



Implementing an IP-Based Voice, Data, and Video Converged Network at SUNY Cortland

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The mission of the EDUCAUSE Center for Applied Research is to foster better decision making by conducting and disseminating research and analysis about the role and implications of information technology in higher education. ECAR will systematically address many of the challenges brought more sharply into focus by information technologies.

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Preface

The EDUCAUSE Center for Applied Research (ECAR) produces research to promote effective decisions regarding the selection, development, deployment, management, socialization, and use of information technologies in higher education. ECAR research includes

- ◆ research bulletins—short summary analyses of key IT issues;
- ◆ research studies—in-depth applied research on complex and consequential technologies and practices;
- ◆ case studies—institution-specific reports designed to exemplify important themes, trends, and experiences in the management of IT investments and activities; and
- ◆ roadmaps—designed to help senior executives quickly grasp the core of important technology issues.

From its most recent research, ECAR published a comprehensive gathering of information on IT networking in higher education in *Information Technology Networking in Higher Education: Campus Commodity and Competitive Differentiator*.¹ The study uses a multifaceted research methodology to collect and analyze quantitative and qualitative data from approximately 545 senior IT and network administrators.

Literature Review

The study began with a review of the relevant literature on effective IT networking practices and future directions in order to define the study's major themes and create a working set of hypotheses to be tested.

Online Survey

We invited higher education institutions in the United States and Canada that are members of EDUCAUSE (1,477) to participate in an online survey. Senior IT leaders, most of them chief information officers (CIOs) or networking administrators, from 488 institutions responded to the survey. Another 29 institutions that are not EDUCAUSE members asked to be included, generating a total of 517 institutions responding.

Interviews

We conducted telephone interviews to further explore some of the key findings derived in the quantitative research. In support of the study's core analytical chapters, we interviewed 19 individuals representing 13 different institutions. We also interviewed 12 higher education networking leaders about their view of networking's future over the upcoming 5- to 10-year time frame. Finally, we sent e-mail follow-up queries to selected

online survey respondents for clarification and further description of some topics. We received responses from 21 individuals.

Case Studies

Researchers conducted this in-depth case study to complement the core study. We assume readers of this case study will also read the primary study, which provides a general context for the individual case study findings. We undertook this case study to examine the State University of New York at Cortland's voice over Internet protocol (VoIP) implementation.

ECAR owes a debt of gratitude to Joel Coulson, network assistant; Ben Patrick, network specialist; Joshua Peluso, systems administrator/DBA; Lisa Rogers, telecommunications coordinator; Daniel Sidebottom, director, Administrative Computing Services; Scott Thomas, network administrator; Paula Warnken, associate provost, Information Resources; and Mark Yacavone, associate director, Admissions.

Introduction

The primary network goal at the State University of New York College at Cortland (SUNY Cortland) is shared by many institutions of higher education: "We work together to determine the technology needs of the university and then develop programs and resources appropriately," states Paula Warnken, associate provost for Information Resources (IR). "It would be nice to be a leading-edge technology institution, but we tie our technology planning into the appropriateness of university academic and administrative activities."

Like other institutions, in 2001 SUNY Cortland faced rising user demands on an aging network infrastructure. A new Title III grant seeded the use of technology elements in university courses, and the network infrastructure could not adequately handle the demand. The institution's PBX switch was also

nearing the end of its life cycle. Interestingly, as the IR organization investigated solutions, it took an atypical approach, opting not to replace its data and voice equipment separately. Instead, the staff decided that a converged data, voice, and video network would be a more cost-effective and efficient solution to its short-term infrastructure problems as well as optimally positioning the institution for future technology requirements. During 2002–2003, SUNY Cortland became the first institution in the 64-member SUNY system to deploy a converged IP-based network.

SUNY Cortland felt the impact of its new converged network almost immediately. The IR organization experienced cost savings by insourcing previously outsourced tasks while also achieving reduced long-distance phone costs. The IT staff is now cross-trained in both data and voice technologies, increasing departmental efficiency. Faculty members and students can now use video, file sharing, and other high-bandwidth applications more easily. Several university departments—including admissions—have improved customer service and productivity by using the programming, monitoring, and reporting features now offered by new network applications. The network's significant benefits prompted EDUCAUSE to award SUNY Cortland its 2003 EDUCAUSE Award for Excellence in Networking: Innovation in Network Technology, Services, and Management.

