://www.convergedaccess.com; Expand Networks Inc., http://www.expand.com; Packeteer Inc., http://www.packeteer.com; Riverbed Technologies Inc. (http://www.riverbed.com; Swan Labs Corp., http://www.swanlabs.com, and Tacit Networks Inc., http://www.tacitnetworks.com

Threats and Vulnerabilities:

Observers have stated that "email is the driving force behind the internet.[1]" In a recent poll conducted by Network Engines, 86% of the respondents said that the implications of their being without email for a day would range from serious to catastrophic.

Microsoft® is the dominant operating system on the Internet and their Outlook email systems, hosted on their Exchange Server, are the most used email system in the world[2]. This criticality of email and the inherent value in the Exchange Server make it one of the key targets for people illegally seeking information or desiring to do harm.

Because of its nature, the Exchange Server is designed to be open, accepting inputs from a variety of sources. This openness is what makes it vulnerable and difficult to protect. A few years ago the Blaster virus, which is a buffer overflow attack, brought down a large number of companies and cost millions to repair[3]. Blaster exploits a vulnerability in the Microsoft RPC area, going through port 135 to wreck havoc. The collateral damage caused by Blaster is that Exchange Servers and email are also taken down. Port 135 is "open," as it is the port that Exchange uses to listen for RPC requests. Of note is that even though patches and defensive information have been available some time, Blaster was the third most common attack recorded in the second half of 2004.[4]

Patching systems and closing Port 135 help solve the Blaster problem, but do not reduce the risk of further attacks on Exchange. Indeed, two forces have increased the risk. One is the mobile worker, who takes his/her laptop home over the weekend and inadvertently gets it infected. When he/she returns to the office on Monday morning, he/she logs in behind the firewall. In this case, assuming he/she is on a LAN, his request for email will be viewed as an RPC call by the Exchange Server. The second is the use of VPNs, which provide a secure tunnel from a client location to the perimeter firewall. However, once at the perimeter firewall, the message(s) in the VPN go where they want to. These messages may contain "Blended threats[5]" which quickly work their way into the network and systems, corrupting data and opening back doors.

Defense-In-Depth

To combat the differing threats and changing attack vectors, a different defensive strategy must be employed. Instead of the traditional perimeter firewall, which blocks everything except that which is allowed, a new architecture of defense-in-depth is required. Defense-in-depth means applying multiple defenses to stop the different and changing threats. These include:

- Making sure that all patches and updates are current
- Applying multiple firewalls, packet filter firewalls at the perimeter and application level firewalls in front of critical servers
- Using strong (two-factor) authentication for remote users
- Periodically testing the network for vulnerabilities

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[1] The Pew Internet & American Life Project studies reports that over 90% of Internet users send/receive email. **www.pewinternet.org**

[2] "Real-World Email Client Usage: The Hard Data, Edward Grossman, July 19, 2002 **www.clickz.com**

[3] C-Net, April 2, 2004 "MSBlast epidemic far larger than believed" This article suggests that between 8 and 16 Million systems were infected. Security, Vol. 2, No. 4 - June 2004 "Blaster Revisited" Jim Morrison. "..the human cost to patch systems and restore those that became nonfunctional are substantial-somewhere between $320million and $500 million…"

[4] Symantec Internet Security Threat Report Trends for July 04-December 04 Vol. VII, March 2005, p. 14

[5] "A blended threat is a computer network attack that seeks to maximize the severity of damage and speed of contagion by combining methods, for example using characteristics of both viruses and worms, while taking advantage of vulnerabilities in computers, networks or other physical systems. The Nimda, CodeRed and Bugbear exploits were all examples of blended threats." **Searchsecurity.com** Definitions

[6] PIX Firewall is a registered trademark of Cisco Systems, Inc. or its affiliates in the U.S. or certain other countries.

The use of multiple firewalls is not a new concept. Many large organizations have frequently used a combination of internal and external firewalls to segment networks. What is new is using a specific appliance based application firewall to protect a specific server. The cost of doing this a few years ago would have been prohibitive to all but the most security conscious. With the decreasing cost of hardware this solution is well within the reach of most entities.

NS6300-EDU Solutions:

The key in this solution is that internal firewall must be an application (Level 7) firewall. Using this capability, the firewall can reject messages that are mal-formed or don't meet specific criteria. For Exchange Servers the optimum solution is the ISA firewall, which is an application level firewall designed by Microsoft to be integrated in a Microsoft solution.

PIX[6]

network/backbone

NS6300 EDU

Exchange Server Segment

Exchange

Exchange

Exchange
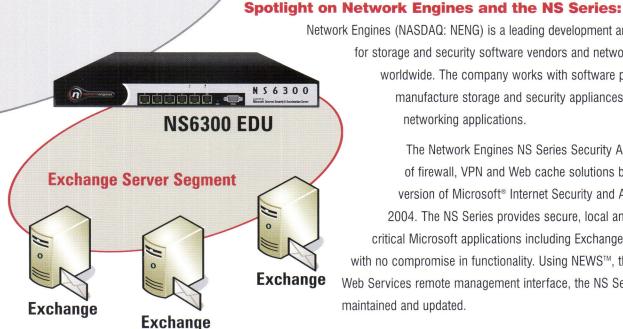
An example of the Network Engines/ISA firewall in a defense-in-depth architecture is shown[6] at left:

The Network Engines implementation of the ISA firewall, provides the ability to screen all messages to the Exchange server, ensuring that only those that are "acceptable" are allowed and that all else is rejected. The NEWS™ software provided by Network Engines as part of the appliance, facilitates setting up and managing ISA, as well easing any required updates or patches to ISA or the hardened Windows® 2003 operating system. The end result is defense-in-depth solution for any organization, providing specific protection for the Exchange server(s).

Spotlight on Network Engines and the NS Series:

Network Engines (NASDAQ: NENG) is a leading development and manufacturing partner for storage and security software vendors and network equipment providers worldwide. The company works with software partners to develop and manufacture storage and security appliances for mission-critical networking applications.

The Network Engines NS Series Security Appliances are a family of firewall, VPN and Web cache solutions based on a full-featured version of Microsoft® Internet Security and Acceleration (ISA) Server 2004. The NS Series provides secure, local and remote access to critical Microsoft applications including Exchange, IIS and SharePoint with no compromise in functionality. Using NEWS™, the Network Engines Web Services remote management interface, the NS Series is easily installed, maintained and updated.

Please visit www.networkengines.com for more information or call 877-638-9323.

About Robert Mannal, CISSP:

Robert is Managing Director, RHMINC a security consulting firm. Previously he held management positions at Security Dynamics (now RSA), in the Information Risk Management Practice at KPMG and at Codex (Motorola). Mannal holds an MBA in Marketing from the Wharton School of Business and is a Certified Information Systems Security Professional (CISSP).

NS6300-EDU
Security Appliance

networkengines

NS6300
powered by
Microsoft® Internet Security & Acceleration Server

PRODUCT HIGHLIGHTS

- **Integrated VPN/SSL**
  Secure remote access, including SSL bridging

- **Proxy firewall with application filtering**
  Protects mission-critical application servers, including RPC for Microsoft Exchange Server

- **Multi-layer firewall security applications**
  Protects your network at the perimeter, asset edge and application level

- **Configuration management**
  Simplified backup, restoration and maintenance

- **Secure management console access**
  Prevents unauthorized access

- **HTTP filtering**
  Deep inspection of application content

- **SSL encryption / bridging**
  Allows SSL traffic to be inspected for malicious code

- **Web publishing rules**
  Enforces secure forms-based authentication

- **High availability fault-tolerance**
  Hardware and ISP fail-over.

The Network Engines NS6300-EDU Security Appliance is a multi-layered security platform specifically introduced to meet the security requirements institutions. The NS6300-EDU provides educational network environments with advanced application-layer firewall, VPN and Web cache functionality for defense-in-depth protection of core Microsoft® infrastructure applications like Exchange, SharePoint and IIS. Based on a full-featured version of Microsoft Internet and Acceleration (ISA) Server 2004, the NS6300-EDU combines ease of implementation and maintenance with prescriptive security and exceptional performance. This compact and flexible solution delivers a comprehensive feature set specifically designed to defend Microsoft server assets in the education setting.

Through the integration of best-in-breed technologies, NS6300-EDU provides extensible network security protection. The Network Engines ISA plug-in Cooperative Enforcement (NICE) program extends the capabilities of Microsoft's award-winning ISA Server 2004 application with industry-leading content security and vulnerability mitigation features. Policy definition and configuration of this multi-purpose platform is easily maintained and automatically updated using NEWS™, the Network Engines Web Services interface. The NS6300-EDU is the most comprehensive, easily managed solution available for securing the world's most widely deployed server platforms.

For more information, contact:

Network Engines. Inc. 25 Dan Road, Canton, MA 02021 USA
Appliance Sales: +1 877-638-9323 • Fax: +1 781-770-2000
email: NSsales@networkengines.com • **www.networkengines.com**

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> *"The NS6300 is incredibly easy to use, fast and secure. It does what it's supposed to do while freeing up time to focus on other mission-critical areas."*
>
> Shawn Partridge
> *Director of Information Services*
> *Cascade Die Casting Group, Inc.*

NS Series: Defense at every level for unlimited Microsoft experience.

New Technologies Redefine the Classroom

Curt Harler

Contributing Editor

curt@curtharler.com

New technologies are altering the educational landscape in dramatic ways. Today's students prefer practical and hands-on to theoretical, can't put their lives on hold for their education, and expect a high level of technological sophistication to deliver a personalized educational product. The new campus uses technology to serve a demographically diverse student body that may not even all reside on the same continent. Whether they are expanding a university's MBA scope from 40 students to nearly three million, teaching students about networking using live networks, or linking rural doctors to a university hospital's trauma center, systems that reach beyond a university's geographic boundaries allow today's audiences to have it all.

Out from Under the Dome

At Notre Dame University, South Bend, Indiana, the well-respected executive MBA program was limited to students near South Bend. Technology changed that. For two decades, Notre Dame has offered executive MBAs and other graduate programs through its Executive Education program. But eight years ago, with the local graduate market in decline, the University knew it had to diversify its offerings to turn that trend around.

