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ACUTA

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Journal

of Telecommunications in Higher Education

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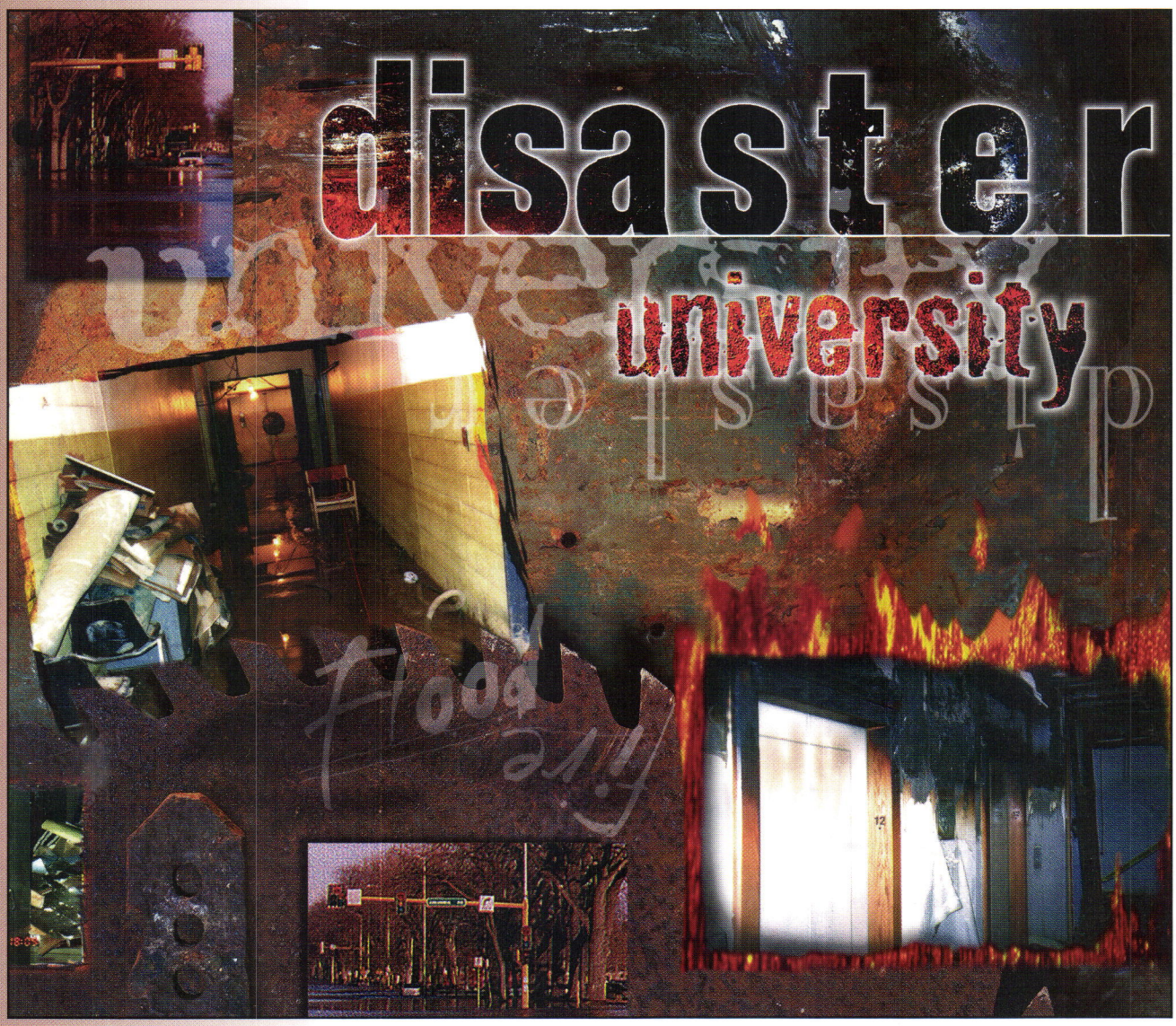

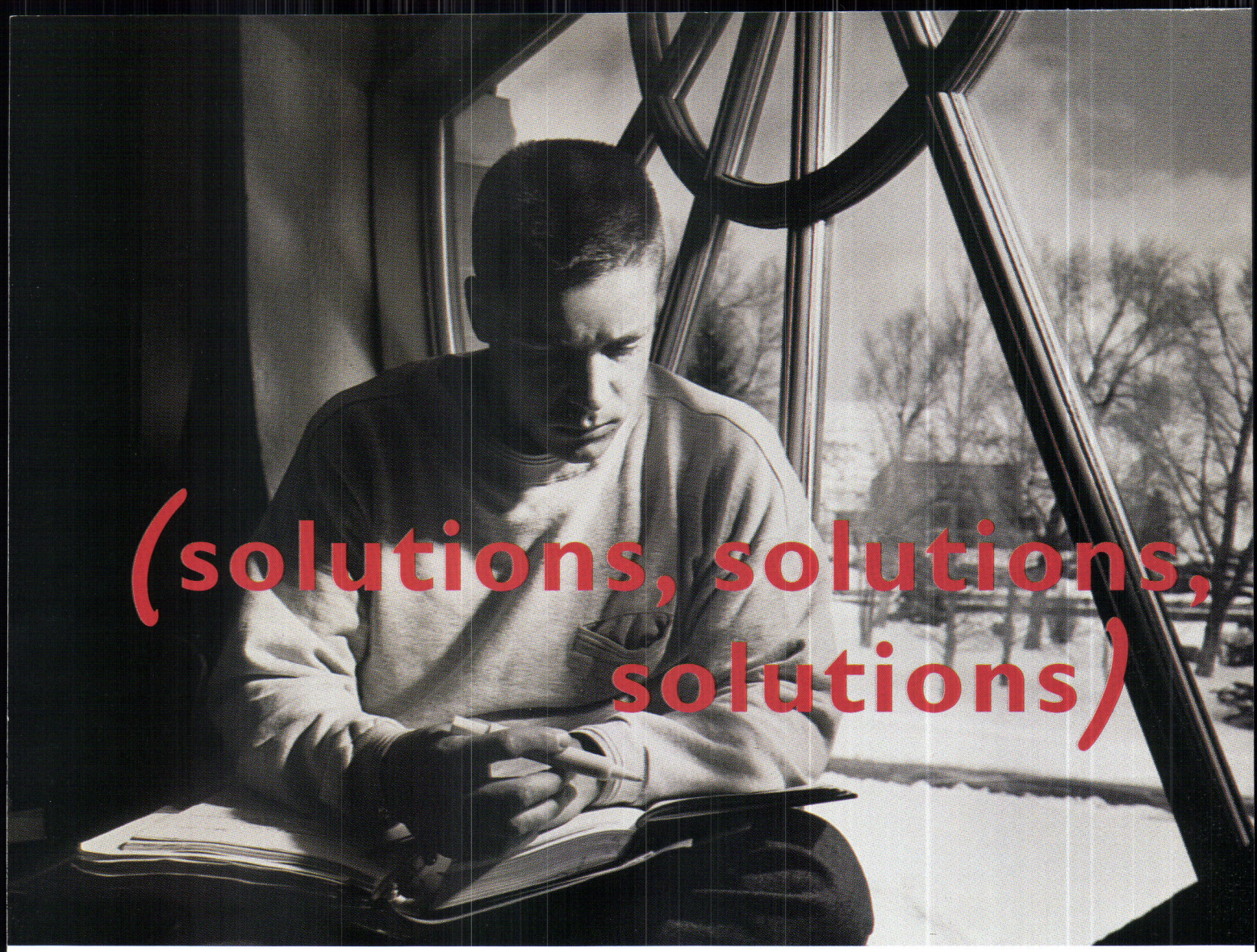

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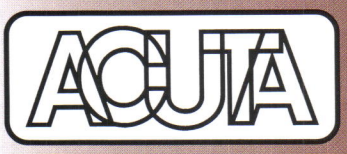