What is especially noteworthy about SUNY Cortland's efforts is that any institution can attempt this project if the situation warrants it. "The move to a converged IP-enabled network can be accomplished by any and all colleges and universities—and it can be completed in one or two major steps, as SUNY Cortland did, as previous solutions reach capacity or become outdated," observes Daniel Sidebottom, director, Administrative Computing Services. "Alternatively, it [a converged network] can be deployed in phases and in a

migratory capacity, bringing together legacy solutions and IP solutions. Outdated solutions can be removed on a step-by-step, building-by-building, campus-by-campus basis, and new solutions can be brought in as requirements dictate.”² Sidebottom also recounts its benefits: “This solution is absolutely one that could and should be employed by every higher education institution that wants to save costs; improve productivity; enable more-robust applications; empower staff, students, and faculty; create revenue opportunities; and improve customer service.”³

Background

SUNY Cortland is one of 64 campuses that constitute the State University of New York. Established in 1868 as the Cortland Normal School, the institution officially became a four-year college providing courses leading to the bachelor’s degree in 1941. The institution was a founding member of the State University of New York in 1948. Today, SUNY Cortland enrolls approximately 7,500 students in its School of Arts and Sciences, School of Education, and School of Professional Studies, conferring both baccalaureate and master’s degrees. Twenty-three departments with a faculty of more than 400 offer the SUNY Cortland student body 59 majors and 44 minors.

SUNY Cortland’s main campus covers 191 acres and includes 30 buildings, 14 of which are residential halls. The institution operates the Outdoor Education Center at Raquette Lake in the Adirondacks, the Hoxie Gorge Nature Preserve outside Cortland, and the Brauer Memorial Geological Field Station on the Helderberg Escarpment near Albany.

Information Resources

Paula Warnken, associate provost for Information Resources, heads SUNY Cortland’s IT and library organizations, which comprise 70 staff members in four divisions and operate on an annual budget of approximately \$4

million. The IR organization includes

- ◆ Academic Computing Services, which supports, promotes, and advances the use of computing and emerging technologies by faculty, staff, and students.
- ◆ Administrative Computing Services, which supports the functions required to manage the flow and control of data pertinent to the college’s operation and to process and track student and alumni information. It also supports activities indirectly related to classroom instruction, such as registration and student record maintenance. Headed by Daniel Sidebottom, the department employs three networking specialists and one telephony staff member to administer the campus network.
- ◆ Classroom Media Services (CMS), which provides instructional equipment for college faculty and staff through fixed classroom installations and circulating equipment and consults with faculty on instructional technology for classroom use. CMS also supports teleconferencing, video conferencing, distance learning, informational programs, and access to off-campus programming.
- ◆ Library Services, which manages the Memorial Library, SUNY Cortland’s main library. The library houses a collection of more than 400,000 volumes, 1,200 journal subscriptions, an extensive microtext collection, and a strong collection of electronic resources. Memorial Library is also responsible for information and computer fluency instruction, which includes credit-bearing courses and workshops for students, faculty, and staff.
- ◆ Center for Advancement of Technology in Education (CATE), which collaborates with faculty and students in the development and understanding of emerging instructional technologies.

SUNY Cortland’s IR organization is centrally administered, with no formal departmental IT staffing. Faculty members serve as local IT liai-

sons in many academic departments, meeting with IR staff members regularly and providing a local resource for IT-related issues.

Administrative Computing Services manages SUNY Cortland's data and voice communication operations. Warnken gradually merged the areas when she joined the institution 11 years ago. She notes that when she arrived, long-distance services were a real revenue generator, requiring a staff of six people to manage billing and the several long-distance providers the college used. Once Warnken contracted out long-distance services and billing, telecom staffing declined to one member and is now integrated with the data networking staff in the Administrative Computing Services organization.

Converged Network Implementation

A combination of factors eventually led to SUNY Cortland's converged network implementation in 2002 and 2003. The institution itself was undergoing a technology renaissance, fueled by a five-year, \$1.75-million Department of Education Title III grant award that became effective on October 1, 2000. As part of the program, SUNY Cortland has provided new technological resources, including a WebCT course management system and incentives for faculty to incorporate instructional technologies. "The faculty began to integrate technology and Internet resources into their curricula and classroom sessions, but the network could not support it," recalls Warnken. "The faculty began to complain, saying the network slowed their classes. We had to provide the faculty with a higher-speed network to handle video, file sharing, and other high-bandwidth applications." Sidebottom also recognized the institution's increasing reliance on the network for administrative services. "We wanted to improve our ability to serve students and parents more effectively with registration, financial aid, and other issues,"

he explains. "The data network is mission critical on a college campus, and you need to keep it running."