It did so in large part through distance learning and now has a potential worldwide student reach. Students hail from cities across the United States and from countries worldwide, including Haiti, Costa Rica, Mexico, China, and Chile.

Key to the program's success was its decision to utilize sophisticated yet easy-to-use two-way videoconferencing, allowing real-time interaction of students and professors from all over the globe.

Leo Burke, associate dean and director of executive education at Notre Dame's Mendoza College of Business, credits the system with playing an integral role in expanding the executive MBA program. "It enabled us to offer a meaningful and seamless education experience to a broader audience of adult students," Burke says.

Notre Dame uses Polycom's ClassStation solutions, including two-way videoconferencing technology that enables the University to expand the classroom across the world, achieving more educational equity and diversifying its program.

Students and faculty interact through the technology, and faculty members have used it to bring guest speakers and industry leaders from around the globe into their classrooms to complement their courses, enhancing educational opportunities for students.

Bill Brewster, director of internal programs and executive education, says that one of the main things they did right was to do a lot of research on systems prior to investing.

"We actually waited a couple of years before we found something that met our quality objectives," Brewster says.

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Notre Dame spread use of videoconferencing technology beyond the classroom, extending its reach into other areas of university life. At the beginning of every school year, the CEO of one of Notre Dame's corporate clients presents the annual kickoff welcome address for students, discussing issues companies face and challenges executives are up against. One year he could not make the trip to South Bend because of weather constraints.

From his home office, Notre Dame connected him via video for the presentation and question-and-answer session. Ever since, videoconferencing has been his preferred method of delivery for this special presentation—it saves time and travel expenses and highlights the effective use of technology for which Notre Dame's Executive Education program has become known.

A more typical use of the systems is in day-to-day student and faculty interaction. Students are able to attend class from a variety of locations based on their business needs. Students can interact not only with the faculty member during live classes but also with students at other locations. This creates the impression of physical proximity even when great geographical distances are a reality.

"Institutions looking to move into two-way videoconferencing really need to hire someone with experience to integrate and choose quality vendors,"

says Brewster. "With a quality vendor and the extra effort, it has really made a difference."

Teaching the WAN at George Brown College

For Anthony Lucifero, having the opportunity to learn about wide area network protocols on a real-life network is far better than just reading about them in a textbook.

Now because of new WAN technology available to students at George
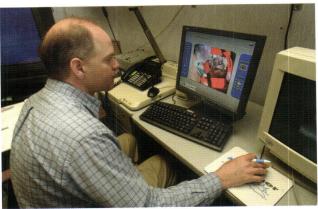
Photo by University of Vermont Medical Photography

In the emergency room, Ray Keller, MD, assistant medical director of emergency services at the University of Vermont and Fletcher Allen Health Care in Burlington, Vt., views a medical simulation from a transport ambulance equipped with special mobile telemedicine equipment. The FAST STAR pilot project is testing the best way to connect doctors and EMS personnel while a patient is en route to the hospital.

Brown College in Toronto, the third-year student in the Wireless Networking Program says he is able to "learn by doing," while also getting a better idea of what protocols such as ATM, frame relay, and X.25 virtual circuits actually look like.

"Educational institutions cannot expect programmers to program without ever seeing a computer. How can a person learn auto mechanics without actually having a car?" says Gideon Hack, vice president and CTO at

Sangoma Technologies Corporation in Markham, Ontario, Canada.

Using a self-contained WAN that runs on a single PC, called the WAN EduKit, students can see the inner workings of WAN protocols. The kit lets the instructor build a WAN in the laboratory without having to access commercial leased data lines. Students can see TCP/IP transactions as they occur over ATM, frame relay, PPP, HDLC, and X.25.

Sangoma started in business 20 years ago as a provider of connectivity hardware and software products for WANs and Internet infrastructure. Of course, the equipment had debugging logic. When they saw colleges buying pairs of units they quickly realized that teachers were running them back-to-back in labs so they could show students the protocols and the traffic. The company then designed a one-box kit that acts as a WAN connection between high-speed LANs and simulates LAN/WAN connectivity.

Typically, a teacher will teach the class using a single box and an overhead projector. The professor can run the class through frame relay, ATM, or other exercises (a VoIP version is due out shortly).

"It's up to the teacher to determine how 'dirty' the class gets," Hack says. Each exercise can be a general overview or go deep into how the 53-byte cells work, actually seeing the network.

Another product called the WANPipe is also part of the company's

educational product suite. It allows educators to build WANs within the lab environment to demonstrate TCP/IP over WAN topologies. These are real WAN networks, albeit over a very short distance.

"In most real-life situations, large companies don't want people fiddling with real data online [for learning purposes]," Hack explains. He adds that this made it difficult for students to work with WAN protocols in a lab environment and actually see how packets are transmitted in a network, to understand how the size of the packets affect transmission, and to be able to work with configurations.

In fact, this has developed another revenue opportunity for schools. In a few cases, the college has been able to market classes based on the WAN learning program to telcos and private companies.

"This is not a toy—it is a completely operable device. But it lets you see the ping from a Cisco router. It lets you see an IP address in the frame relay frame," Hack says. The EduKit products are deployed in several Canadian colleges, including George Brown, Seneca, and Humber. It is scheduled to be available in the U.S. market in 2005. "The one problem we have is that people who have been teaching for years without this kind of equipment can't believe it exists," Hack says.

Healthy Solution from the University of Vermont Medical School

The University of Vermont's (UVM's) Medical School is extending its trauma program with a local hospital. There, trauma surgeons provide consultative services to rural communities using state-of-the-art videoconferencing technology.

Despite the crazy things college students do on campus, it's a fact that patients in rural America suffering a severe trauma accident are twice as likely to die as trauma patients in urban areas. The availability of trauma training, longer discovery time, and greater distances to travel for treatment have all affected death rates in rural trauma patients.

Because of these startling statistics, the UVM College of Medicine and Fletcher Allen Health Care established a teletrauma network in 2000 that connects hospitals in the region to the level-one trauma center at Fletcher Allen. Since its inception, the trauma staff has treated more than 60 patients through the teletrauma network. Participation has grown from three hospitals in 2000 to eight in Vermont and New York.

Dr. Bill Charash, director of surgical critical care and director of the teletrauma program; Dr. Michael Ricci, Allbee Professor of Surgery, chief, Division of Vascular Surgery, and clinical director of telemedicine; Michael Caputo, director of information systems and telemedicine operations at the UVM College of Medicine; and Dr. Fred ▶

Rodgers, chief, Division of Trauma, Burns, and Critical Care, all note that the program has been well received by hospital staff and families of the patients in the region.

Building a Teletrauma Network

"We didn't do everything right the first time," Caputo says. "We learned a lot."

One mistake was trying to share equipment. Now he insists on dedicated equipment and dedicated lines. "It can't be shared equipment," Caputo says. "You don't have time to fool with switching lines or running equipment around."

Fletcher Allen technical staff built the teletrauma program on three dedicated ISDN lines, which a testing team monitors. The team checks the lines twice daily during the work week to ensure first-time connection to rural hospitals.

If a power supply is down or camera is disconnected, an e-mail goes out to the physicians, notifying them that the unit will be fixed in a few hours. "This gives us time to deal with the situation properly," Caputo says.

The teletrauma network also leverages the hospital's existing 24-hour operator service. Remote sites call the operators on a toll-free number and request a teletrauma consult.

The operator contacts the trauma doctor on call, who responds by connecting to the rural hospital via videoconference.

The UVM College of Medicine deployed Polycom units in eight hospitals and seven physicians' homes. Five units around campus are dedicated to teletrauma. Doctors can connect via videoconferencing to help elevate the quality of care and put trauma experts—

vascular surgeons, neurosurgeons, and pediatric surgeons—at the fingertips of rural hospitals.

For instance, a patient was involved in a severe motor vehicle accident and suffered a closed-head injury with internal bleeding. Rural hospital doctors had experts from the Fletcher Allen trauma center walk them through a surgical airway procedure via videoconference. It alleviates fears for rural doctors, as they know they have access to an expert in a moment's notice.

"We provide guidance during trauma procedures and help build confidence in the local doctors, bringing a higher level of care to the patients," Charash says.

"We wanted a hardware unit rather than something PC based," Caputo adds. "These units easily mount on a ceiling or wall and provide the reliability and robustness we needed."

In addition to trauma, there are a lot of telemedicine sites set up in the hospital for departments ranging from dermatology to general surgery. In the hospitals, video units are mounted above patient beds on the wall to give a bird's-eye view of the room. Trauma doctors can then zoom in and out, gaining access to the entire room.

Expanding Telemedicine

Throughout the system, hospital staff is taking videoconferencing beyond its traditional role. Continuing-education events incorporate the technology in grand rounds. On average, UVM broadcasts 30 educational conferences and grand rounds a week.

Caputo is proud of the program to deploy one of the units to doctors' homes. "If a call comes in at 3:30 a.m.,

they don't have to leave home," he says. The big benefit is the time savings. The physician does not have to dress and drive to the hospital. "Those 20 to 30 minutes can be lifesavers," he says.

Uses are also expanding to administrative meetings for workgroups and projects within the hospitals. Clinical applications are active for consultations in dermatology, psychiatry, and surgery. The teletrauma project represents an expansion of the telemedicine program into more high-stakes medical situations.

For those looking to start similar teletrauma and telemedicine programs, the UVM College of Medicine team recommends the following:

1. Have a clinical champion.

2. Provide a dedicated unit at each remote site.

3. Have dedicated resources.

4. Test your units and call center daily.

5. Have a maintenance plan ready at all times.

The advice probably would be valid for almost any outreach program that takes the university beyond the gates of Old Main.

Conclusion

Innovative technologies are changing the way education is delivered around the globe. Without the traditional constraints of space and time, we should see remarkable opportunities for educating tomorrow's students more effectively and efficiently.

Curt Harler is a contributing editor to the *ACUTA Journal* who writes and frequently speaks on technology topics. Reach him at curt@curtharler.com.