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27th Annual Conference
July 12–16, 1998
San Diego, California
Marriott Hotel & Marina

Fall Seminars
October 11–14, 1998
Dallas, Texas
Le Meridien
Track I: Enterprise Networks
Track II: Marketing Your Student Services and Campus Security Issues

Winter Seminars
January 17–20, 1999
Sheraton New Orleans
New Orleans, Louisiana

28th Annual Conference
July 18–22, 1999
Nashville, Tennessee
Opryland Hotel Convention Center

It is surprising how a catastrophe can change our values. It's hard to see people's lives piled in a heap on the curb. The best you can hope for out of a disaster such as this is that you learn some lessons you never have to use.

—Rich Lehn

University of North Dakota

The ACUTA *Journal*

of Telecommunications in Higher Education

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The ACUTA Journal
of Telecommunications in Higher Education

Volume 2, Number 2
Summer, 1998

FEATURES

Focus: Disaster Preparedness

INTERVIEW

CAMPUS PROFILE

COLUMNS

President's Message

Margie Milone, Kent State University
ACUTA President, 1997–98

This is my final opportunity to speak to you through this column. Where has the year gone? Wasn't it just last week we were in Atlanta and my year as ACUTA president was beginning? I guess not; we're due in San Diego soon! The months go by so quickly.

I think I've grown during this year—personally and professionally. I've learned a lot about people and about myself, and I'd like to share some of these insights. (It seems appropriate that this issue focuses on disaster preparedness; if we don't learn lessons from our mistakes, our life will surely be a succession of disasters!)

1. Don't sweat the small stuff. I don't know who coined this phrase, but I believe it. What really matters is always people—not things, not money, not activities. Only people. Do you genuinely care about the people with whom you work, and do they know you care? Ask Rich Lehn, Jim Hebbeln, Jack Canavera, or Jo Ellen Schulz whose campuses have been turned upside down by disasters in the past few months. I suspect the number one concern, in every case, was the people. Things can be replaced. People need to know we care!

2. Realize your potential. Be all that you can be, and don't be discouraged when you reach for a star and get a handful of dust. Look carefully—sometimes there are diamonds in the dust. Some people compare themselves to others who seem more successful or live in a better house or drive a bigger car. These people constantly berate themselves for falling short. If we diligently strive to realize our potential, we will find happiness. It's usually the striving, not the arriving, that brings fulfilment. Only be disappointed in yourself when you fail to *try*!

3. Dare to dream. Imagination is to life like a spark to kindling. Without imagination, without dreams, we never reach. We never see beyond ourselves. We never outgrow minimalism.

I've said all that to say this: Chances are, you have a position of some responsibility on your campus. You didn't get there by doing only what you had to and resting on your laurels. But if you haven't taken stock lately, maybe it's time to do a little self-evaluation.

This issue of the journal focuses on disaster planning, but the bottom line is this: Being a good manager whether times are good or bad means being knowledgeable, prepared, and responsible. What we have to ask ourselves, wherever our position falls on the administrative ladder, is how well do I handle the demands of my job? Am I the master of my job, or does it master me? A personal checklist may help us evaluate our performance:

- Do I pursue opportunities to become more knowledgeable in my field?
- Do I actively seek ways to expand the scope of my responsibility?
- Do I manage my task load capably—without complaining?
- Do I have a reputation for being dependable—a can-do kind of person?
- Do I put the good of my institution ahead of personal motives as I make job-related decisions?
- Do I help the team I manage achieve their own goals in addition to our department goals by providing an open environment and encouraging innovation, creativity, and continuous improvement?
- Do coworkers feel comfortable coming to me for assistance or advice?
- Do I devote enough time to realizing the vision for my department or my institution?

When disaster happens—whether it's a cup of coffee spilled on a keyboard or a tornado that levels the campus—do you drive the solutions or are you part of the problem? I have left the expert testimony to the authors of articles in this journal, but I urge you to look around for room for improvement—and start at your own desk! And if you're one of the ones who have survived a real disaster, my hat goes off to you. I hope you will continue to share the lessons you've learned with the rest of us.

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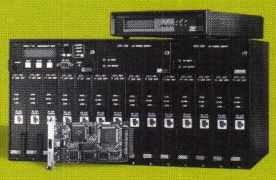

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It's a Disaster!

by David McDaniel

BMS Catastrophe Restoration Co. photo

Fire damage results not only from combustion, but from water used in fire suppression and subsequent corrosion, from the greasy soot generated by certain plastics, and from chemical fallout.

The Aftermath of Disaster

In the "Great Flood of '97," the University of North Dakota was devastated. Restoring more than 40 facilities on campus meant "de-mucking," removing debris, treating for bacteria, and dehumidifying.

At a Virginia university, a welding spark in an attic space started a fire. Residue from the fire extinguisher used to extinguish it settled throughout the attic, hallway, entryway, bathrooms, and most importantly, the laboratories. Although testing determined that the soot and fire-extinguisher contaminants were not corrosive to the electronic equipment, it was necessary to hand clean the structure and contents of the labs, decontaminate the HVAC system, and deodorize the facility.

While a disaster may need only a few minutes to cut a path of destruction through your campus, cleaning up afterwards and restoring critical systems or data may take weeks or months. What makes the process so difficult?

A Brave, but Vulnerable, New World

Although certain characteristics and procedures typify all disasters, each one is also unique. Technology has made today's disasters far more complex than they were just a quarter century ago, but it has also enabled us to deal more effectively with catastrophes than ever before.

One of the complications of disasters today has arisen from the marriage of data and voice. With the advent of digital transmission protocols such as IP telephony, ISDN, ATM, and SS7, the telecommunications world has effectively merged with the data-processing world.

The equipment used in each is similar in form and function. Both operations are computer intensive, demarcated at the peripheral level. The improved efficiencies of digital switching have concentrated large amounts of traffic into a small number of nodes. This concentration increases the vulnerability of the network to failures in these nodes, increasing the need for reliability and redundancy.

The downsizing of companies has further concentrated service centers into national response locations. A single facility failure can paralyze a corporation.

Two things can effectively reduce the downtime and cost of the loss in a catastrophe: (1) A thoughtful pre-loss equipment and facility design—that is, designing and selecting equipment that will limit or mitigate damage during a fire or other disaster; and (2) a carefully designed disaster response plan. Part of any response plan is stabilization of the loss site and protection of the contents. Prompt emergency action will control the damage resulting from contaminants and allow time for restoration of the equipment and facility. It is important to know what must be done immediately and to have materials available to implement the emergency action.