Both Warnken and Sidebottom knew it would require a network upgrade to meet these new demands. SUNY Cortland operated a six-year-old, 155-Mbps ATM backbone flat data network with 10-megabit shared links to the desktop. "The network had no redundancy, no quality of service (QoS), and was no longer supported by the vendor," explains Sidebottom. "Scalability and bandwidth were real issues. ATM was great for the wide area, but when you brought it back to a campus or business setting to use as your backbone, it had its problems. For example, we could not segment the network out. As more faculty members began to use the network, the technology became a real limitation."

At the same time, SUNY Cortland's telephone system was on its last legs. The institution's 17-year-old Nortel SL-1 PBX switch was operating at 99 percent capacity and had maxed out its shelf space. Administrative Computing Services found it increasingly difficult to add more phones in certain parts of the campus. "There was an opportunity to upgrade the current switch," recalls Sidebottom, "but why invest almost three-quarters of a million dollars into a solution that was costly to maintain and had a limited future?"

Evaluation

At first Sidebottom and his staff explored discrete solutions to resolve the data and voice infrastructure problems separately. "But as we kept diving in and learning more about our options, vendors turned the discussion to a VoIP application running over a converged network," recalls Sidebottom. This proposed solution complemented his staff's expertise and current organizational structure as well. "Voice becomes an application over the data network; an IP phone becomes another appliance for the data networking staff to

manage," he continues. "Our expertise is on the data side, not on the voice side, so a converged implementation made sense to us. If an organization is stronger on the voice side, however, it will experience a sharper learning curve."

In theory, the solution made sense, but Sidebottom and his staff were still uncertain about its practicalities, unconvinced that the application was mature enough to go forward. During their six-to-eight month technical evaluation, the staff obtained input from other sources, and the vendors made great strides in research and development. The university hired two consultants to verify the solution's feasibility. One specialized in PBX technology; the other focused on data networking. "It was very interesting to watch the two consultants move forward in their discussions," recalls Sidebottom. "Initially the PBX consultant was against the proposal, but as he interacted with the data consultant, he became more convinced about its viability. In the end, both verified the project."

Another convincer was a site visit to observe a recent implementation using 700 IP phones at a large school system. "The other institution was similar in size and scope, and it reassured us to see the application actually, physically working," says Sidebottom. "When we published our bid spec, we felt comfortable at that point that this was the right solution. We knew the institution might initially lose a few PBX features—speed dial, callback, hiding directory numbers, and intercom—but the next release or two would offer them again."

Finally Sidebottom developed a project ROI. "The costs really justified the end when we compared it to other options," states Warnken. The analysis found that replacing the outdated voice and data networks with the new IP-based converged voice/video/data network would ultimately cost the institution

more than a quarter of a million dollars less than purchasing, deploying, and supporting two disparate voice and data networks. The anticipated return on their technology investment was less than one year.⁴

Warnken and Sidebottom also worked together to educate the senior administration about the proposed converged network project. Warnken sits on a management team that comprises the deans and one other associate VP, so she informed them of how the new network would enhance faculty members' forays into technology and teaching. SUNY Cortland's president at the time had a reputation for being very technology savvy and was highly involved in technology-related decisions; Warnken kept the provost, who is the IR spokesperson to the president's cabinet, involved in the evaluation process. At the same time, both Warnken and Sidebottom maintained close relationships with the CFO and discussed the potential efficiencies the new network would bring to business operations. The cabinet approved the proposal, and SUNY Cortland issued its request for proposals for an IP-based voice, data, and video converged network in 2002.

In April and May 2002, the institution chose a Cisco hardware and software solution, to be integrated and deployed by Ronco Communications. Technical and vendor expertise were important selection criteria, but Sidebottom also liked Ronco's customer orientation. "Ronco came to the plate to work with us—not dictate to us," states Sidebottom. "The firm spent hundreds of hours at our campus to learn about the environment before we issued our RFP." Also important was the strong relationship between Ronco and Cisco Systems, which contributed to the holistic strategy that Sidebottom envisioned for the project: a single implementation team with participants from Cisco, Ronco, and SUNY Cortland. "Not only did we all work together on the implementation, but if we needed

additional information during the design or planning stages—for example, about Unity and Exchange integration—Ronco brought in high-level Cisco staff to help us understand what we needed to do.”

Finally, Ronco had expertise with Nortel PBXs, something lacking in SUNY Cortland’s data-centric IR organization. Ronco presented a turnkey end-to-end solution, all the way from implementation, configuration, and training to post-installation support. In fact, Sidebottom still employs Ronco to provide support for voice-related issues postimplementation, augmenting Administrative Computing Services’ data-oriented expertise.