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WiMax: Facing the WMAN Challenge

Nathaniel J. Melby

melby@nova.edu

The last mile, or the last portion of infrastructure necessary to connect a location to a network, has proven to be a formidable opponent, remaining a challenge even after a variety of technologies have claimed to be solutions to the problem. These challenges have been felt in education when remote campuses are difficult and expensive to connect to main campus networks. To provide network services to every desirable location, extravagant amounts of funding, resources, and equipment are sometimes necessary. In today's world of tightly controlled education budgets, these requirements could be too much for some schools.

Recent developments in the IEEE 802.11-based technologies have proven to be functional and effective solutions for wireless networking in limited coverage areas. Commonly referred to as WLANs (wireless local area networks), they have the potential for computing mobility of a level that has been unachievable in the past. However, the coverage areas are too limited for remote campus application.

Another IEEE specification for wireless networking, 802.16, has now emerged. This specification is targeted toward the development of a standardized, broadband, wireless-access solution. As a complement to its cousin 802.11, 802.16 is intended to connect 802.11-based and other networks to the Internet, and it has the potential to resolve the last-mile problem for many providers. The advantages of this next-generation wireless technology include the potential to further the wireless revolution and enable more cost-effective, high-speed connectivity to remote classrooms, instructors, students, and administrators.

Enter WiMax

The IEEE's 802.16 specification on broadband wireless access (BWA) systems, or WiMax, provides for the usage of point-to-multipoint BWA networking solutions in a fixed state.[1] There are future plans to incorporate mobility into the standard with 802.16e.[2] These types of networks transport traffic using frequencies between 2 and 11 GHz in the 10 and 66 GHz bands to enable multimedia, data, voice, video, and other bandwidth-intensive traffic.[3] BWA systems carry high-performance and high-bandwidth networking in the wireless medium and provide for use of Internet protocol versions 4 and 6, providing metropolitan area network (MAN) and long-haul interconnection. These types of networks are interoperable with existing wired infrastructures and are often directly connected to them.

Before 802.16, interoperability was a challenge for wireless technology targeted at fixed and MAN use. 802.16 was developed to standardize the physical layer and media access control (MAC) layer of existing wireless technologies operating between 2 and 11 GHz, such as local multipoint distribution system (LMDS), and between 10 and 66 GHz, including multichannel multipoint distribution system (MMDS)[4]. One of the greatest advantages that WiMax carries over its

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predecessors is the ability to use symmetric communications.[5] Compared with widely available solutions such as cable modems and digital subscriber lines (DSL), this is a very distinct advantage, particularly for those who run a Web-based business from home or office as well as for commercial application.

Many times, as technologies converge, a technology originally intended for one purpose finds an application in new and emerging environments. This is the case with many of the fundamental principles of 802.16. In contrast to more traditional telecommunications, data networking standards are historically developed and placed into global application without many of the pressures of complex political influence.[6] Typically, lower-level standards—such as layer 1 and layer 2 standards pertaining to local area network (LAN) and MAN environments—have been established by the IEEE 802 LAN MAN Standards Committee, publishing through the IEEE Standards Association. Middle-level specifications are typically addressed by the Internet Engineering Task Force (IETF). Even though other organizations publish LAN and MAN standards, the IEEE 802 group is considered the authority in the field.[7]

By carrying 31-mile range, non-line-of-sight (NLOS) connections, and data transfer rates of up to 70 Mbps in an aggregated medium, 802.16 technologies have the potential for a dynamic impact on communications technologies. WiMax has the ability to quickly provision service, avoid expensive installation of networking cabling, and grow beyond the current physical limitations of cabled infrastructures.[8] In comparison with European networks, the backhaul of cellular towers in the United States has been lacking due to link usage by third-party provider leases. 802.16 technologies could very well be the solution to this problem.[9]

There are many other benefits of the implementation of this technology in educational environments, including avoidance of the long wait for T-1 circuit provisioning, connectivity to high-speed access for places that are currently unreachable for cable modem and DSL service, and as an effective solution for rural areas and places where cabling costs are prohibitive.[10]

Also in educational environments, WiMax offers the following advantages:

1. High-speed network connectivity for remote locations challenged by the last-mile problem.

2. NLOS wireless network connectivity to any receiver within range.

3. Quality of service (QoS) provisions for survivability of voice over IP (VoIP) and other real-time, congestion-sensitive traffic.

4. Mobility built into the standard. This would provide receivers the ability to connect to the same wireless network from any point on campus, remote campuses, homes, and other locations within a 31-mile range.

QoS functionality is built into 802.16, facilitating true service-level guarantees via a polling-based deterministic MAC layer. A focus by the IEEE 802.16 working group on standards-based interoperability with 802.16c helps to build the foundation for wireless computing to make a ubiquitous move toward MANs. Recently, Intel joined Aperto Networks, Alvarlon, Fujitsu, OFDM Forum, Nokia, Proxim, WI-LAN, and Airspan to establish a nonprofit organization to certify 802.16 equipment standard compliance.[11] Even though point-to-multipoint BWA solutions have been available for a long time, there have been no standardized WMAN solutions.[12]

The MAC layer of 802.16 is broken into transport-activity supporting sublayers, such as those intended to support IPv4, IPv6, Ethernet, and ATM. This could be very appealing to vendors, giving them the flexibility to use a range

of protocols.[13] 802.16 extensions such as 802.16a, 802.16b, 802.16c, and 802.16e have been established to amend 802.16 design specifications, and have been reaching a fervor of development recently.[14]

IEEE 802.16

Defining the radio-air interface for BWA operating in the spectrum between 2 and 11 GHz and between 10 and 66 GHz, the IEEE 802.16 working group supports development and standardization of approaches for wireless networks targeted at MAN applications. These applications support U-NNI functions as well as the coexistence of LMDS technologies, operating between 23.5 and 43.5 GHz.[15] IEEE 802.16 focuses on MAN operations, just as 802.11 focused on LAN applications.

By focusing on the development of point-to-multipoint BWA configurations, 802.16 intends to enable voice, video, multimedia, data, and other traffic-intensive flows in MAN and WAN (wide area network) environments, in conjunction with the Broadband Radio Access Network (BRAN) committee of the European Telecommunications Standards Institute (ETSI).[16]

In April 2002 the first publication of this working group provided the IEEE Standard 802.16 Air Interface for Fixed Broadband Wireless Access Systems. This standard specified that a wireless MAN would provide access to buildings though exterior antennas, or subscriber stations, in turn communicating with base stations (BSs) in a point-to-multipoint configuration. Providing an alternative to traditional cabled networks and other access networks such as fiber-optic, DSL, and cable modem links, the working group intended to resolve the last-mile problem and bring functional access to high-speed core networks to residential and commercial buildings.[17]

In this standard, wireless MAN technology was intended to provide fixed network access to a building, while

more traditional networks such as Ethernet or WLAN (IEEE 802.11) will provide interconnectivity between LAN hosts inside the building. More recent progress in 802.16e allows for mobility, extending the WMAN MAC protocol data exchange directly to individual users.[18] In this type of application, links between the BS and the home receiver and from the user's computing device to the home receiver use different physical layers, but the built-in QoS function of the WMAN MAC is able to support the connection.

A connection-oriented entity, the 802.16 MAC supports QoS and bandwidth allocation by BS interaction with terminal requests. The algorithms supporting this allocation are capable of supporting literally hundreds of terminals per channel, and allow for sharing of terminals by multiple users.[19] Even though QoS and bandwidth allocation means are provided in 802.16 design, the specific details of these operations are left without the guidance of standardization and will allow vendors a basis for differentiation.[20] A request-grant mechanism continues robust efficiency even when (1) terminals carry several connections, (2) volumes of statistically multiplexed users are present, and (3) separate QoS levels are necessary.

The MAC also supports IP4 and IP6, Ethernet, VoIP, and ATM using features such as packing, payload-header suppression, and fragmentation.[21] However, the MAC does not merely allocate bandwidth and transport information. In addition, there is a provision for a privacy sublayer, fostering key exchange and encryption, as well as network and connection authentication to mitigate theft risks.[22]

The intention of the IEEE 802.16 standard was to create a set of air interfaces that could be based on a common MAC protocol in support of different physical-layer specifications dependent on the usage spectrum as well as spectrum regulations. Focusing on frequencies from 10 to 66 GHz, the

base standard focuses on a frequency range that is available across the globe. However, at the shorter wavelengths there are several challenges, including very limited line-of-sight functionality.[23] As single-carrier modulation is used in one of the three air-interface specifications, the 10–66 GHz interface is called WirelessMAN-SC2. Other specifications include WirelessMAN-OFDM (orthogonal frequency division multiplexing) and WirelessMAN-OFDMA (orthogonal frequency division multiple access).[24] In this configuration, the base station allocates time slots to subscriber stations, and time division multiple access (TDMA) uplink access is provided. A combination of frequency-division multiplexing and time-division multiplexing is used, and half-duplex frequency-division multiplexing subscriber stations are supported. Bursting is supported by both multiplexing components, while coding and modulation options are assigned as bursts occur.[25]

The most recently released version of the 802.16 standard, released in October 2004, compiled previous versions and amendments 802.16a, b, and c to form a single unified revision.[26]

IEEE 802.16a

The 802.16a specification stated that one of three air-interface specifications should be used, allowing for interoperability and legacy support. These specifications are: WirelessMAN-SC2, using single carrier modulation; WirelessMAN-OFDM, combined with TDMA access and a 256-point transform; and WirelessMAN-OFDMA, using OFDM with a 2,048-point transform and carrier subset addressing at individual receivers for multiple access.[27] 802.16a defined an optional meshed topology to augment traditional point-to-multipoint designs.