Planning is the best way to assure rapid resumption of business and to minimize the cost of a loss. A few years ago we talked kilobytes and megabytes of data storage; today, data storage is measured in gigabytes and terabytes. The storage of data and network information depends upon magnetic or magneto-optic media, and the process of recovering data from damaged media after the loss is tedious and expensive. Frequent redundant backups and offsite storage of media offers the best protection of digital data.

The Deadly Duo

Damage from fire and water results primarily from contaminants and corrosion. An analysis of this deadly duo reveals the specific agents of destruction.

• Contaminants

Fire generates both heat and combustion byproducts that are an integral part of the fog-like soot which condenses on cool surfaces. An average EDP center or switching office will contain six tons of polyvinylchloride (PVC) plastic. When heated, PVC generates hydrogen chloride gas. Combined with water, this gas forms hydrochloric acid, a very corrosive chemical. Other building materials will form sulfates and nitrates. Even fire-extinguishing chemicals such as Halon exposed to the high temperatures in a fire will degenerate into such products as hydrochloric acid, hydrofluoric acid, and hydrogen bromide.

BMS Catastrophe Restoration Co. photo

Fire damage accounts for staggering losses.

The soot generated by a fire which has consumed plastics and elastomers is a greasy, waxy substance composed of carbon, oxidized organics, and other byproducts such as those discussed above. The presence of carbon on the surface of electronic equipment degrades the dielectric performance, especially in high-frequency and high-impedance applications. Each fire will have its own unique chemical fingerprint in the soot, since the chemical components are determined by what burned, in what quantities, and under what conditions. The major concern in saving electronic equipment is the control of metal corrosion.

Particulate matter generated can threaten the integrity of data stored on magnetic media. Because of the high concentration of data stored on the surface, carbon particulate must be removed before contaminated media is used.

Water associated with floods or fire suppression also carries contaminants. Inorganic salts from building materials and particulate matter are deposited on circuit boards which have been exposed. The water's ionic content, acidity, suspended solids, and organic content is to be suspected.

• Corrosion

Acids react with metals to form salts. This process removes metal. When ionic substances such as chlorides, sulfides, and nitrates are deposited on a metallic surface with different types of metals in the presence of moisture, corrosion also occurs. This type of corrosion is an electrochemical reaction called galvanic corrosion. Once the metal is gone, it cannot be replaced. Other types of corrosion also occur, such

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as crevice, pitting, leaching, and intergranular. Unless all this corrosion is controlled, it will continue and cause electronic failure. The only effective long-term control is the removal of the contaminant with carefully designed cleaning protocols.

Measuring Corrosion Potential

The rate of corrosion is proportional to the amount of contaminant present. As mentioned above, the most common corrosive contaminant which occurs in a fire is hydrogen chloride. Quantitative tests should be run to determine the surface concentration of chloride. Properly used, the test can provide fast quantitative data on the concentrations of such chemicals found at the scene of a loss. If very high surface concentrations of chlorides are found, corrosion damage is imminent, and immediate steps must be taken to mitigate the danger of losing the equipment. The most effective means is lowering the humidity.

For military electronics the scale of surface concentration is bounded on one end by MIL spec 28809A, which requires no more than 20 micrograms of sodium chloride equivalent (SCE) per square inch (3.1 micrograms SCE per square centimeter). This is the definition of a clean board. Some manufacturers, such as IBM, have a more stringent requirement of 14 micrograms SCE per square inch (2.2 micrograms SCE per square centimeter). On the other end, experience by Bell Core labs in Hinsdale, Illinois, has shown that any PC board with a surface concentration level above 400 micrograms SCE per square inch (62 micrograms SCE per square centimeter) cannot be reliably restored.

The pH scale is useful in determining the presence of additional contaminants which are not detected

by halogenide testing (such as sulfates and nitrates), and to corroborate halogenide surface concentrations measured. Routinely pH values from 5.5 to 7.5 are found in testing. Values below this range are cause for concern.

Magnetic Media

One important asset which must be preserved after a disaster is the critical data on magnetic media. Media which has been exposed to contaminants should be examined by a professional before any attempt is made to use them. If an attempt is made to use a floppy disk with hard particulate matter on the surface, damage to the oxide layer may destroy data as the floppy spins. Water can dissolve the adhesive between the substrate and the magnetic oxide coating resulting in loss of data. Tapes must be dry and clean before any attempt is made to copy the data.

Hard disk data can be partially saved, even after a head crash. This process is very labor intensive and requires special equipment in a clean room. Contaminated media is replaced with clean media. Restoration of data is a process involving the emergency cleaning of the media so that data may be copied onto other media. The original media will be discarded (or archived). Remember:

- If exposed to flood waters, keep tapes wet until they can be restored. Use air-tight plastic bags, pack in a plastic-lined box, etc. Keep in a cool area (< 65 degrees F).
- Tapes must be cleaned within two weeks to avoid fungus growth.
- Do **not** attempt to dry with heat!
- A 95 to 100 percent success ratio is possible, predicated on 72- to 96-hour response.

Water Emergencies

1. Removing the water is priority one, but never assume people don't need to be reminded not to use electricity around water. Emphasize caution, both verbally and visually, by posting a sign:

   WARNING

   DO NOT ENERGIZE ANY WET EQUIPMENT

   REMOVE POWER

2. Open cabinet doors, remove side panels and covers, and pull out drawers to allow water to run out of the equipment.
3. Remove standing water with wet vacs. Use low-pressure air (50 psi) to blow trapped water out of the equipment. Absorbent cotton pads or diapers can be used to blot up water. Use appropriate caution around header pins and backplane wire wrap connectors to avoid bending.
4. Vacuum and mop up water under any raised computer room floor.
5. Equipment which contains open relays and transformers will require a special bake-out before application of power.
6. In the days that follow, watch for corrosion of mild steel hardware components. *The most effective means of corrosion control is to lower the humidity to reduce the reaction rate.*

Response Teams

To the uninitiated, soot-covered equipment which has been inundated with water often looks ruined. However, immediate action to preserve the equipment and avoid additional damage may allow the equipment to be restored to pre-loss condition. Restoration is the fastest and most cost-effective method to resume business operations. If you have identified, qualified, and contracted with a restoration company to use in the event of a disaster, a simple work order will initiate services when you need them. Many restoration companies will sign a pre-loss contract with no cost or obligation. When disaster strikes, responding quickly is critical to successful recovery. It makes sense to have your response team in place and to have given thought to how you will respond to a disaster.

David McDaniel is chief scientist for BMS Catastrophe Special Technologies Division in Ft. Worth, Texas. He is responsible for post-loss analysis, recommendations for recovery procedures, protocols, and remediation. His background includes eleven years as a member of technical staff at Bell Labs Digital Transmission Division, nine years as engineering manager for SIE Geosource, and three years as research director of PCES. Contact David at 800/433-2940 or by email at: dmcdaniel@bmscat.com.

SLCC: Lessons Learned

After a pipe broke underground, the floor of SLCC's print shop began to rise and buckle.

by Bill Robinson

Natural disasters such as the Mississippi River floods of 1995 and 1927 are the stuff of legend. But the flood that wiped out the telecom system at St. Louis Community College's Forest Park campus on October 23, 1997, was not the fault of "The Big Muddy," as the river is sometimes called. This disaster was the result of human technology gone awry.

