Kent State: summa cum laude

The university wins our highest distinction in the Network World 2000 User Excellence Award competition for its converged voice, data and video ATM network, built with savings from Centrex bills.

By Paul Desmond
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Convergence doesn't have to mean IP, and it doesn't have to break your network budget.

That's what Kent State University proved in building a converged network based on ATM and fiber-optic technology. Devised to replace an aging voice network, the new $23 million net is being funded over a 10-year period entirely out of savings from the elimination of Centrex bills. In addition to state-of-the-art voice, the network supports all data and video needs for more than 30,000 students on the university's eight campuses in northeast Ohio.

On top of that, the network has positioned Kent State to offer a variety of distance-learning courses to myriad new constituents. These include high school students taking advantage of a state program that pays their first-year college tuition and teachers who may soon have to complete state-required certification programs. The network also lets the university compete for technology-related state and federal grants to cover operating costs while furthering student and staff careers.

In short, Kent State demonstrates how network technology can be powerfully applied to organizational objectives. For this, it earns itself the top honor in the Network World 2000 User Excellence Award competition.

The road to convergence

The groundwork for Kent State's award-winning network was laid in 1994, before the school even had a formal network services group. "There was one person who was ready to retire. He was the network services group," says Bruce Petryshak, executive director of IS and telecommunications at the main campus in Kent, Ohio.

At that time, another department was embarking on a project to bring cable TV service to campus residence halls using fiber-optic cable. IS saw that as an opportunity to get some fiber of its own so it could upgrade its data backbone. A deal was struck to run fiber for both projects.

To help in the effort of installing the new data network fiber, IS hired an outside consultant, Total Systems Integration (TSI) of Galion, Ohio. The goal was to bring two fiber connections to each of the estimated 100 buildings on the main Kent campus for redundancy. Petryshak's team saw ATM as a good long-term play, so TSI designed an ATM backbone using a series of rings, "like a four-leaf-clover design," says George Dallas, president of the firm.

Then in 1997, Kent State's Centrex contract with Ameritech was due to expire, so the university began to explore its telecommunications options. The old voice network on the main campus was clearly outdated. It consisted of 100 key systems, mostly Lucent Merlins. Each of the seven regional Kent State campuses had a similar setup, with no direct calling between them, or even between many buildings. In most instances, Centrex lines were used as trunks into a building, with possibly 10 lines serving 50 to 100 extensions. Users could call one another within a building but had to compete for one of the outgoing lines to call outside. To top it off, the voice mail system was departmental only, not personal.

"We effectively had 100 different companies that were not connected to each other," Dallas says.

After receiving estimates of $15 million to $18 million to upgrade its aged copper cable plant, digging up the campus in the process, the university decided to go with an all-fiber option.

Once it made that call, Kent State decided to expand the ATM backbone, which it was already using for data and video. It also made sense to merge Kent State's telecommunications and IS organizations into one group under Petryshak, and head down the path toward a converged voice, data and video network.

Once again, IS hired TSI to devise a plan.

A master ATM plan

Petryshak specified that the university had to pay for the new network out of its existing budget; no additional funds would be available. Figuring this stipulation would require financing the network over a period of years, Petryshak says he also wanted to ensure Kent State would not be stuck with antiquated equipment halfway through the deal.

He settled on a plan for financing the network over 10 years. To make the loan payments, Kent State would use the $2.3 million it would save by eliminating Centrex charges.

Petryshak also had a "technology insurance policy" built into the contract. For the life of the 10-year deal, any hardware and software components that were no longer supported or fell out of compliance with industry standards would be replaced by the winning bidder at no cost to the university. At the end of 10 years, all components would be covered by a similar two-year warranty.

With a detailed design on paper, TSI put out a request for quotation, as opposed to a request for proposal. By state law, Kent State had to go with the low bidder, which was NEC Business Network Solutions, in Irving, Texas.

The result is a converged network that supports voice, data and video over nearly 40 miles of fiber. At the core are five Nortel Networks Centillion 1600 Multiservice ATM Switches, augmented by more than 100 Centillion 100 LAN-ATM Switches. Each of these smaller edge switches are connected to two of the Centillion 1600s over separate fiber links. Kent State employed single-mode fiber for high-speed links with multimode fiber supporting lower speeds. Four T-1s run from the main campus to each of the seven regional campuses, extending the reach of the ATM net.

For voice, Kent State went with a distributed PBX design. At the main campus, an NEC NEAX 2400 digital PBX is broken into three processors that function as a single logical PBX. Each processor is attached to a core ATM switch and also has two fiber connections to Ameritech.

PBX functionality is extended to remote buildings using NEC Digital Remote Units (DRU), which act like hubs for remote phones. Installed in remote wiring closets, the DRUs link to E-1 ports on the ATM edge switches. Use of the European E-1 standard lets each port support 30 lines back to the PBX, or 20% more than a T-1.