Including both unlicensed and licensed frequencies, the design of this physical layer was focused at NLOS use. As a result of the NLOS provisions, however, there is a very significant threat of negative impact on the signal due to the phenomenon of multipath fading. This results in

more expensive antennas for the receiver.[28] Currently, vendors are focusing on target data rates of close to 70 Mbps in a 14 MHz channel. With this configuration, cell ranges of up to 50 km are intended.[29]

IEEE 802.16c

As the first 802.16-2001 amendment, IEEE standard 802.16c created the inclusion of system profiles.[30] Approved in early 2002, continuing work has been focused on completion of a set of compliance test documents in compliance with ITU-T X.296 and ISO/IEC 9646. June 2004 brought the completion and publication of IEEE Standard 802.16/Conformance03, which is still under development.

IEEE 802.16e

An amendment to the IEEE 802.16 standard overall, project 802.16e was approved in September 2004. This project intends to provide improvements to the physical and MAC layers to facilitate both mobile and fixed operation in licensed frequency bands.[31] Focused at supporting subscriber stations moving at vehicular speeds, features are under development to support higher-layer handoffs between BSs. This project limits its scope to the licensed bands below 6-GHz that are suitable for both mobile and fixed use.[32] Approval of 802.16e is targeted for August 2005.

This initiative, combined with the popularity and exponential growth of implementation of 802.11 WLAN initiatives, could foster growth in 802.16 implementations. As the industry will have reasonable experience making 802.16 subscriber-station hardware by this time, this project's completion could promote the fast introduction of cost-effective mobile radio interfaces and drive deployment of mobile terminals.[33]

802.16e holds the key to the widespread adoption of WiMax. Once mobility has been built into the standard, it will be possible for subscriber stations within range to connect with

the same client equipment anywhere. When coupled with a virtual private network (VPN) connection, students, instructors, and staff will have the same connectivity in their homes, on the train or bus, or in the classroom as they would when connected to a PC in a computer lab on campus.

Implementation and Adoption of 802.16 Standards

Interest for 802.16 technology in Asia is very high, as WiMax holds the potential to resolve last-mile and cabled infrastructure challenges that are common in the region. A 2001 conference in Beijing brought discussion and debate concerning adoption of 802.16a as the Chinese standard for 3.5 GHz BWA.[34] By working closely with ETSI, the 802.16 working group maintains interoperability with ETSI HiperMAN. This essentially turns 802.16 into a communications standard that may be adopted globally.

Future Directions

The current standard's focus on stationary terminal units is being enhanced to encompass mobile terminals, providing enhancements to the latest IEEE 802.16 standard, 802.16-2004. This project, 802.16e, will support subscriber stations moving at vehicular speeds, as well as specifies higher-layer handoffs between BSs.[35] In this amendment, operation will be limited to the licensed bands for mobile and fixed use below 6 GHz, without impact on fixed user capability.[36] Currently, test documentation for interoperability is under development, and vendors are developing chips using the protocols. The very first release of these chip sets was announced in October 2003, beginning an industry wave of release.[37]

In addition to the work of 802.16e, 802.16c is working to help improve conformance and interoperability.[38] This will prove itself to be a focus for these technologies as chip manufacturers create 802.16 hardware, and as the global market for these technologies brings the benefits of economies of scale to end users by lowering costs.[39]

As a result of the potential for 802.16 BSs to exchange MAC protocol data directly with computing devices such as laptop and desktop computers, companies such as TeleCIS Wireless have announced intentions to combine both 802.11 and 802.16 technologies on a single chip.[40] With plans to release a fixed WiMax chip in the second half of 2005, TeleCIS plans to release the combination chip in the second half of 2006, offering 802.11a, b, and g in conjunction with mobile WiMax capabilities.[41] This timeline is concurrent with other industry initiatives and has the potential to create yet another wave of industry-wide wireless advances.

The application and adoption of this technology very strongly depends on the practical implementation as seen by the users. The deployment and implementation of 802.16 certainly carries an opportunity for growth and evolution. This is one of the first wireless standards that has carried such a high level of evaluation, research, and design development. Corporate, government, residential, and academic environments may see uses for this technology in applications that do not seem readily apparent today. Candidate areas for 802.16 networks may include those lacking broadband access infrastructure, areas with a need for cost-effective backhaul services that can be placed in flexible architectures, regions with deployment-time constraints or prohibitive cabling expenses, and areas where a network is required to provide bandwidth-intensive service such as video, voice, data, and multimedia over a single multiservice network.[42]

Conclusion

WiMax holds the potential to solve many of the common problems facing remote campus connectivity, including the last-mile problem, high costs of high-speed connections, and the limitations of unreliable access portion technology. IEEE's 802 committee, and all of the 802.16 participants, have once again displayed IEEE's ability to create interoperable standards from complex

technologies with the design of 802.16. 2005 will prove to be a definitive year for the technology, as products built to integrate this new technology with existing wireless networks become commercially available.

Nate Melby is a doctoral candidate in Nova Southeastern University's Graduate School of Computer and Information Sciences and a communications analyst for American Standard Companies. Reach Nate at melby@nova.edu.

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Mobility and the New Student

Winnie Sung
Ericsson Enterprise AB
winnie.sung@ericsson.com

"We were struck at the appearance of an ample Black Board suspended on the wall, with lumps of chalk on a ledge below, and cloths hanging at either side. I had never heard of such a thing before and there I first witnessed the process of analytical and inductive teaching."

– Samuel J. May, 1813-14

Close to 200 years ago, a simple blackboard changed the way abolitionist Samuel J. May learned about math while attending a school in Boston. It was his first encounter with what was then considered the latest in education technology.

Fast forward to 2005, and the blackboard as a learning tool has evolved first into digital and now mobile modes of communication. As a result of the progression from blackboard to overhead projector to online course to mobile-virtual classroom, participation in higher education has increased. For example, according to a 2004 report by the National Post-secondary Education Cooperative, 75 percent of respondents at Rensselaer Polytechnic Institute indicated that delivering a course to their workplace was the sole reason they could participate in the class. Similarly, a collaborative distance-education program between Old Dominion University and community colleges in Virginia yielded a 3.3 percent increase in the college participation rate among Virginia residents. It appears that technology has, indeed, made higher education more easily accessible to the population.

Who Are Today's Students?

Because of its accessibility, higher education is no longer dominated by 18-to-22-year-olds who are enrolled full time and live on campus. According to the National Center for Education Statistics, many students are older (43 percent are over age 24), and more students than ever are part-timers. As a result, the profile of today's higher education students continues to change drastically.

The Society for College and University Planning calls this burgeoning population of learners "new students." These are students who have been heavily influenced by information technology. These are the Generation Y students (born between 1981 and 1995), sometimes called millennials, ngeners, or NetGeners, who use instant messaging as their main form of communication. These are the Generation X students (born between 1965 and 1980), who are comfortable with e-commerce and represent a high percentage of entrepreneurs. These are also the baby boomer students, who could be single mothers completing degrees via e-learning.

These new students have vast differences in background, social behavior, and expectations. The biggest challenge facing higher education institutions is how to deal with such a variety of people.

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What Are the Needs of the New Students?

Regardless of their backgrounds, new students are the customers of higher education institutions. True, they are here to learn. But they are also highly sophisticated customers who have options and are willing to make choices. They look for a certain level of service, in both response time and quality, or they will not stay. Self-service, when available, becomes an increasingly acceptable choice and, for many, the preferred way to navigate universities and colleges. Thus, providing the right service is of utmost importance.

Service is about listening to the students—understanding and accommodating various learning styles and, most important, meeting their needs. Information must reach these students whenever and wherever they need it; it must not require them to wait until they are sitting at their desks.

Staying technologically connected is the number one priority for the new students. According to a recent study by the Pew Internet & American Life Project, of 1,460 mobile phone users surveyed, 63 percent of mobile phone users in the Generation Y demographic use short message service (SMS) compared with 31 percent of Generation X mobile phone users. In a campus environment, this means, for example, that students want grades or schedule updates forwarded to them as soon as they are available, directions to classrooms instantly, and access to campus security via a single click on their mobile phone when they need help.

But connecting is not the only need. Our 24/7 customer-service culture has nurtured the attitude of zero tolerance for delays. To eliminate delays, an increasing number of higher education institutions offer automated e-mail response and customized Web-mail to provide instant responses to students. Students can get answers to a host of questions. Topics ranging from college admission to graduation are immediately provided to a student's e-mail account or Web portal 24/7. The new students are customers of e-commerce; a higher education institution, just like any e-commerce site, must ensure that its customers are served promptly so they won't abandon their "shopping baskets" and move on.

While providing automated services without delay is important, it is also vital that live service of exceptional quality is readily available—operators who will listen to the needs of the students and offer live assistance. On many campuses, when students call an instructional help desk staffed by generalist faculty, they expect to get answers concerning the logistics of a course seven days a week, even when the instructor is not available. When a question requires the expertise of a tutor or teacher's assistant, they expect the generalist to locate and then route the query to the proper professor so that they get the answer they are looking for and can complete an assignment successfully.

Servicing the Customers

In embracing the evolution of technology, many higher education institutions have already been transformed with the infrastructure required to serve students' needs, such as university portals, wireless networks, and mobile devices. Many of these institutions, in meeting the challenges of delivering the right kind of service to their customers, have applied today's "service-to-the-student" standards to a new generation of contact center technology.

Today's contact center technology has grown beyond the stereotypical image of agents sitting in a room, answering calls about account balances or product information. These days, it's about providing the services that the new students need to stay connected—creating a more proactive response center using not only the traditional technologies, such as interactive voice response, but also technologies such as SMS and global positioning service. It's also about providing automated services, such as auto e-mail response and customized Web-mail, in various media and in the format chosen by the student, as well as segmenting the students and mapping them to skilled experts, regardless of time or geographic location.

Up-to-date contact center technology should also provide a means for the institution to stay connected with the parents of students, in the medium desired by the parents, anytime anywhere. So, for example, the business office might send a "trigger" e-mail to remind parents of the due date for tuition, or student life might send an "alert" e-mail, or call, or SMS message to notify parents of school festivities.

More than Just Customer Service

In a knowledge-based culture such as ours, the main goal of higher education institutions is to educate our new generation. Yet, because higher education institutions are essentially enterprises as well, efficiency and revenue generation are critical to success.