At 3:30 that Thursday afternoon, an eight-inch underground water main supplying the fire-sprinkler system ruptured just outside one of the campus's four main buildings. Every minute for five hours, 1,600 gallons surged into the campus.

The outpouring could not be stopped because no one with the local water company knew the location of the sprinkler-supply shut-off valve.

Finally, a 30-year employee of the college, Roger Brendecke, recalled that the valve lay under the street where it had been covered with five inches of pavement over the years. With the help of a metal detector and a jackhammer, the valve was found and turned off, according to Jack P. Canavera, SLCC's telecom director.

LESSON LEARNED: Don't depend upon the local water utility to be able to shut off water flow when a main breaks.

SLCC has since installed—on college property outside its buildings—its own shut-off valves for water mains supplying the campus.

When a shutoff valve is paved over, the city expects customers, at their own expense, to dig up the pavement and raise the valve to an accessible level. The college learned this from television news coverage of the disaster!

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The Raging Torrent

What became a raging torrent had begun as only a trickle. Water leaking from a tiny hole in the main had, over time, created a huge cavity in the soil under the eight-inch pipeline. After enough of the ground supporting it had eroded away, the pipe collapsed and broke under its own weight.

When the floor of a basement print shop began to rise and buckle, college personnel knew something was amiss. Soon a wall and then the floor of the print shop were breached by the subterranean current. Water that had filled the print shop gushed through the hole in the floor to a sub-basement where the telecommunications switch was located. As the water gained momentum, it created a giant whirlpool that scoured everything in its path. Walkways and utility tunnels connecting the campus's four main buildings allowed the water to reach two other buildings.

As the water continued to gush unchecked from the ruptured main, the St. Louis Fire Department sent 15 pumpers to the campus in a noble, but futile, effort to pull water from below ground. Fire-fighting pumpers are not designed to lift water out of low lying areas. The differential between street level and the basements was beyond the efficiency of the pumpers.

LESSON LEARNED: Equipment designed for one purpose may not be suited for other, even similar, purposes.

Counting the Losses

By the time the tide was stemmed, considerable damage had been done to the basement and sub-basement areas of three buildings, Canavera reports. The campus's SL-1 phone switch was immersed in four and a half feet of water. Fiber optic and other communications equipment were either submersed in water or exposed to levels of humidity beyond the limits of their manufacturers' warranties. Other losses included an asynchronous transfer mode LAN/WAN system, an electrical substation, environmental controls for the cooling and heating system, boiler equipment, fans, motors, duct work, and insulation. Serious structural damage was also done to walls and floors.

Michael Petz, video engineer at SLCC, points to the high point of the flood, which reached 4.5 feet above the floor of the switch room

The Effort to Recover

"Through truly a Herculean effort by various college staff, vendors, and contractors," says Canavera, "the campus reopened for its 6,000 students on Monday, November 3, eleven days after the disaster struck.

GTE, the college's telephone maintenance vendor, flew in a Nortel Option 11 over the weekend of October 30 as a temporary replacement for the SL-1 that had been bathed by the flood. The telephone switch room was given what Canavera calls "a cursory cleaning" the following Tuesday by a crew from CATCO, a disaster cleanup company. "This meant shoveling the mud off the floor," he explains. The next day Southwestern Bell, the local exchange company, completed a rough cleaning of the D-mark. By that Thursday a mobile electrical generator was powered up to provide lighting and drive dehumidifying equipment.

"That Friday we set up a recovery command center in a college building a block away from the Forest Park campus," Canavera continues. Southwestern Bell ran phone lines to this building the same day as ordered, and basic communication was established via seven 1-FB circuits and voicemail provided by SWB.

Queens vs. Worker Bees

The campus telecom system with its 40 trunks had served 750 phones, but the temporary switch could support only 56. Canavera had already ordered seven cellular phones from Nextel and 25 others from AutcoCellular/Ameritech for emergency use. The college president's office then assigned these 88 phones to college personnel based primarily on rank.

College staff who had no phones received communications from runners who brought them from a campus message center equipped with a cell phone and fax machine.

LESSON LEARNED: Chief executives tend to allocate resources to ranking administrators while overlooking the "worker bees" who provide the essential services that make an institution function. Land-line phones should have been assigned to people who actually perform necessary services, such as department secretaries, while upper management should have been given cellular phones, Canavera says.

Installation of the temporary switch began on Sunday, October 31, but wasn't completed until the next day because wiring records were very poor and system programming was on water-logged floppy disks.

LESSON LEARNED: Keep a copy of your system programming and other documentation off site. Don't depend on your maintenance provider to do this. If you do, let them show you where they keep this material.

The floppy disks and system hard drives were sent to OnTrack, a firm that specializes in recovering data from disks and drives. The cost of recovery, completed about two weeks later, came to about $1,000, plus shipping.

Backup data is now kept in two locations. The maintenance vendor keeps one copy, and the college keeps another at an off-campus location.

Follow the Tone and Wait at the Door

Without detailed, up-to-date diagrams to guide them, technicians attempting to restore telephone service had to "tone trace" wiring from phone jacks back to the switch room wiring frame. With minimal communication, this was no easy task. Cellular phones could not penetrate to the basement. Another obstacle was locked doors. "Pass keys did not open all the locked doors we encountered as we struggled over the weekend to restore service," Canavera points out.

LESSON LEARNED: Have access to all doors that block access to telecom equipment and cabling. The college security department plans to inventory and verify all door locks on campus this year.

"Acknowledging to my professional peers that we didn't have up-to-date, detailed wiring diagrams on file is embarrassing," Canavera confesses. "But how many of us have the resources to take the precautions necessary to minimize the impact of an unpredictable disaster?"

As is the case with many telecom professionals who serve the growing needs of higher education, Canavera's attention is spread rather thinly over several wide areas. These areas are wide in terms of distance as well as professional competence. Forest Park is one of four SLCC campuses serving 50,000 students, plus 3,000 faculty and staff. The four-campus system is serviced by four telecom switches as well as two smaller systems. Canavera's staff consists of one outsourced technician, a secretary, and a video engineer. A request for a telecom analyst in his budget proposal last year fell on deaf ears. "We have to pick and choose priorities as best we can and hope for the best," he laments.

More and More Problems

This experience also brought out the importance of short-term as well as long-term backup. After eight hours of work, programmers had the Option 11 configured, but the switch reset itself before the programming could be saved. And, it had to be programmed again.

Other problems included handling the crush of direct inward dialing traffic after limited phone service was restored. "Since the vast majority of DID phones were going to be down, we added a second operator console to handle the DID calls that would default to the operator," Canavera explains.

"With the enormous number of calls made once people again had phone service, we could have used five consoles. During the days without phone service, calls to the Forest Park campus's main number were transferred—via an SWB routing service—to an announcement mailbox at the SLCC Administrative Center switch in downtown St. Louis. This worked well, and we probably should have continued using it for a few more days to give out the working DID numbers rather than depend on the two campus consoles to handle all the traffic," Canavera recounts.

LESSON LEARNED: Although you may prefer to provide live operator service after a disruption such as this, an automated process probably can provide information to users more smoothly and consistently.