SUNY Cortland’s new network features a single-mode fiber backbone offering converged voice, data, and video at Gigabit Ethernet, scalable to 10-Gigabit Ethernet. The new network is fully redundant and consists of 500 switches and network equipment. Locally it offers a 100-Mbps LAN, 11,000 voice/data ports, 600 IP phones, and more than 60 analog gateways to serve 3,500 analog phones.

SUNY Cortland implemented several applications as part of the network implementation:

- ◆ Cisco Emergency Responder lets emergency agencies identify 911 callers’ location and eliminates the need for any administration when phones or people move from one location to another. This application lets the Cortland University Police Department staff remotely access 911 calls from anywhere on campus.
- ◆ Cisco IPCC is an integrated contact center solution that Administrative Computing Services initially implemented for its financial aid and admissions departments. It allows multiple voice applications to be presented to a voice-enabled IP network, including dynamic call routing, real-time reporting, queues, and other applications maintained through a Web interface and database lookups.

- ◆ Cisco’s Unity unified messaging system lets users retrieve voicemail, e-mail, and fax messages from a single in box. Workers can listen to their e-mail over the phone, check voice messages from the Internet, and, when Cisco Unity is integrated with a supported third-party fax server, forward incoming faxes to wherever the user may be—at the office, another building across campus, or a hotel across the country.

Implementation

After the vendor selection, the real work began. “The biggest factor that can make or break an implementation is the up-front preparation,” explains Sidebottom. “It really impacts the problems you have after cutover.” Much like a doctor giving a patient a thorough physical before an operation, the implementation team conducted a comprehensive tour of the network, inspecting every closet to verify the electronics, the number of drops, and the amount of fiber available.

For the most part, the wiring was in good shape. “During our last network upgrade several years ago, we installed enough fiber to support the campus in the future,” explains Scott Thomas, network administrator. “The backbone is a combination of single-mode and multimode fiber, and desktop cabling is mostly Category 5, with a mixture of Category 5e and Category 6 twisted-pair cable.” Only a very small percentage of cable had to be repulled due to wear and tear. The implementation team, however, did install some new fiber to connect the buildings where the network equipment resides, creating a redundant loop.

The network’s electronics, however, was a different story. “We planned to replace everything,” continues Thomas. “Since we had a flat campus network with only one subnet, we spent quite a bit of time deciding how to divvy up VLANs [virtual local area networks] and subnets.” Eventually the implementation

team decided to implement one data VLAN and one voice VLAN per building; segmenting by floors was deemed too complicated. The implementation team did not replace the hubs that connect two off-campus sites to the network because they already used Cisco routers.

On the software side, one challenge was to link all the e-mail accounts with the voicemail in preparation for unified messaging. Synchronizing Active Directories was facilitated by the fact that the IR department used Microsoft Exchange 2000, which is compatible with the Cisco Unity system. Ronco wrote the scripts to build all the user accounts and make them voicemail enabled, and they extracted all the information from the old Nortel system and introduced it into the Unity system. Since SUNY Cortland has a fairly large rotating faculty population, it implemented some generic mailbox accounts for transient faculty members.

Reliability was another concern now that voice became an application running on a data network. There are no single points of failure anywhere on the network and, as noted previously, the network is segmented into VLANs to ensure reliability. QoS is built into the network, enhancing voice quality. In addition, Administrative Computing Services implemented private addressing schemes on the voice application and initiated access control lists. Finally, the department added a firewall. SUNY Cortland also added backup battery power during a separate project, after determining power requirements. The goal was to sustain two to three hours of power, until a backup generator could bring the main switch room back up.

Administrative Computing Services also sought to engage the campus in the implementation process, e-mailing progress updates, holding campus meetings, distributing literature, and maintaining a Web site about the implementation. In addition, the new network presented users with an opportunity to

tailor the system to meet their needs. Ronco met with every university office to discuss how to reconfigure the new system to meet any unfulfilled requirements.

Training was another issue. Ronco held sessions to introduce users to the new IP phones and set up IP phones in a lecture hall for people to experiment with and experience. Those users who had analog telephones would retain analog lines, while digital phone users would switch to IP phones as a result of system incompatibilities. "We had to make a cut somewhere between analog and IP phone users because it was going to get out of hand," explains Sidebottom. "If we provided an IP phone to everyone, that would entail over 1,000 phones instead of the 450 phones we actually installed, making it rather costly to finance at \$390 per phone." Thomas elaborates: "We wanted the students to stay analog because we couldn't see imposing this expense onto our students. The phones were expensive, and we would also have to install power switches in all the residence halls. As it was, we installed analog-to-IP gateway devices in the residence halls to handle the residential analog phone service."