Mobile extension technology brings some new efficiencies to the contact center. With today's contact center technology, the staff members of the 24/7 instructional help desk as well as the expert tutors are no longer required to

be on campus—main or remote—at the time of service. They can be on the move or working from home or in the dorm. They also don't need to be tied down to a specific schedule; their participation is dynamic, occurring only when it's required. This flexibility enables the institution to save on operating expenses while allowing staff members to achieve greater efficiency and enjoy more freedom. Virtual contact center technology today also creates larger agent groups whose pooled resources accomplish more.

Students find satisfaction in the use of efficient technology. Just as the office worker expects technology to help him communicate with coworkers, students want easy access to fellow students or departments: They want to simply dial an extension to reach a friend or initiate a study session via a conference call. Students learn best when they are engaged, thinking critically, and using the tools that can encourage development of skills they will need when they enter the workforce.

More colleges and universities are adopting mobile extension technology in an effort to fulfill the needs of these new students. The technology creates more options to accommodate a wide range of new student learning characteristics, and it also provides revenue for the institutions which may offer it to students as a chargeable service.

Mobile extension technology makes it possible for the student's mobile phone to be connected to the institution's PBX, just as any other campus extension is. Traffic to and from the mobile user passes through the institution's PBX, which acts as a communications platform, allowing the system to link services to the calls. Users of the mobile extension technology are

defined just as other standard extensions. A telephone number is associated with the extension, as well as the relevant class of services. For other users of the institution's PBX, the mobile user exists just as any other extension does.

Mobile extension technology can also act as an adhesive force for the community, enabling students to be integrated with the institution via its PBX and allowing for a whole range of conveniences. Students can call fellow students or departments simply by dialing an extension. They can access PBX features such as a security hot line, callback, message diversion, and follow-me. They can participate in study groups attended by students and tutors from geographically dispersed areas, while being able to access PBX features

such as intrusion, call park, conferencing, and second line.

Samuel Would Have Been Pleased

From blackboard to digital to complete mobility, technology has indeed come a long way since Samuel May was first introduced to the blackboard in the 1800s. He would have been pleased to see how, because of technology, the ways and time that education can be delivered are both expanded and extended. Institutions that meet the needs of the new students and overcome the mobility challenge can distinguish themselves from others in ways that extend well beyond academics.

Winnie Sung is product manager, contact centers, at Ericsson Enterprise AB. Reach her at winnie.sung@ericsson.com.

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Interview

Donald J. Farish, Ph.D.
Rowan University

Dr. Donald J. Farish came to Rowan from Sonoma State University, in California, where he was the provost and vice president for academic affairs. Farish is in the midst of leading Rowan through an aggressive 10-year improvement plan. His goal is to help transform what was a well-regarded institution into a university with a national reputation for excellence and innovation.

Dr. Farish's influence on higher education goes well beyond the halls of Rowan University. He is a member of the New Jersey Presidents' Council executive committee and is an active member of the New Jersey Commission on Higher Education's long-range issue organization planning team, the New Jersey Association of State Colleges and Universities and the Middle State Association of Colleges and Schools.

Farish earned a doctorate in biology from Harvard University; a juris doctorate from the University of Missouri; a master's in entomology from North Carolina State University; and a bachelor's in zoology from the University of British Columbia, Canada.

Questions for this interview were submitted by the **ACUTA Publications Committee** and coordinated by **Walt Magnussen**, Texas A & M University, Publications Committee chair, with assistance from **Anthony Mordosky,** former ACUTA president and primary member at Rowan University.

ACUTA: Could you describe the sort of technology enhanced classroom that Rowan University is installing and utilizing?

Farish: Technology is pervasive throughout Rowan University with 46 technology enhanced classrooms (TEC), 26 open-computer classrooms, and more than 400 faculty regularly using classroom technologies. The typical TEC classroom configuration at Rowan features a diversity of technologies: lecterns with PC and Macintosh computers, VHS and DVD, Crestron control interface for "touch-ready" access to integrating technologies, projectors and screens, document cameras, and Hitachi Starboard touch displays for "John Madden-like" annotations.

ACUTA: Is Rowan evaluating the possibility of adding a distance education program? If yes, can you share with us how this investment makes the transition to distance education a smaller leap in terms of technology investment as well as preparing faculty for a new era?

Farish: Rowan is currently exploring distance education and online learning programs for graduate-level offerings. Rowan has several critical pieces of technology in place that can advance this transition such as a videoconferencing training facility that incorporates state-of-practice Polycom and other videoconferencing technologies. NJEdge videoconferences, banner training, grants training, and faculty training are already taking advantage of this facility.

WebCT is Rowan's online course-management system that allows faculty to organize their course materials and make use of a variety of course-delivery and communication tools. WebCT supports learning along a wide spectrum that extends from face-to-face courses enhanced by a Web presence using WebCT components to full online courses where all interaction takes place within the WebCT environment. WebCT, then, is a one-stop shop that saves time, money, and effort—and transforms the classroom into a truly interactive learning environment.

The Rowan Virtual Meeting (RVM) is another piece of technology that is currently being beta-tested and implemented. RVM is a Web-based synchronous communication and presentation application for online learning and collaboration at Rowan. RVM facilitates online collaboration, communication and learning by allowing the sharing and exchange of information and ideas with classes, partners, prospective students, and employees in real-time — anywhere with an Internet connection and a Web browser. RVM features real time audio and video conferencing, use of PowerPoint presentations, whiteboard, online surveys, and, in the future, application sharing. This application is also being considered to replace traditional language-lab speaking and listening practices, facilitating immersion pedagogy and enabling international partnerships.

ACUTA: What enablers and hurdles are there when implementing technology in the academic environment?

Farish: There are many hurdles implementing technologies in the classroom. Initial and ongoing technology costs in an era of stretched budgets is the primary hurdle, but staffing and support

issues, managing technology growth, and maintaining current practices are equally challenging.

Technology infrastructure and cognizance of how best to use technology in academia is paramount when attempting to successfully diffuse innovations. Early adopters require positive experiences when using technology; nothing disappoints more than failure. Innovation has driven changes in computing needs at Rowan. In earlier years, the greatest demand was for computers that could be used for productivity (word-processing, spreadsheets, statistics, and network communication). Today, these same needs remain but in addition, there is widespread demand for computers that allow faculty to teach more effectively use specialized software, the Internet, multimedia presentations, course management systems such as WebCT, integrated digital technology solutions such as DVD and digital video, and future technology innovations such as synchronous collaboration tools. The computer, then, is the lifeline for faculty communication, research, teaching, and instructional development and deployment. This supports the premise that diffusion of effective teaching practices using technology requires the proper tools, support, and continued evaluation.

ACUTA: What strategies do you find successful in funding classroom technology in general?

Farish: A critical issue to overcome in successful funding of classroom technologies is to first understand the costs of technology implementation, maintenance, support, and replacement. Without an understanding of the real costs associated with technology, funding becomes difficult to justify. The nuts and bolts of network switches and computer configurations may not be as exciting as, for example, dedicating a new building. But rarely do you think of the significance of the underlying telecommunications network and support when you purchase a new phone. (Can you hear me now?)

Moreover, the successful funding of technology is also influenced by how we effectively use innovative technologies to reduce costs. For example, integrated imaging and software server tools allow the management of diverse IT computer systems with a single solution. Imaging tools automate the setup, updating, restoration, and migration of computers and the services they run, without requiring IT staff to visit each device individually, saving time and effort. This practice establishes a protocol where all university lab computers look, feel, and operate the same way, facilitating easier and more effective customization of discrete university computer labs. In this way, the leveraging of resources enables the Rowan computer environment to streamline operations and reduce management costs while increasing the responsiveness and value of IT resources and services. ▶

Another example of streamlining services and support in our TEC classrooms is the implementation of Crestron management software, "Roomview." Roomview allows centralized control, updating, and maintenance of all Crestron TEC classrooms from one location – providing up-to-date information on the status of any TEC classroom.

ACUTA: Are new classroom technologies changing the way professors instruct?

Farish: Technology classrooms cannot be defined through technology alone; but rather, the classroom can be best defined according to the effective instructional activities that space can facilitate, and how technology can foster the academic goals of Rowan University.

Technology promotes active participation, where open dialog and discourse occurs between faculty and students. Course materials become more engaging and interactive—encouraging discovery and experiential instruction.

ACUTA: What enhanced learning programs or specially equipped classrooms distinguish Rowan from the average campus? How was the decision made to take this direction? With the benefit of hindsight, what would you do differently if you had to start over now?

Farish: Rowan Virtual Meeting (RVM) and WebCT are the two learning tools that have the most potential for changing the direction of learning at Rowan. RVM, similar to other products such as Centra, WebEx, and iLink, facilitates online discussions, presentations, and classes anywhere with an Internet connection and a Web browser. Online (Distant Education) learning, faculty training, international and inter-organizational meetings can all be accomplished with RVM without the need for travel.

The strategic direction has evolved based upon the needs of our faculty. After the adoption of WebCT as the campus course management system, the professional staff has worked with the faculty to assist in leveraging technology to enhance the learning environment of the campus. A direct result was the internal development of RVM to support the faculty use of the online environment.

In hindsight, I know that we would have begun sooner; we would have planned for a more robust, redundant and, hence, reliable network (in order to encourage faculty use); and we would have used outside consultants early on to get a better grasp of what we needed and a more accurate estimate of cost.

ACUTA: How does Rowan plan to maintain its position as a technological leader in the future?

Farish: Rowan must continue to think "out-of-the-box." It's not how Rowan plans to position itself as a technological leader; but rather, how Rowan intends to use technology effectively, seamlessly, and make it transparent across the academic and student life cultures of the campus. Technology can make things easier or get in the way. So, becoming a leader doesn't necessarily mean more technology, but using technology appropriately to accomplish the Rowan mission.

ACUTA: What faculty incentives that support using technology in the classroom do you offer?