The loss of fiber equipment such as lasers and multiplexers was another severe blow. "The four metropolitan campuses and administration center are linked by fiber," Canavera notes. Communication between campuses that would have been handled by the fiber now had to use Southwestern Bell trunks. At times, this extra volume blocked external calls.

In addition to voice communication, connection to the campus mainframe, telelearning. and teleconferencing services was also lost. Since video services were out, the college had to give students the option of attending these courses at other campuses or allow them to drop the classes with a refund. Data services that connected the mainframe to the stricken campus were restored in limited fashion with dial-up lines between the administrative center and the campus.

The Insurance Conundrum

Getting the insurer to cover replacement costs was one of his biggest challenges, Canavera found. "We obtained the okay from our insurance company on October 31 to permanently replace our ruined SL-1 with an Option 61-C, but this approval did not come easily," he recounts. "GTE provided us with a detailed list of components for the replacement switch, but this was not enough for our insurer. We then had to provide the same detailed list for the damaged system. This required creating a bayface layout [schematic drawing] of the old system," he explains. "Then the two configurations had to be reviewed by an insurance 'expert' to verify that we were indeed replacing with 'like kind.' This process went quickly despite the fact that the SL-1 and the Option 61 are truly a generation apart," Canavera adds.

The Dark Side of the Fiber

Insurance coverage of fiber optic equipment was another thorny issue. SLCC's insurer agreed to replace all equipment that had been submersed. But it balked at replacing lasers and multiplexers that were untouched by the water, even if only an inch or less above it. Although the manufacturer of the lasers said the equipment should be replaced, the insurance company at first thought otherwise.

The laser vendor's representative opened a fiber connector and observed a drop of water on the end of the fiber housed within the card. No one from the insurance company saw this, however. "We knew that the entire fiber system was under battery backup power as the water climbed the fiber rack," Canavera adds. "But we had no idea what kind of voltages were applied to the laser during this period."

Then the other shoe dropped. The manufacturer refused to test the equipment because it was out of production and feared exposure to liability if the equipment worked initially and then failed.

LESSON LEARNED: Don't do initial damage assessment without an insurance representative present.

Eventually the insurer agreed to cover the cost of one remanufactured fiber mux. SLCC chose to purchase two new fiber muxes, however. "The units we had used are out of production," Canavera explains. "We have done enough research to know that when you buy a fiber mux, you usually buy two, a matched pair—one for each side of the dark fiber line. We were unable to find two remanufactured muxes of similar vintage, however. And the manufacturer could not guarantee compatibility."

Excess humidity and the ambiguity of warranties also threatened to jeopardize a major investment SLCC had made in asynchronous transfer mode in advanced technology. "We had recently installed more than $300,000 worth of ATM LAN/WAN equipment in a room that had two inches of water on its floor," Canavera notes. A manufacturer's representative who inspected the site said the company would no longer honor the warranty since the equipment was probably exposed to levels of humidity exceeding its specifications. This decision also eliminated technical support via telephone provided during warranty. And the local vendor who maintains service contracts for ATM equipment declined to take it under a maintenance agreement. To make matters worse, SLCC's insurer said the loss of warranty was not its responsibility.

After some long and serious bargaining—the negotiators were held in a locked room for the final session—SLCC and its insurance company agreed to a resolution. Instead of attempting to replace the existing equipment, the college would go ahead with the purchase of new equipment that it had planned to acquire in the future. The insurance company agreed to test the old equipment and reimburse the college for any found to be moisture damaged.

Getting to Higher Ground

To help ensure that a similar disaster would never recur, Canavera insisted on moving the switch room one floor above its previous location, but still below ground. This level had two inches of water on its floor during the flood, but was still regarded as a safer environment. "We thought the insurer would be happy since the move should lower its risk," Canavera explains. But the insurer would not cover the cost of constructing and connecting a new switch room.

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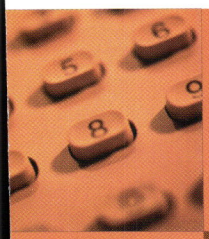

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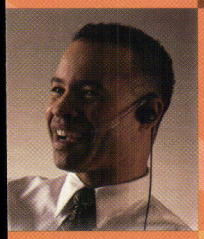

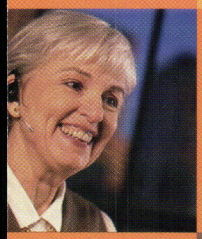

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On Friday, November 21, with construction to begin the following Monday, the college trustees approved the additional expense, about $30,000.

As a public institution, SLCC had to take bids for this and most other work. Bidding requirements lengthened total recovery time by at least three weeks, Canavera estimates.

Total losses for the entire campus from the disaster amounted to nearly $8 million. Just how much will be covered by insurance remains unclear since claims are still being submitted. Losses related to telecommunications totaled about $800,000, with perhaps 85 percent to be covered by insurance.

Getting Back to Normal

Canavera turned on the campus's new Option 61-C at the end of the day on January 1, 1998. "It was down to the wire with some snafus that didn't allow for a pleasant Christmas break," he reports.

Air conditioning for the switch room came on-line December 22, and Northern Telecom got the dark fiber up the next day.

The wiring contractor's job was to splice about 3,000 pairs of in-house cable and run them to the new switch room. This was to be completed by December 23, but on the 23rd Canavera was informed that it wouldn't be finished until the 31th. After he protested vigorously, this date was moved up to the 30th.

Southwestern Bell was to move the D-mark by December 26. While the Bell cabinet was moved by that date, the Bell IDF facility was still incomplete on the morning of the 30th. Canavera called SWB only to learn that the SWB construction crew responsible for the relocation had not turned the job over to the SWB installation crew responsible for the IDF facility. And no one would be available until the morning of the 31st. Then, because SWB was short staffed, a construction person was sent to build the IDF. This person had never done this before and built a facility that was ordered by wire pair rather than by trunk group. But the job was finally completed by 7 p.m. on the 31st.

When Canavera complained mightily to SWB about the quality of the work, he was relieved to learn that the work was only temporary and the best that could be expected during the holidays. SWB rebuilt the facility correctly on January 5 and 6.

SLCC's maintenance provider, GTE, worked until early evening on January 1 to cut in the trunks and bring up service to the campus.

College staff returned on January 2, while faculty returned on January 5. "We spent the week of the 5th handling trouble calls—150 the first three days—resetting many voicemail passwords," Canavera relates. "Many people on campus did not read or understand the memo I sent informing users of their new six-digit passwords."

On Monday, January 12, Canavera declared the crisis over.

Reflection

Canavera has asked the college to conduct a formal review of the recovery. The proposed topic: What policies or procedures of the college hindered the recovery process? As of April 16, the college had not responded. "Some have the mentality that this will never happen again," the telecom director surmises.

Canavera is grateful that the SLCC trustees streamlined purchasing procedures by waiving board approval for items costing $500,000 or less. The college was unwilling to waive any other administrative procedures that held up the recovery, however.

When faced with a catastrophic emergency, Canavera would like to see bidding and other processes streamlined. Following standard bidding procedures for construction of the new telephone switch room delayed the overall project by three weeks, he estimates. "Then there are the time, effort, and expense needed to secure performance bonds, draw up short contracts, conform to prevailing wage agreements, and other red tape," he adds.