Initially the implementation team planned to switch over the voice and data networks simultaneously, but state funding issues forced them to switch over the networks sequentially. The data network became operational in August 2002; the voice network cutover occurred in January 2003. "It actually worked out better because we addressed bugs in the data network, ensuring peak operating efficiencies, before we added the new voice application," states Sidebottom. "It would have been tough to do both at once."

In preparation for both cutovers, Thomas spent the prior two weeks reviewing all the little details two or three times, to head off potential problems. Cisco and Ronco set up a "situation room" on campus, where they made the network operational beforehand

in a controlled environment. “Our entire campus network—over 500 pieces of equipment—was operational in this one little room, configured and labeled accordingly,” recalls Thomas. “Ronco deployed all the pieces gradually into the closets.” Joel Coulson, network assistant, recalls that “on the cutover nights, the Ronco, Cisco, and SUNY Cortland staff members flipped the switches and waited to see what happened—and the network just worked.”

Post-cutover, Ronco managed a help line to handle any user problems and troubleshoot any potential problems. “None were showstoppers,” recalls Sidebottom. “They were mainly little issues from users not familiar with the system.” Interestingly, the network’s reliability was tested less than two weeks after the voice cutover in 2003 when the Slammer virus hit the SUNY Cortland campus. The virus overwhelmed the data network, but the voice system continued to operate without a hitch.

Application Spotlight: Admissions Department Call Center

One of Administrative Computing Services’ goals for the converged network was to increase productivity in the university business offices. It initially installed the Cisco IPCC Express Contact Center in two call center application sites—the admissions and financial aid departments—during the converged network implementation. The admissions department receives approximately 100,000 calls per year, and when Mark Yacavone, associate director of Admissions, heard about the new network, he jumped at the chance to learn more. “When I learned that the college might choose a new solution, Dan [Sidebottom] allowed us the opportunity to meet with the vendors to discuss our interests and needs assessment,” recalls Yacavone. “So the staff and I took a clean sheet of paper to list our

requirements, how we’d want the system to work, and all of the capabilities that are valuable to us.”

The admissions department had to address both global and local issues when designing the new call center. “The Express Contact Center is basically a global product,” explains Sidebottom. “Any feature set that one department changed affected the other department. After talking with both departments, we found that they function totally differently. For example, one department wanted calls to be logged into a queue, but this did not make sense for the other department because fewer people manned the phones.” Both areas hammered out compromises, either together or through an arbitrator. Then both departments worked directly on local issues with Administrative Computing Services, which programmed changes after hours and refined them on the basis of user feedback the following day.

The admissions department’s two significant issues were adequate staffing of the phones and the equitable distribution of incoming calls among the staff. “We had to build the system based upon how the office works,” explains Yacavone. “Before the call center system, we had no concrete information to help us with our planning. The staff completed tally sheets and we had our own perceptions, but we had no data to support our conclusions. Now the system’s reporting function helps us to identify peak calling periods and we can change our office staffing accordingly.”

Before the call center implementation, an individual’s phone rang and either the staff member answered the call or it was routed to voicemail. The admissions department phone system also let staff members log in to answer a phone or log out. Yacavone used the call center application to create a more equitable system involving three tiers of staffing to answer the phones—a round-robin, skill-

based routing method—to ensure that the caller avoids voicemail. The current routing structure consists of three tiers:

- ◆ Tier 1: Two staff members dedicated to answering phones.
- ◆ Tier 2: Three secretaries who primarily process applications and other paperwork but also handle overflow calls routed from Tier 1.
- ◆ Tier 3: Two staff members whose day-to-day responsibilities don't include answering phones but do include responding to calls routed from Tier 2.

Within each tier, calls are equitably distributed; the person who received a call least recently receives the next call. A call rings three times at a staff member's phone and then is routed to another phone automatically if no one picks up. If all staff members within a tier are engaged, the call moves to the next tier. If the caller needs to interact with another call center area, such as financial aid, the call is routed accordingly and placed to the front of that call center's queue.