Farish: Instructional Technology and the Faculty Center for Excellence in Teaching and Learning initiated an *Innovations in Teaching Using Technology* grant in 2004. This grant is principally targeted to initiatives that are innovative, scalable, adaptable, and applicable to teaching. An innovation is not only the introduction of a new idea, product, or method, but also one that underscores the need for change. Innovations that are scalable provide solutions to more than one condition. The intent of this grant is to fund and support innovations in teaching using technology at Rowan University. A modest amount of funding as well as Instructional Technology support is awarded each semester to two faculty proposals. All proposals are juried and competitive and reviewed on relatively brief statements of intent that should focus on defining issues of teaching that are potential targets for innovation and improvement throughout the Rowan community.

Another incentive involves providing laptops as alternatives for desktop computers for faculty using WebCT and Internet innovations.

ACUTA: Would you share an example of the technology-enhanced classroom being used in what you would consider an innovative way to enhance course delivery?

Farish: Tom Fusco, a Rowan Theatre/Dance faculty member, uses a tablet PC in his classroom to take classroom notes and to share stage layouts and diagrams "on the fly" with his students. This interactive and participative method of teaching is unique, and it captures the interests and creativity of his students.

ACUTA: To wrap up the interview, please share any words of wisdom that you might have for other universities that may be considering bringing technology to the classroom.

Farish: I don't know that I have any words of wisdom for other universities, but as a president I realize only too well that technology does not save money so much as it expands capacity and creativity, that it is expensive and cannot be done on the cheap, and yet it is essential if a campus is going to attract top faculty and provide a first-class education to its students. Having a talented director or vice president in charge is also essential, a problem Rowan was fortunate in solving several years ago.

Providing incentives, and especially technical support, for the faculty is another fundamental requirement. Mostly, success involves staying power: a multiyear plan that may well change, but that must be supported on an on-going basis.

ACUTA expresses our appreciation to Dr. Farish for taking time from his schedule to answer our questions. Rowan invites you to visit their website at http://www.rowan.edu.

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Integrating Instructional and Network Technologies for Distance Education

Dennie E. Templeton, PhD

Radford University

Over the past several years, instructional multimedia and distance-education technologies have been at the forefront of educational reform. Many educators, administrators, and political factions have allocated millions of educational dollars for instructional technology and distance-education initiatives to support infusion of technology into college-level curricula. With new and emerging technology and distance-learning modalities continually changing, many educational institutions have had to struggle with not only what to purchase but how to use the technology for both traditional and distance-education applications within the campus mainstream.

In the development and deployment of distance-education technologies on any campus, defining distance education can be almost as difficult as implementing it. The primary objective of distance education is to maintain the connection between educator and learner through various delivery modalities and technologies. Technology within the context of distance education is the connective thread that links educator to learner.

Hybrid or *blended* instruction reflects the interactive nature of distance education today as well as the use of multiple delivery technologies that may include a combination of both synchronous and nonsynchronous delivery of instruction. More important, it provides a communication term that closes the gap between distance

education and the traditional classroom model. Radford University (RU) has taken this approach in the development and deployment of distance-education instructional technologies and collaborative support infrastructure.

About Radford University

Radford University is located in the city of Radford, Virginia (population 16,500), 36 miles southwest of Roanoke. The University is a coeducational, comprehensive institution with undergraduate and graduate programs. Total enrollment for fall 2004 in both on- and off-campus programs was approximately 9,100 students. The majority of Radford's students live in university residence halls or in private accommodations within walking distance of the campus. Graduate programs are offered on campus as well as through regional education centers in southwest Virginia. RU places great emphasis on student contact and the ability of faculty to interact with students both on and off campus, and distance-education initiatives reflect this core value.

Through the University's vice president of academic affairs, the College of Information Science and Technology, and the Graduate and Extended Education College, the RU Office of Distance Education (ODE) coordinates the distance-education technology development and delivery of educational offerings to extended campus centers and Web-based portals

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using both synchronous and asynchronous instructional technologies. The ODE also collaborates with the campus IT departments, network services, academic computing, the Technology in Learning Center (TLC), computer services, and campus facilities departments to provide training and support services in the evaluation and development of hybrid courses and programs utilizing a combination of approaches to instructional delivery of distance courses.

Radford has had to take a step-by-step approach to implementing new technologies for both on-campus and extended-site locations, the main considerations being cost of the technology, reliability, budgeting, and support issues related to implementing and maintaining new technologies.

As a state institution, RU uses a fixed ATM network through a state teleconference network facilitated by Virginia Tech. RU uses the network for delivery of educational programming, meetings, advising, and faculty projects. Through the ATM, ISDN, or IP network, RU can provide connections to Virginia educational institutions, selected K–12 schools, and a number of state agencies.

The first applications of extended campus and distance technologies were teleconferencing classes using two-way interactive television classroom systems (RUITV). The graduate classes were offered between the main RU campus and regional locations in southwest Virginia. The synchronous teleconferencing classes are the closest simulation to a face-to-face education experience for faculty and students and have been structured to parallel traditional classes on campus.

Development and Growth

In 1999, RU maintained three two-way interactive distance-education classrooms for regional teleconference classes. Two classrooms were located on the RU campus, and one classroom was located at Virginia Western Community College in Roanoke. No identified technical support was in place, and most technical problems were directed through the computer help desk and on-site coordinators. Multisite connections were not possible unless requested, approved, and connected through the state ATM network.

Later in the year, the ODE was established to facilitate the emerging program requests and work with campus IT, computer services, and academic-computing departments to provide a support and professional development model for the distance education for both videoconferencing and emerging Web-based technologies. Due to limited resources, multiple departments had to work together not only to support the teleconference model but also to examine new and emerging instructional technologies. Through collaboration and in-house training programs, both faculty and technical staff were exposed to a holistic approach to identifying and deploying new instructional technologies for classroom and distance-education needs.

Over the last three years, RU has maintained and expanded its teleconference support structure as the primary distance-education delivery model. Through regional grants from Verizon Communications and institution support, RU now has five videoconference distance-education classrooms on campus and deploys four Polycom portable videoconferencing

units to sites on and off campus for short-term videoconferencing requests. At the extended campus sites, classrooms have been added at the Roanoke Higher Education Center, Virginia Western Community College, and the Southwest Virginia Higher Education Center in Abingdon.

RU has also added an ISDN and IP Accord Polycom communications bridge on campus that allows the University to function as a multiple-site host. Working with regional community colleges and K–12 schools, RU has now established working communication portals throughout the state. Applications include connections to local hospitals and state agencies for training, meetings, and instruction. Faculty and student sessions have been linked to educational institutions and sites in Ireland, England, China, and Zululand University in South Africa.

RU also has instructional satellite downlink capabilities primarily for professional development, PBS, and NASA programming. Additionally, the department of chemistry and physics, NASA, and the ODE collaborated in the installation of a high-resolution picture transmission (HRPT) satellite station at RU receiving visual, infrared, and other data from satellites. Through the efforts of RU's telecommunications support, the library media department, and several campus IT departments, a dish farm was also established to support delivery of programming through the campus cable television network allowing downlinked programs to reach most classrooms on campus.

Hybrid Technology Support Model

During the evolution of the fixed ATM network, RU departments, faculty, and staff worked together to identify and evaluate additional delivery modalities

to support the strategic mission of the University. Through collaboration among the ODE, academic computing, the TLC, and the College of Graduate and Extended Education, instructional development and training for distance education evolved into a collaborative support model.

The first consideration was to treat the distance-education technologies, synchronous or asynchronous, as teaching tools. Faculty could use the technology to support their curriculum and implement it as desired using Web-based materials, teleconferencing, Web streams, satellite, or a combination of all. In several academic circles this has also been referred to as a *buffet, blended,* or *hybrid* approach to instructional delivery. The distance-education hybrid support model concept parallels the hybrid technology delivery model and provides a foundational base that faculty, staff, and administration can reference for assistance in instructional design and development for distance-education applications. The team concept also provides a structured model that assists faculty in the sometimes overwhelming process of developing or converting courses for multimedia, Web-based, and Web-enhanced delivery.

At the same time, RU academic computing and the TLC have developed and deployed a comprehensive WebCt professional development program for faculty and staff. Web-based technologies are used to develop and deliver hybrid Web-enhanced instruction using a number of delivery combinations including videoconferencing, video streaming, and face-to-face instruction.

With the adoption of WebCt 4.0 in 2003, RU faculty explored and developed instructional support tools for use in both on- and off-campus instruction. A majority of the faculty now use WebCt as a Web-enhanced tool for instruction including discussion boards, grade book, and research and assignment posting.

In the fall of 2004, RU adopted Macromedia Breeze to provide training and videoconference capabilities using the Web. As with WebCt, the focus of the support structure for Web-based initiatives was built on the professional development initiatives provided by academic computing, TLC, and IT services through the Office of Professional Development. Without the collaboration and cooperation of all technology departments on campus, technology integration for distance education would be slow to emerge.

Institutional Support and Emerging Technologies

One of the key elements in distance education is to recognize the shift in balance in technology deployment for instructional applications. RU administration, departments, and faculty have supported technical and instructional development departments in evaluating and integrating new technologies on campus.

With a hybrid approach, RU has been able to build on each instructional technology implementation. As WebCt and Macromedia Breeze are integrated into the campus, the various technology and instructional departments of the University have had to identify how to present the technologies as instructional tools—and not strictly for distance education. New Web-based delivery platforms now provide the faculty expanded options in delivering Web-based instruction using audio and video. Macromedia Breeze allows

archived video of lectures and posting of PowerPoint presentations online as independent lectures or supplements to Web-based platforms such as WebCt. This has also allowed the University, through cooperative models, to maximize its technical support resources both on campus and at the regional extended-education centers.

Strategic Planning for the Future

Strategic planning for distance education has a number of volatile issues in long-range planning including advancement and deployment of new and emerging technologies, a new student base, and faculty and administrative perceptions about distance education. Any distance-learning strategic initiative must not only address the pedagogical and instructional development concerns of the curriculum but also ask key questions directly related to the support. It is important to address these concerns in a strategic plan that ensures that instructional technologies for distance education are not driving the curriculum development and conversion process but are being used as supportive tools for curriculum development.