Such delays, along with the need to have telecommunications fully functional by January 1, 1998, put Canavera in a real bind. Since construction of the telephone switch room had to be completed first, any lack of performance by this contractor necessarily compressed the time available to contractors performing subsequent work. "We ended up with multiple contractors working within the room at the same time. Mix in the holidays, and this was a real nightmare," Canavera recounts.

"I guess I should feel fortunate that starting with no walls and utilities, we built a room, installed equipment, and had the whole thing cut over in five weeks," he concludes.

A frequent contributor to the ACUTA Journal, *Bill Robinson is a freelance writer living in Richmond, Kentucky.*

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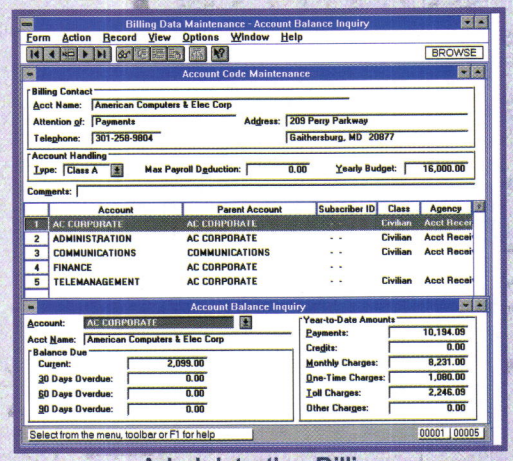

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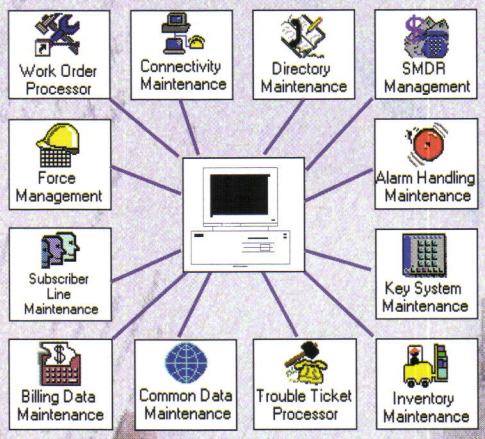

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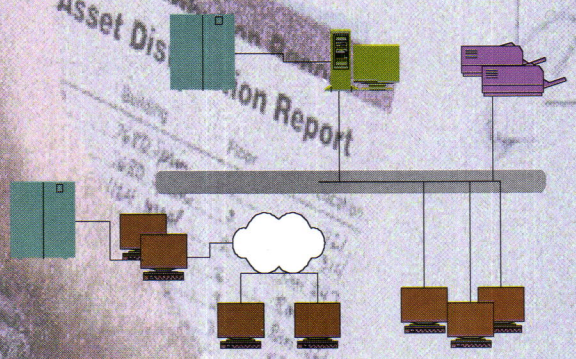

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Working with Wide Area Networks:

Minimize Risks and Prepare for Disaster

by Ron Kovac

Reducing the computer from room size to desktop had perhaps the most significant impact on office culture of any of the events in this century's technological revolution. The '80s—the decade of the personal computer—saw PCs become standard office equipment, and hardware and software created a whole new industry. It was not until the late '80s that personal computers were recognized as islands of information whose power could only truly be harnessed with networking. Rightfully, the '90s became the decade of networking, and initial focus was on the local area network (LAN) as the most immediate need within the college environment.

Recently, with the many changes in the way higher education accomplishes its purpose, attention has begun to shift to the other side of networking, the wide area networks (WANs). Once the domain of RBOCs and large corporations, the WAN is now a necessity for even the smallest of colleges due to the proliferation of telecommuting, regionalization of colleges, and expansion of distance learning and the Internet. What's more, these WANs need to look and feel like a local network and maintain the same uptime, even though dispersed over a region, state, or even the country.

WANs have vastly different characteristics from LANs, and therefore their implementation, management, and disaster planning are unique. WANs incorporate innumerable elements (switches, wires, and electronics) and are worked on by a number of people (intentionally and sometimes unintentionally). Adding to that the unpredictable forces of nature and the fallibility of human systems, it is easy to see why any network can fail. It works so well only because of the steps taken to minimize risks and prepare for disasters.

A Case Study

The State University of New York, also known as SUNY, is the largest state university system in the country. Consisting of four university centers, two medical colleges, thirteen four-year colleges, and a host of community colleges, the system has over 60 entities scattered around the state. The diversity of interests and goals of these entities is paralleled only by their diversity of technical infrastructures. One of their commonalties lies in the need for a common infrastructure to enable communications with the SUNY system administration office located in Albany and among the various entities of the system. Although each college established its own form of LANs, communication between colleges was seen as a luxury, and communication with

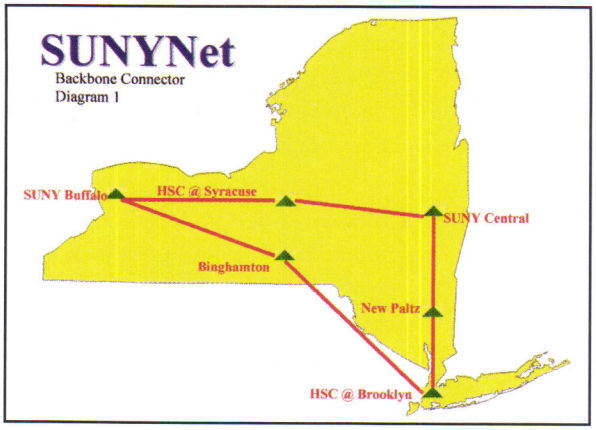


Diagram 1:
SUNYNet backbone

system administration was inefficient.

To meet the communication needs between colleges and to make communication with SUNY system administration more efficient, a comprehensive WAN was required. SUNYNet was charged with this task. SUNYNet was to provide the necessary communication between these 60-plus entities and with SUNY system administration for financial processing purposes. Additionally, SUNYNet was to provide the gateways to other networks such as the Internet, the Department of Labor network, and the state controller's office network.

Network Requirements

To meet the needs of the SUNY community, it was first necessary to look at the protocol and traffic requirements. To accomplish the tasks, the WAN would have to transport essentially three types of traffic: (1) SNA and bi-sync traffic between the various entities and system administration for the Enterprise Legacy systems; (2) DECNet for an integrated and comprehensive library system; and (3) TCP/IP-based traffic for e-mail, Web access, distance learning, and other applications.

WAN Backbone

To meet the traffic needs, a network backbone consisting of dual T1 links was created (Diagram 1). These T1 links connect various backbone sites within the state. Each backbone site is in a different LATA and is hosted by a regional SUNY site. T1 lines for the backbone are leased from an interLATA provider and are bid through a formal RFP process every few years to secure the highest quality and lowest cost. The T1 links are hooked into intelligent T1 multiplexers at each backbone site. These multiplexers are able to allocate bandwidth for the various loads on the system and are able to adjust bandwidth and traffic flow dependent on the availability of lines. A high degree of fault tolerance is designed into the system, and the design allows for three of the four lines entering a backbone site to fail while still maintaining critical communication within the region.