The call center application also lets Yacavone and staff monitor calling activities. The manager's Web page tracks staff members' availability, calls in the queue, the estimated waiting period before the caller speaks to an agent, calls in session, total calls in the day, and the number of abandoned calls. "I look at the report every day before I leave, to give me a wrap-up," Yacavone explains. "If we encounter double-digit abandoned calls during the day, then I start discussing resource requirements with the staff." Using the agent summary report, Yacavone examines the number of calls handled by each agent within a specified period. "The new calling scheme has split out the phone workload nicely," he reports. "The number of phone calls answered differs drastically from one tier to another, but within each tier, each staff member answered roughly the same number of total calls." The staff members' Web site

displays the system's status, including people in the queue and other agents handling the phones.

Yacavone recounts several call center benefits:

- ◆ *Better customer service.* Instead of receiving a busy signal or having their calls sent to voicemail, callers are put into a queue and hear music and information announcements, and they are routed to the best-qualified person as quickly as possible. Admissions staff members can also monitor call queue lengths, and they can make better staffing decisions to serve callers better and more quickly. When appropriate, caller information and student records can be pushed to the staffer's computer desktop simultaneously with a call.
- ◆ *More efficient operations.* With the new call center in place, Yacavone reports that the secretaries can plan their days more effectively, scheduling application processing and other projects to off-peak phone times. During the past admission cycle, Yacavone notes, the department tracked prospective students better, mailed viewbooks out a month and a half earlier than the previous year, and completed data entry months ahead of schedule—all while handling a 10 percent increase in applications. The admissions department also eliminated one of two temporary staff positions typically filled during the peak application processing period. "There were some years when the temporary staff members just answered the phone," explains Yacavone. "The phone used to ring constantly. We did not know how to prioritize it, so we dedicated the temporary personnel to the phones. Now the temporary staff position is still a Tier 1 position, but because this duty is split among three people, he or she can now work on other tasks."

- ◆ *Improved departmental planning.* Yacavone has new managerial tools that assist in departmental planning, tracking call volume throughout the application process, and noting peak calling periods. For example, every year the admissions office mails out a card to encourage all prospective students to call admissions to schedule their campus visit. Yacavone anticipated an increase in calls during the subsequent three or four days and prepared the staff accordingly. “The report verified our assumptions,” he states. “We knew the call volume would pick up, but now we know the magnitude of increase is roughly 50 percent and can plan accordingly.”
- ◆ *Improved morale.* Yacavone reports that staff members feel “the system is fair, so the phone is no longer an issue for the office. Before, complaints and improvement suggestions dominated every Monday staff meeting. Now we don’t speak about it.”
- ◆ *System troubleshooting.* The admissions staff can monitor the call center system themselves, enabling them to rapidly fix or report problems. For example, if the system reports no available representatives, all the department members know to log off and then back on. If they cannot fix the problem themselves, they call the Administrative Computing Services department within minutes of diagnosing a problem. “We never had this capability before,” states Yacavone. “Now I receive the information real time on my desktop, enabling me to spot problems quickly.”

Institutional Benefits

SUNY Cortland has experienced numerous technical, operational, and fiscal benefits from its converged network:

- ◆ *Enhanced network infrastructure.* SUNY Cortland’s network now offers better speed, security, reliability, and scalability.

Backbone speed increased from 310 Mbps to 2 Gbps; speed to the desktop is now 100 Mbps, up from 10 Mbps. The new network is fully redundant; there are no single points of failure anywhere in the network. Additionally, Sidebottom notes that “the robust nature of the network, as well as its reliability and scalability, means that the university will be able to grow and adapt and provide all the necessary solutions its students, faculty, and staff need—for decades to come. Solutions and applications previously not feasible are now possible and will empower the entire university community.”⁵

- ◆ *Data and voice cross-training.* The staff has been cross-trained such that they can now assist with all aspects of the new, converged solution. For example, Joshua Peluso, systems administrator/DBA, reports that he “now writes many custom call center scripts. I know the Unity system in and out. Beforehand, I never touched a piece of telephone equipment.” Or, as Thomas elaborates, “We were networking guys before. Now we handle most of the system administration and changes in house. We’ve figured out many of the little tricks and tips that the telecom administrators have known for years, such as building a call tracking database for phones. Only when we have a question do we now call Ronco for assistance.” The unified messaging systems centralized the management of all messaging technologies into one department. Previously, e-mail resided with the Academic Computing Services group. To handle the additional responsibilities, Administrative Computing Services added one staff person.
- ◆ *Greater productivity.* Sidebottom notes several examples of productivity gains resulting from the converged network: faster user access to network applications, ease of message access and processing with the

unified messaging system, and greater operational efficiencies in the call centers.