To keep the RU interactive television ATM network (RUITV) in tune with future synchronous distance needs, the RU Polycom bridging network added in 2003 was selected for its capability to support ATM, ISDN, and most important, IP delivery. The bridge handles all three portals together or independently depending on the teleconferencing needs. Any room on campus—at extended-education centers or temporary locations—can become a teleconference classroom through a network access plug-in. Over the next

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year, RU will maintain the ATM service now in place but gradually convert fixed distance-education classrooms to IP classrooms. With the addition of portable units deployed as needed for temporary classrooms, IP videoconferencing units can also take advantage of the bridging to react and support both current and future needs.

Other campuswide technology initiatives have also emerged in the last year. Through the work of RU network services, IT departments, and academic computing, Radford became one of the first universities in Virginia to have a completely wireless networked campus in 2004. The IT and network services departments have also applied to Virginia Tech to become a participant in the NWV-ng (Next Generation Network Virginia) Internet2 Sponsored Educational Group Participant (SEGP) program to access the Abilene Network. Internet2 partnerships will provide faculty, staff, and student access to more than 200 Internet2-member educational institutions and corporate partici-pants—all to enhance the reliability and broadband delivery capabilities for emerging technologies for both on- and off-campus instruction. The Waldron College of Nursing and Health Science is also working with regional hospitals to provide videoconferencing for instruction, conferences, and partner-ships to develop tele-health connections for rural southwest Virginia.

Through the professional develop-ment programs offered by academic computing and the Technology in Learning Center, expanded applications for instruction using WebCt and Macromedia Breeze provide faculty with the hybrid technology choices for Web-based instruction. Beta testing is now being conducted to parallel RUITV broadcasts to educational centers in the region with Macromedia Breeze allowing for live classroom broadcasts on the ATM network and simultaneous broadcasts through IP connections using Breeze—a delivery method that requires communication among all technology services on the RU campus to support.

As WebCt and Breeze are introduced as instructional choices they will be evaluated as both an independent delivery and hybrid-instruction system model. As the uses of the instructional technologies grow, multiqualified technical support personnel will be needed to cover a wide range of support needs.

Summary

Research shows that properly imple-mented technology can enhance and improve student learning. This is the number one priority of any technologi-cal or educational reform. To imple-ment the reform, the student and faculty need to be knowledgeable consumers of instructional and distance-education technologies.

Student learning is not a result of technology implementation but a result of the curriculum and the instruction. If teachers are not comfortable with the technologies, the student's learning curve will be directly influenced. To achieve this, faculty professional development addressing technology applications, instructional pedagogy, and a support system need to be viewed on the same level as technology hardware acquisition.

Any success that the campus has realized through integration of new and emerging instructional technologies has come from the collaborative support model between IT network services, academic computing, the Technology in Learning Center, computer services, campus facilities, extended education, and distance-education departments. Administration, faculty, and staff provide the foundational support to allow for change in the campus technology structure in meeting the mission, vision, and values of Radford University. Through the evolutionary process it is hoped that long-term models will be developed based on proven methods of integrating instruc-tional technology tools and applications for distance learning.

Dennie Templeton is director of distance education at Radford University. Reach him at dtemplet@radford.edu.

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Do a Friend a Favor:
Introduce a Colleague to ACUTA

At ACUTA's 2004 Annual Conference, Eastern New Mexico University, Roswell, was recognized for its state-of-the-art videoconferencing system with an Honorable Mention in the competition for the Institutional Excellence in Communications Technology Award . We salute the University with this description of their project, taken from materials they submitted in application for the award.

Eastern New Mexico University

A Joint Title V Grant between Eastern New Mexico University (ENMU)-Roswell and New Mexico Junior College (NMJC) was designed to replace an outdated and inoperative two-way television with state-of-the-art videoconferencing instructional television (ITV) with both telephonic and Internet connectivity capability. This joint grant currently provides interactive education to and between 18 high schools throughout Southeastern New Mexico. Resource and instructional sharing among the schools is a key to providing education not otherwise available at the remote high schools in this region.

Residents of the two service regions and students at both colleges suffer the barriers of poverty and low educational levels, resource-poor high schools, language difficulties, discrimination, and myriad other problems. Rural isolation and vast distances make it extremely difficult for current or potential students to obtain a college degree.

The colleges in this cooperative effort believe that these multiple barriers can be addressed most effectively by working together. By capitalizing on each other's strengths, sharing transfer and occupational programs in high-demand fields, providing shared support services, and using technology to deliver instruction, the colleges will be able to support Hispanic and low-income residents in achieving career and college goals.

In conjunction with these two programs, ENMU-Roswell has developed New Mexico's first accredited online degree, an AA in University Studies, with two to four more online degree plans to be completed within two years. This program includes the WebCT-based Internet system, ITV system from the joint grant, and faculty training and development in online-instruction methodologies. To provide the infrastructure required to support these programs, ENMU-Roswell has completely overhauled its campus network infrastructure to provide clean, secure, and reliable networks capable of supporting full voice, data, and video convergence. Additional improvements required to support the new programs include complete rebuild of ENMU-Roswell's homegrown website to include Web server, initiation of SSL services, upgrade of site navigability, accessibility (508 requirements), security, and quality of content.

Planning, Leadership, and Support

Provost's cabinet, Information Services, Instructional Council, and advisory committees all cooperate to converge and integrate systems and capabilities to align programs, funds, and planning to the ENMU-Roswell strategic plan. This alignment is done through the budget planning processes, evaluation and assessment processes, and mid- to long-range planning processes. These interrelated projects comprise staff, faculty, and students from all University stakeholder areas. The grant includes cross-functional committees from ENMU-Roswell and NMJC. Additionally, committees coordinate the associated regional and out-of-region high

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schools and job works programs, and adult basic education (ABE) programs.

Standing committees of campus-wide stakeholders were formed to help monitor needs, make recommendations, and develop future requirements and processes. Development of the ENMU-Roswell strategic plan coupled with the information technology strategic plan has resulted in comprehensive computer usage standards, a disaster recovery plan, and a security program. These programs have all had very positive effects on our overall planning, readiness, and reliability.

The ENMU-Roswell Planning Council plays a pivotal role in this process. The Council includes college administrators, division chairs and directors, faculty and staff representatives, and a student representative, who is selected by the Student Government Association. All council members take an active part in the planning process and serve as liaisons to their college constituency groups, disseminating information and bringing concerns, ideas, and solutions back to the Council. ENMU-Roswell's Community College Board, Community Advisory Council, and program advisory boards are also vitally involved in the college's planning process, meeting regularly with college constituencies to review goals and objectives and provide feedback and recommendations for improvements in services and programs.

ENMU-Roswell was chosen out of 122 colleges and universities in the North Central Association to be part of the 28-member team that would pilot a new AQIP endeavor to accredit schools using continuous quality improvement standards and methodologies. By joining AQIP, ENMU-Roswell agreed to participate in a cycle of workshops, assessments, reports, and activities that would enable it to strengthen its core educational systems and supporting processes, track its performance, and use the results to drive continuous improvement. Using Baldrige standards as the basis for continuous improvement,

ENMU-Roswell, therefore, embraces a continuous cycle of measurable goal-setting, assessment, evaluation, feedback, and goal-setting. The first phase of the AQIP process has now been successfully completed.

This comprehensive approach to planning and decision-making gives ENMU-Roswell an in-depth analysis of the core strengths, weaknesses, and problems of the college's academic and student services programs, institutional management, and fiscal stability, based on extensive participation by the community, college employees, and students.

Promotion of Technology and Maturity of Effort

Funding from grants, operational budgets, and capital equipment funding will allow continued expansion and improvement in converging and integrating the systems and improving accessibility to students throughout New Mexico and even nationwide.

All of these programs were accomplished without affecting operational budgets or requiring extensive cutbacks or deferrals of other programs. To accomplish this extensive an infrastructure and learning-environment change required planning, budgeting, and phasing of individual projects with the full cooperation of staff and faculty. This required that all stakeholder areas work toward the common goal of high-quality, accessible, and varied learning opportunities.

Over the past two years, ENMU-Roswell has instituted significant changes in operational processes, network integrity and reliability, network and data security, and awareness of Privacy Act, Teach Act, and Patriot Act requirements. ENMU-Roswell has integrated a significantly more complex and robust administrative system (SCT BANNER) while also moving to faster speeds (MB to GB capacity) and greater-capacity bandwidth for data traffic by moving from a frame relay T1 to an ATM link which allows additional bandwidth as needed. Coupled with increased security

hardware, tracking and monitoring hardware and software, the University is able to far more effectively control access and maintain compliance in reporting and privacy requirements at all levels. Changing to campus-wide licensing for operating system, office suite, and anti-virus security applications has allowed for more flexibility and yet greater compliance with legal requirements at the same time.

The limited telephone capability to support our expanding requirements was met by switching to a 48-channel ISDN system (from 24 analog channels) and installing voice over Internet Protocol (VoIP) systems. This capability also will allow telephones to be placed in the classrooms for the first time, enhancing communications and security. Improvements included installing a core switch with increased reliability, redundancy, and traffic management capabilities; providing new smart switches in buildings; increasing the network backbone to gigabyte capability between most buildings; and continued improvements and upgrades in software, licensing, and inventory.

Quality, Performance, and Productivity Measurements

ENMU-Roswell currently maintains 14 ITV locations in conjunction with their Title V partner institution New Mexico Junior College, with further expansion planned for nine more sites. ENMU-Roswell's distance-learning classes, unduplicated headcount, for the fall 2004 semester was 1,576 or 37 percent of the total enrollment. The coverage area of the network includes almost all of New Mexico and parts of Texas with actual classes being taught online. Planning has begun to expand the integrated ITV network to include two new sites and provide services to the Mescalero Apache school system. Coupled with these programs, ENMU-Roswell now deploys three laptop computer labs with a wireless networked server to provide stand-alone training in remote locations.