Network Nodes

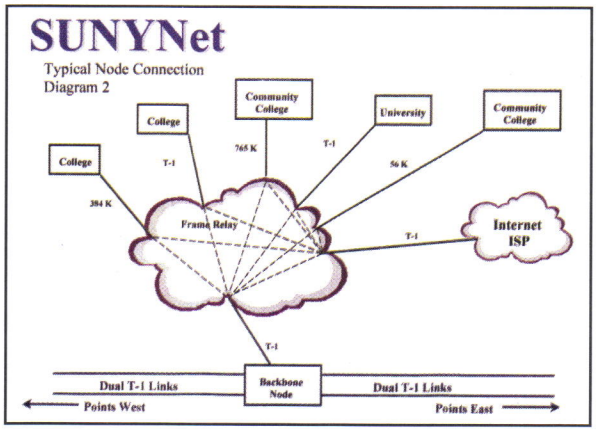
Connecting to each backbone site are the various regional colleges and universities (Diagram 2). These, by and large, are within the same LATA, so telecommunication costs are kept to a minimum. All the connections from the node sites are made to the backbone site through frame relay. SUNYNet began moving into frame relay in the early '90s and completed the migration in 1996. The impetus for moving to frame relay was primarily cost, but other factors also influenced the decision. The ability to put virtual circuits between colleges (that did not have to go through the backbone site) and the ability to use frame relay for minimizing risks were very appealing.

Additionally, less equipment is required at the backbone sites (one DSU versus fifteen DSUs), resulting in fewer points of failure, lower costs, and reduced power and space requirements. Each college entity, depending on its needs, selects an appropriate connection speed: 56K, 384K, 768K, full T1 bandwidth, and T3 for frame relay.

Even with all the potential points of failure, SUNYNet is able to maintain a very high uptime percentage (exceeding 99 percent) by the incorporation of various strategies. Each of these strategies is unique to a WAN environment and, combined, form a powerful way of minimizing failures. The three strategies employed are:

1. Managing the vendor
2. Designing for disaster
3. Planning for failure

Diagram 2: SUNYNet typical node connection



1. Managing the Vendor

Unlike the local environment, a WAN operates pretty much outside of your direct control. In a sense, outside vendors and their staffs are responsible for your performance. You are leasing space or capacity, and this is *not* under your control. Typically these vendors are the telephone companies, but with the '90s comes a host of other potential players (cable TV, power companies, etc.) This is not to say there is nothing to be done; there are various strategies to minimize risks. While these systems may be out of your direct control, they still need to be monitored in order to maintain desired levels of reliability and performance.

• The RFP

The first strategy to use is the RFP. The request for proposal defines the relationship between you and the vendor, specifies your desires to the vendor, and determines your network reliability. Be sure to include the following in any WAN RFP:

Route diversity. If a high rate of reliability is required between sites, multiple lines and route diversity need to be requested. Most vendors will choose to provide your lines and circuits in the same bundle from site to site. This will create a single point of failure. An errant backhoe or cherry picker could, in one fell swoop, wipe out your WAN connection and therefore your network. Depending on the distance and the availability of vendors, various levels of route diversity can be requested. Contact your local vendor and request the options and prices. Remember, if you don't specify route diversity, you won't receive it.

Diversity maintenance. Often you pay for and get route diversity at the start, but as the vendor's network evolves and repair work is done, the vendors migrate your diverse paths back into the same bundle! Route diversity must be requested and maintained with the vendor. After requiring it in the RFP and verifying you received it, you should make biannual checks to guarantee that your request is being maintained. Route diversity, verified via a routing diagram, will (in painful detail) provide all the wires, electronics, and locations that involve your circuits. Typically you and your customer service agent will be surprised about the amount of change in a six-month period.

> An organization must have a disaster plan that does not rely on technology, and this plan should be tested periodically to ensure that all parties know how and when to implement the plan.

Transmission medium. Unless you request otherwise, you will get the cheapest medium that the vendor has available. Frequently this consists of one or many microwave links. Microwave links, although generally reliable, are very sensitive to atmospheric disturbances. Large thunderstorms and snow squalls may put the signal down in the gutters, especially for data. It is difficult explaining to your campus that a thunderstorm in another part of the state is affecting your communication (especially when the sun is shining at your site). It is suggested that you specify *all* hops be in terrestrial cable (either copper or fiber) to maintain the same level of reliability that your local network has.

These and other elements need to be weighted and ranked properly in the RFP and your evaluation-ranking sheet so you are not subject to the lowest-bid trap. Technical merits should be weighted equally or higher than cost. This ensures that the vendor will give the RFP due consideration and that you will not be setting yourself up for a disaster.

• Relationship Management

A second strategy useful in managing the vendor is in the area of relationship management. When disaster strikes a WAN link—and it will due to the scope of the network and the number of diverse elements—remember that yelling over the phone does not work. It may make you feel better, but that's all. When a true disaster strikes, the problem needs to be elevated with the vendor. The effectiveness and timeliness of these resolutions are usually related to your relationship with the company. If you have been meeting, at least yearly, with people on the escalation list (which, of course, you requested in the RFP), you will know the scope of their control and the extent to which they can assign resources to effect a resolution to your problem. These are people you will call on infrequently (only in times of disasters), but when you do, you will want action. If they and you can associate names and faces with a relationship (however limited), it will help the situation immensely.

2. Designing for Disaster

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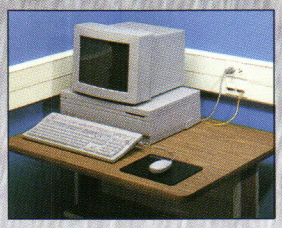

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interference from people (both intentional and unintentional), and natural events, the design of the network must account for failures. Failure of links and circuits must always be kept in the design equation for they are far more prevalent in the WAN environment than the LAN environment. The ring topology fits the bill. It both redirects traffic in case of a line failure and provides a level of redundancy over and above the network layer.

The ring topology is excellent for a backbone design, but most academic institutions will not be involved with this scope or complexity. But even with a single-line WAN, it's best to have a contingency plan beyond dusting off your resume. A few cost-effective options are available that can prevent an event from becoming a disaster:

- Allow for an alternate path for data via ISDN backup. The cost for ISDN backup, which has grown in popularity recently, is minimal compared to the insurance it provides.

Implementing an ISDN backup requires an ISDN card (for the routers at the local and remote site) and an IDSN line. Currently ISDN monthly charges are minimal—about the same as a POTS (plain old telephone service) line. Of course you would incur ISDN usage charges also, but only during the use of the line, which means during a disaster. At that point, such charges will probably be irrelevant as you will be the hero of the day. Although a single ISDN line will not provide the transmission speed that your dedicated WAN link did, it will provide enough for the critical information flow. An interesting option available would be to use the ISDN line capacity for peak periods rather that upgrading the WAN line. Depending on duration of the peak period (number of hours of usage charge incurred), this may be a cost-effective way to alleviate peak period slowdown.

- Another approach is using POTS lines for backup. Similar to the above scenario, the line would be used when the primary WAN line ceases to exist. An upside of this approach is that a POTS line can be transferred from another use (incoming fax line for example), negating the monthly charge for an additional circuit. The downside to this approach, versus an ISDN circuit, is speed. A 28.8K modem cannot compare with a single 56K channel of an ISDN line.