- ◆ *Greater campus coverage.* The converged network enabled Administrative Computing Services to bring remote campus sites into the institutional network, including the Raquette Lake Outdoor Education Center in the Adirondacks, the McDonald Building, and the West Campus, offering four-digit dialing. Additionally, the department plans to add a 240-bed off-campus student housing complex on the network and charge students for access to the voice network, generating additional revenue.
- ◆ *Cost savings.* Sidebottom estimates that by eliminating the outsourced maintenance, Administrative Computing Services saves “approximately 750 hours per year in resource time and approximately \$100,000 per year in outsourcing and moves/adds/changes costs. IP phones are now simply unplugged, moved, and plugged in at the new location—the phone reregisters itself with the Cisco CallManager application, meaning that all the settings, user profile, and phone extension are retained. Before, the university would have to pay the voice vendor to make a site visit to make manual wiring changes, and have to pay several hundred dollars per change. It often took several days and sometimes up to a week to get the changes made. With multiple moves, adds, and changes per week, this was not very cost-effective. In addition, the university expects to save approximately \$15,000 to \$20,000 per year using toll bypass—moving long-distance calls across the wide area network (WAN), and using four-digit dialing within the campus.”⁶ Sidebottom also notes cost savings stemming from reduced amounts of equipment, less cabling, and fewer staff required to manage the entire network.

Lessons Learned

The Administrative Computing Group outlined several lessons learned; some are general truisms, others are specific to the converged network implementation.

- ◆ *Perform a needs assessment up front to determine a converged network’s institutional value.* “Institutions should implement a converged network only if the shoe fits,” states Warnken. “You have to do a needs assessment, just like for any other IT initiative. A 5- or 10-year ROI assessment quantifies the initiative’s potential benefits up front and can help you determine how a converged network plays into the institution’s short- and long-term IT requirements.”
- ◆ *Leverage the opportunity across the campus.* Institutions may implement a converged network to address an immediate need such as aging infrastructure, but the technology positions the institution to explore solutions for other problems. “People that are investigating this should look outside the box and advise others that nothing should be held back,” states Sidebottom. “Take a look at everything that you have that is associated with your campus. There is a good chance to bring it into the mix and take advantage of this new environment.” Or as Peluso succinctly states, “Things that you dismissed before, you can think about now.” SUNY Cortland not only implemented a converged network but also enhanced the institution in numerous ways with its new emergency response system, unified messaging system, and call center operations. SUNY Cortland may have implemented all these projects when installing the converged network, but other institutions can phase in new enhancements. This planning process goes hand in hand with the needs assessment discussed earlier.

- ◆ *Switch over the data network first.* Since voice is an application running on the data network, Sidebottom advises IT organizations to ensure that the data network is optimally operational before adding voice. Among his checklist items are QoS, redundancy, and power needs in closets.
- ◆ *Inventory the entire campus.* One thing that surprised the SUNY Cortland implementation team was the number of certain devices found on campus. Of particular note were fax machines, since no formal inventory record existed, as they used regular phone lines. The implementation of Cisco's Emergency Responder required an inventory of all the "blue light" emergency phones located in parking lots and stairwells that contacted university police directly. Elevator phones were a particular challenge. "Some picked up an autodial; others rang down circuits so the system would do the dialing rather than the phone," explains Thomas. "The power needed to push the signal—like in an elevator phone—may not have worked well with the network equipment we had, so we had to tweak the parameters." Voicemail menus were more complex than anticipated. "It was amazing all the things we did not realize," recalls Sidebottom. "It did not hurt us, but it represented more things that we had to deal with."
- ◆ *Don't bite off more than you can chew.* "If you are going through a large-scale implementation, concentrate on the network first," advises Sidebottom. "Implement the call center application separately. Implementing both simultaneously was a lot to handle." The latter involved business process as well as technical issues. "You have to sit down and really understand how these offices function currently, and how they want to function optimally, and then configure the call center application appropriately," Sidebottom continues. "It was a large undertaking. We struggled for a full week before the call centers worked well in both the admissions and financial aid departments."
- ◆ *Remove the data silos.* As with any system implementation, one data change may have unintended impacts across the system. "We can't do anything in Microsoft Exchange e-mail directory without considering its impact on the Unity messaging system," states Sidebottom. The implementation team also learned from experience that Unity has to be 100 percent compliant with Exchange. When the Unity system was switched over, some flaws were quickly exposed and had to be addressed immediately. Also the servers initially communicated not as optimally as anticipated. It took the department four months to discern that the installer picked up some domain configurations incorrectly, which in turn impacted performance.
- ◆ *Keep users in mind during the design process.* "Users do not prepare enough up front for redesigning business processes," Yacavone believes. "Prepare yourself for all the questions you need to ask your office to determine needs, to determine workflow, and how to use the technology to enhance operations. For example, determine which staff person is most appropriate to answer caller questions or how should the calls be routed in the department."
- ◆ *Keep users in mind after the implementation.* The implementation team felt they informed the campus well during the implementation, but postimplementation communication could improve. One reason is that some feature changes were so minor that it was assumed users might not notice. "But they did notice," recalls Peluso. "For example, we reprogrammed the telephone icon's handset in the IP phone display to shake when the phone rings, and the caller ID function to display