Monitoring this cooperative project requires a high degree of commitment, cooperation among staff at both colleges, and a clear understanding at both institutions of the goals and objectives of the project. In this complex collaborative project, management is perhaps the single most critical determinant of success. The strategies used to assure open communications between the cooperating institutions are summarized below:

- Frequent and wide reporting by Title V Coordinator to stakeholders

- Regular meeting schedule

- Reporting by Title V Coordinator to ENMU-Roswell and NMJC

- Special Title V coop arrangement newsletter, web site, listserv

- Wide dissemination of internal and external evaluation results

- Title V representation on all key College Committees

- Title V representation at relevant community meetings

Cost, Benefit, Risk

Joint Title V Cooperative Grant activity budget (ENMU-Roswell and NMJC) is $2,647,096. The project management budget and evaluation for ENMU-Roswell is $562,445, for a total budget of $3,209,541. Approximately 50 percent of the activity budget is for hardware and software; approximately 45 percent is for personnel and related expenses. The initial investment by ENMU-Roswell for the WebCT initiative was $15,000 in 2001. Subsequent funding was from institutional funding in-house and is currently at $45,000 per year for hardware, software, supplies, and equipment.

Customer Satisfaction and Results

Planning for the Title V project has included the identification of data elements, data-collection procedures, and data-analysis procedures that will be used to measure the attainment of activity objectives. These procedures are used to measure the success of the project in helping ENMU-Roswell and NMJC meet the goals of the grant. A formative evaluation will be conducted at midpoint in each project year. A summative evaluation report is completed at the end of each project year, detailing success in achieving each objective, identifying problem areas, and prescribing remedial actions needed. This report will also be distributed to Title V staff, the provost, the president, the internal monitoring team, and to federal authorities.

All of the programs and degrees granted have been Associate Degrees. Now, articulation agreements have been reached with a number of four-year institutions for higher level degrees. These courses will give local students the added advantage of pursuing an advanced degree while staying in the area.

The impact of the combination of projects is an average of 15 percent increase in FTE per year over the last two years, increase in retention, increased success rates, and student satisfaction. ENMU-Roswell has the fastest growing Web-course program in the state. The University has gone from eleven courses and 125 students in the fall of 2001 to 112 courses and more than 2,100 students enrolled in the spring 2004. Students' final grades have been equal to or better than those of students taking traditional on-campus courses.

The University is nearing completion of its fourth year as an AQIP partner. ENMU-Roswell has now consecutively set record semester enrollments, both head count and FTE. This included an enrollment for fall 2003 of 4,004, an increase of nine percent over the previous fall semester. The institution also had a record head count and FTE for the summer of 2003 of more than 1,500 students.

For more information, contact Arthur Leible, dean of information technology services, (arthur.leible@roswell.enmu.edu) and James Buchanan, director, Joint Title V project. Visit the website at www.roswell.enmu.edu.

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Here's My Advice . . .

and what's not so important vary greatly, especially at the more senior levels of our organizations.

In his favor, Truman didn't have e-mail to generate confusion. (Some advice: ease up on the CCs and BCCs, don't be so quick to hit the send button without reviewing what you just typed, and know when to stop typing and start talking). Truman didn't have voicemail for people to hide behind either. (Have you ever called someone and been so surprised that they actually answered the phone that you didn't know what to say?)

Truth is, in the technology business nothing is ever as simple as it appears to

be. Think about why as-built drawings never seem to get done right: complex project, too many changes along the way, running out of money, running out of time, must finish so we can get on with the next project. No time to do justice to those as-built drawings. And often it seems, not enough time to do justice to a lot of other important things.

A third issue in this mix is balance and keeping a reasonable semblance of balance in your work. "Get a life" as they say. I don't think Harry Truman was so good at this. This is a personal thing that you need to deal with. But working

stressed out much of the time isn't usually real effective, or much fun either.

Technology management is a complex and confusing business and seems to get more so all the time. My message: You have to sweat the details if you're going to succeed. And you've got to communicate effectively. Looking away and avoiding the confusing issues only creates problems later on. But keep it all in balance. Know when to push and when to back off.
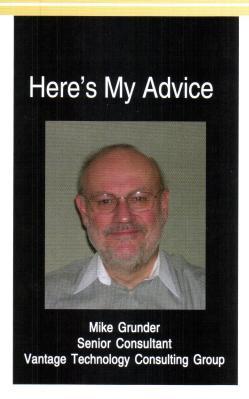
Mike Grunder is senior consultant at Vantage Technology Consulting Group and a former ACUTA president. Reach Mike at michael.grunder@vantagetcg.com.

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Here's My Advice

Mike Grunder
Senior Consultant
Vantage Technology Consulting Group

It's in the Details

I recently finished reading *Truman,* David McCullough's biography of Harry Truman. It's a great big doorstop of a book that reads more like a novel than a biography and gets into much of the detail of Truman's life and presidency.

One of the amazing things about Harry Truman was his incredible energy and attention to detail while still being able to make tough decisions. A wonderful example of this, and a historical footnote I never knew, was that he very closely oversaw the rebuilding of the White House during his term as president. The place was literally falling down around him when he moved in.

I was stunned (and amused) to read a memo he wrote to the contractors insisting, in no uncertain terms, that as-built drawings be done properly so that future generations would know precisely what got done and where all the hidden systems reside.

So along with wrapping up World War II, dealing with Joseph Stalin, creating NATO, developing the Truman Doctrine and the Marshall Plan, and keeping the Korean War from becoming World War III, he made sure as-built drawings were done properly for the White House rehab. Makes you rethink what busy means.

Technology being what it is (and politics too), it seems that all too often nothing seems to work right. On the contrary, I'm continually amazed that things work as well as they do, all things considered. I'd like to think this is because we sweat the right details and we communicate pretty well, and we manage to keep some balance along the way.
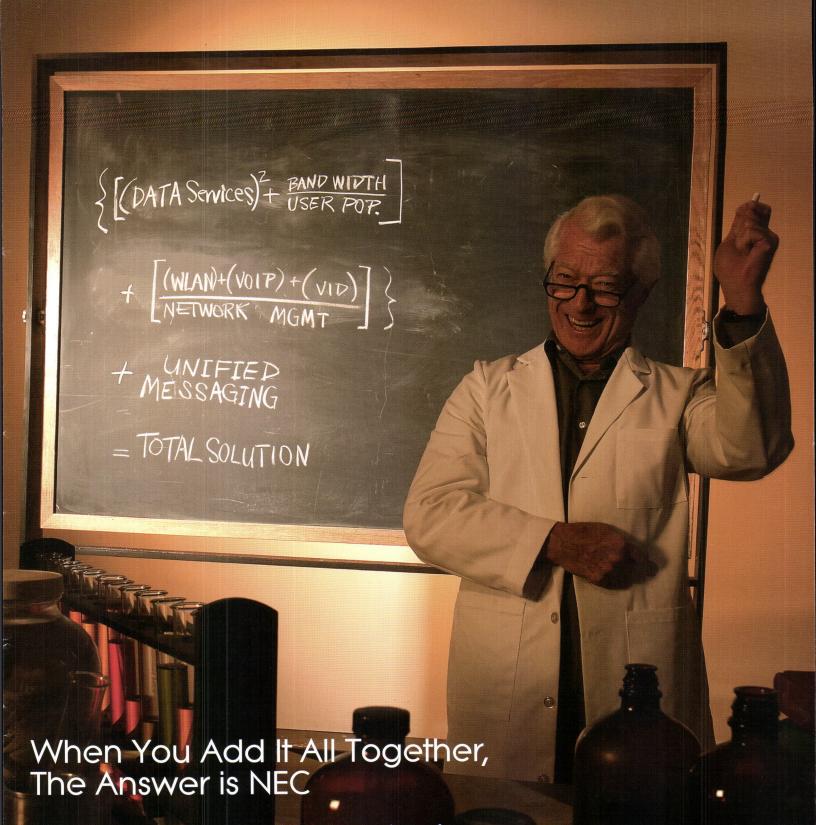
They say the devil is in the details, and Murphy tells us that nature always sides with the hidden flaw. At the risk of oversimplifying, I think that realizing the former and being prepared to deal with the latter may be the number one secret to success in both project management and management generally. There are often big consequences in not dealing with small things.

Truman also knew how to communicate effectively, in clear, easy-to-understand terms. This is a characteristic of his that's still celebrated today. ("Eschew obfuscation" was a button I picked up at a conference some years back.) Truman invited the press right into his office, on a regular basis, and talked straight to them. He was equally direct with the public. He wasn't bashful about telling them the truth as he knew it about the important issues of the day.

Good communications is probably the toughest thing in the world to successfully develop, and it's right up there with sweating the details as the most important. Good communications makes sweating the details a lot easier, in great part because everyone needs to sweat the details, not just you. Spread the pain!

It's ironic that technology has given us so many quick and efficient ways to communicate, yet developing common understanding of issues big and small is still difficult. Technology is complex and difficult for people to understand, and people's perceptions of what's important
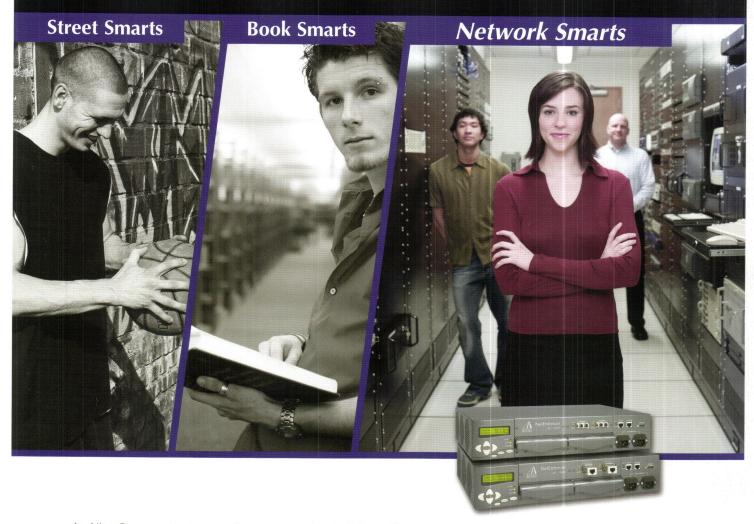
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