The 25 distance-learning classrooms serving Kent State's eight campuses are likewise now attached to the fault-tolerant ATM net. Switched voice traffic runs over permanent virtual circuits (PVC) that support circuit emulation. Video and data travel over switched PVCs, circuits that can essentially be established as needed. In addition, the ATM Private Network-to-Network Interface protocol supports soft PVCs, which are backups for each PVC designated through software. Should the primary PVC go down, traffic is immediately routed over the soft PVC. No more classes canceled because of a T-1 failure.

Reliability was a key reason Kent State chose ATM instead of IP for its converged network.

"For an organization as large as ours, voice over IP just isn't there," Petryshak says. "For 70 to 100 users, you might be able to do it. But we've got 10,000 lines. And [voice over IP] directs you to a voice solution. We allow access to any resource - voice, video or data."

The ATM-based voice net gives Kent State features such as private voice mail, including a voice mail box for each student who lives on campus, simplified dialing plans and least-cost routing. The latter is a function of the wide-area connections to each remote campus, which lets calls jump off-net at the remote location nearest the destination site. For example, calls to Cleveland, about 40 miles from Kent, are effectively local calls thanks to a node at a Cleveland site affiliated with the Kent State School of Architecture.

Tallying the bounty

The new voice net has also simplified life for telecommunications administrators on campus, while reducing costs.

The new phones purchased as part of the project are covered by a 12-year warranty, says Margie Milone, manager of telecommunications at Kent State. "We will be saving between $60,000 and $100,000 per year in repair and replacement costs," she says, noting she previously had to keep a large inventory of spare parts and equipment for the many types of phone equipment on campus. "This is a huge reallocation of funding that goes back to pay for this entire plan," she says.

Another benefit is NEC's AimWorx suite of management tools, which provides a single console from which administrators can update voice mail systems, enter service orders, generate work assignments, reconcile bills, do charge-backs and more.

Fiber-optic cable offers practical benefits of its own. "We've had four schools in Ohio that have been hit by lightning in the past two weeks," TSI's Dallas said in September. "One advantage of fiber is there's no copper cable to bring the lightning in."

Perhaps the biggest benefits will come from the video capabilities.

Ohio is building ONEnet, a network that will bring an ATM link to every K-12 school district in the state, or about 3,800 buildings. Kent State, which has been using distance learning for its own students for some time, will be able to offer content to all state districts.

For example, the state has a program whereby high school juniors and seniors can take courses at state colleges at Ohio's expense. The students get the opportunity to enter college as sophomores upon graduating from high school.

Kent State's distance-learning capabilities puts it in a prime position to offer courses to students statewide, letting them "attend" class from their own school or one nearby. Besides saving the student money, the program presents a recruitment opportunity. "Once they have credit here, there's a good chance they're going to attend Kent State," TSI's Dallas says.

Another opportunity may be to offer state teachers classes. Ohio is debating a plan that would require all teachers in the state to complete a master's degree program by 2005 or 2010. As with high school students, Kent State will be in a good position to use distance learning to offer certification courses.

"One of the major tenets of the strategic plan is to leverage the ATM network to make Kent State a seamless institution for living, learning and research," says Greg Siebert, manager of network services at the university. On the research end, Siebert says the IS group helps write grant applications for Kent State researchers, playing up the role of the ATM net.

"Just the fact that we have this backbone can be cited in the application and we can use it in actual research," Siebert says. "One of our unspoken goals is to try to attract at least the retail cost of the network back in external funding in the next 10 years," which would mean roughly $1 million per year.

Already Kent State has secured more than $1.5 million in grants related to the network. The largest chunk was a $1 million state grant used to get its VTEL video network off the ground at all seven regional campuses.

Kent State now has 21 state-compliant room-based VTEL systems connected to the ATM net, and is experimenting with Web- and H.323-based desktop video.

"People ask what the killer app will be and what can you do in the future that you can't do today," Siebert says. "We think video will be the killer app."

This year, video will connect Kent State students to the Great Lakes Theatre Festival, a theater company in Cleveland. Using video running over its ATM backbone and Internet2 connection, theater students at any Kent State campus can act as directors for rehearsals taking place at the theater in Cleveland. Or students could observe a Great Lakes director, ask questions and interact with actors.

The ATM network has Kent State positioned to offer similar services to the local community. For example, the university is exploring the idea of offering its videoconferencing rooms for use by local businesses. Likewise the idea of extending the fiber backbone to area apartment buildings, many of which house Kent State students, is another possibility. That would bring the same voice, data and video services to off-campus students.

"There are so many things we can do, we have to pick and choose," Petryshak says. "But we're not restricted by the technology."

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