information on two lines. People called us about the changes.” Another issue was lack of user feedback for specialized features. “Some seemingly innocuous features, such as a beep to indicate call waiting, annoyed the call center staff,” he continues. “If we had asked their opinion beforehand, we would not have made that mistake. We learned we can’t assume anything is right when programming call-center-related functions.”

- ◆ *Schedule site visits for users as well as technical staff.* The site visit to the school district helped the Administrative Computing Services group envision a converged network and VoIP application at SUNY Cortland. Yacavone wishes he could have done the same to learn more about similar call center system implementations. “I think we knew our requirements up front, and we designed a product to meet our needs,” he explains. “Since our implementation, we’ve hosted a couple of site visits for potential users and we could provide them with firsthand experience about implementation pitfalls and advice on how to create an optimal design. It is not always best to be the first.”

Future Directions

Now that SUNY Cortland’s converged system is operational, the institution can incorporate leading-edge applications when appropriate, including video, wireless IP, and system-wide IP applications.

The enhanced network enables faster access to video applications for faculty members and students in their daily activities. The Administrative Computing Services group is also experimenting with video-enabled telephones and PC-enabled video for video conferencing applications. “We want to build the applications first and then introduce them to the departments,” states Sidebottom.

Wireless is another area of interest, and currently the Administrative Computing Services group is deploying more access points throughout the campus. In the future Sidebottom foresees a campus network supporting PDAs, tablets, PCs, and wireless IP phones in an integrated environment. Faculty and staff members can now use wireless IP phones, and the university is considering expanding their availability to students. Sidebottom wants to pilot student wireless IP usage in an off-campus student housing unit directly across the street from the campus. “It would be a great test environment because there are only 12 to 14 residents,” he explains. “We could beam a wireless signal over to them and students could sign out a wireless IP phone from residential services. Optimally the phones would utilize a dual chipset so students could use the campus wireless system and switch over to a cell system off campus.” Sidebottom also envisions a potential revenue stream emerging from wireless IP phone service.

Other university departments have requested their own call centers after observing the successful implementations in the admissions and financial aid departments. New call centers are operational in the student accounts department; the technology help center/switchboard; and Hallnet, an Internet connectivity initiative from every residence hall room on campus. The health services and residential services departments have requested call centers also.

SUNY Cortland’s implementation could expand beyond its campus as well. Other SUNY institutions have expressed interest in their own converged networks, and a system-wide implementation may also be feasible. “Years ago the SUNY system maintained dedicated POTS [plain old telephone service] lines for intrasystem communication,” explains Sidebottom. “A system-wide converged network could offer IP-based voice as well as incorporate video confer-

encing and video phones.” Two other SUNY sites that house SUNYnet and the research foundation have implemented VoIP, and SUNY Cortland is piloting a program to explore the benefits of interconnecting. “We are investigating phone traffic between the sites to determine the cost savings by linking our call management systems and offering four-digit-dialing capability.”

“The IP-based network implementation has been SUNY Cortland’s most leading-edge technology project during my tenure,” says Warnken. “It works because it was appropriate, it made sense, and it was best for the institution.” Indeed, as Sidebottom notes, “The new converged network enables university staff, faculty, and students to communicate more effectively, allows for university growth and expansion, effectively integrates remote

campus facilities, and allows more-robust solutions and applications to be utilized to improve the academic experience.”⁷

Endnotes

1. J. A. Pirani and G. Salaway, *Information Technology Networking in Higher Education: Campus Commodity and Competitive Differentiator* (Boulder, Colo.: EDUCAUSE Center for Applied Research, Research Study, Vol. 2, 2005), <<http://www.educause.edu/LibraryDetailPage/666?ID=ERS0502>>.
2. D. Sidebottom, “2003 EDUCAUSE Award for Excellence in Networking: Innovation in Technology, Services, and Management Application,” internal document, State University of New York at Cortland, 2003.
3. Ibid.
4. Ibid.
5. Ibid.
6. Ibid.
7. Ibid.