- Another alternative that takes into account a regional failure is VSAT. VSAT (very small aperture terminal) technology has become affordable for backup purposes. Small, portable devices are made specifically for this purpose and units can be maintained at a central site. If a remote region loses all communication lines (due to a failure at or around a regional POP), voice lines, data lines, and even your well-planned ISDN backup lines will be useless. A portable VSAT can reestablish these links within hours.

Another item to consider is fully using the technologies available through your vendor, such as frame relay or DACS (digital access and cross-connect system). SUNYNet uses the flexibility of frame relay so that each backbone region has its own Internet connection (multihoming). This allows for consistent access to the Internet even with complete SUNYNet backbone failure.

Failure Planning: The Last Step

Even with the most stringent RFP, the closest monitoring, and the optimum failure design, WAN links will fail more often than local links. With WANs, there is always a fair degree of danger and risk for losing the line.

An ultimate backup plan, consisting of paper transfer, must be thought out. Mission-critical applications, such as payroll, must go on regardless of telecommunications failures or even power failures. Both of these together are abnormal but certainly not unheard of, especially in an El Nino year. An organization must have a disaster plan that does not rely on technology, and this plan should be tested periodically to ensure that all parties know how and when to implement the plan.

Conclusion

There are certainly no foolproof mechanisms to avoid disasters in any technological environment, especially with wide area networks. But a well-thought-out strategy will reduce risks and effectively deal with failures that do and will occur. We owe the implementation of these strategies to our customers and to our institutions.

Ron Kovac is currently a professor at the Center for Information and Communications Sciences at Ball State University. His areas of expertise include WANs, network security, the Internet, and educational technology. He has consulted with numerous firms and educational insititutions around the country.

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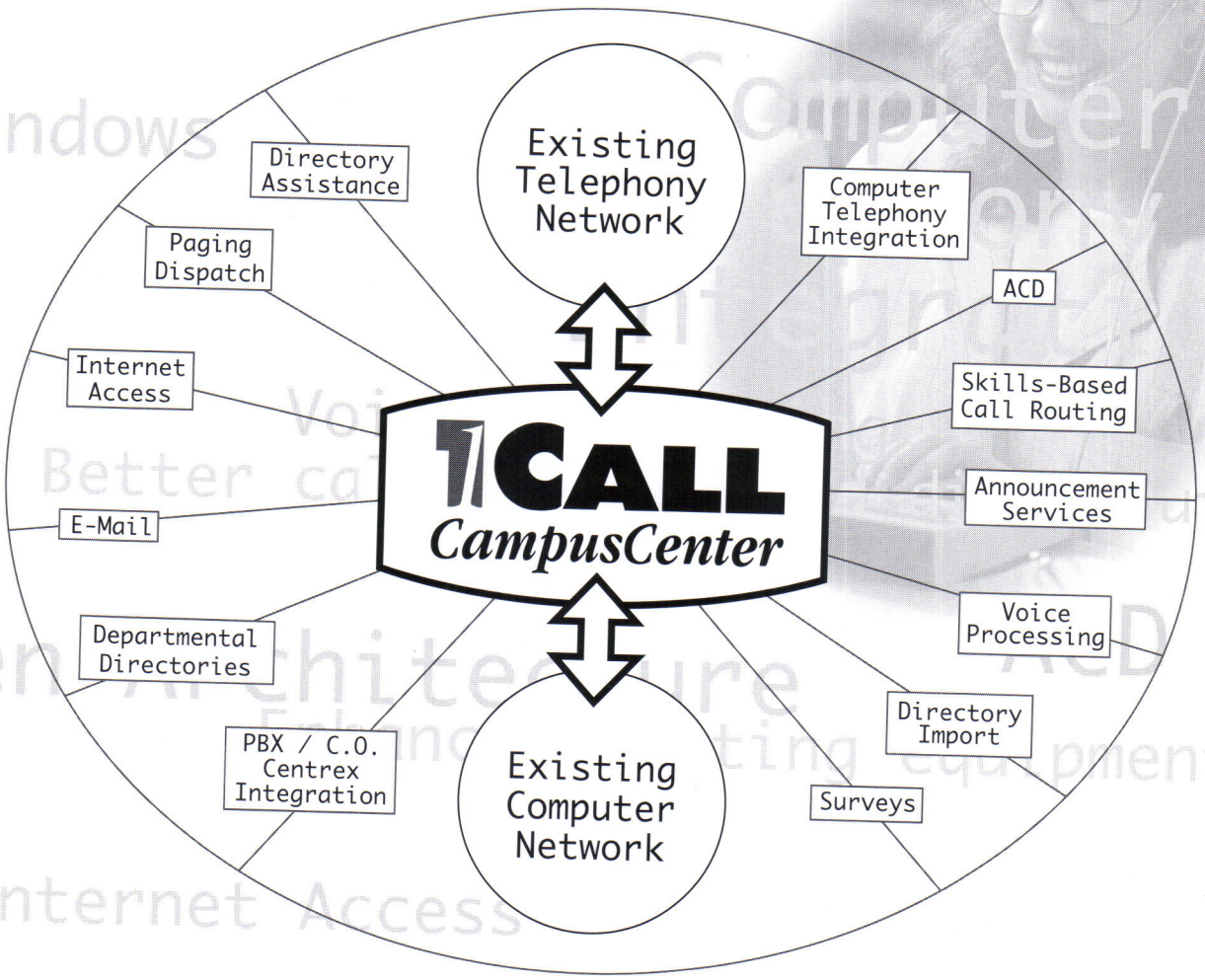

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Wireless to the Rescue

New wireless technologies may reduce the amount of time you spend "sweating the small stuff" when major disaster strikes.

by Curt Harler

When crunch time comes during any disaster—whether storm, fire, or power outage—everyone involved in safety, security, and rescue will demand communications ability. There are a lot of options for providing communications. The key is to plan ahead. Little things (like D, AA, or those tiny AAA batteries for pagers) can become major stumbling blocks in disaster recovery communications. If the situation persists more than a few hours, batteries and flashlights will be more important to the communications effort than any other single factor. Whether the boss is assigning a task or an emergency worker is calling in for advice, often the only way to stay in touch is over wireless or cellular phones.

Wireless radio and cell phones save time and travel and are a safety feature for employees involved in disaster recovery.

"The big push in the industry is being made by wireless carriers who ask users to give them a part of their phone business today and have the wireless available to provide network diversity if there is a problem," says Ben Tartaglia, executive director of the International Disaster Recovery Association (IDRA), in Shrewsbury, Massachusetts.

Firms like WinStar Telecommunications in Tysons Corner, Virginia, offer full-time wireless network service which can be used to provide alternate routing in many situations. As with any disaster program, some preplanning is necessary. Building a 38-GHz wireless network could require five to ten days. The project requires line-of-sight to the point of presence (POP) and has a distance limitation of 1.2 miles in a city like Boston.

"With a cable cut, a school can lose multiple vendors at once," notes Nancy Roth, senior national accounts manager for WinStar. At that point, wireless DS-0 and DS-1 service can become the main routing between the wireline and wireless POP. Using APS (automatic protection switching), traffic is automatically switched between the networks and then rerouted when the wireline network comes back up. If the basic network is in place, it is possible to upgrade the wireless to DS-3 overnight by swapping radios, Roth says.

Smaller Radios

Much is available in the handheld arena, too. Often the grounds crew and building maintenance staff will have a collection of radios available for daily use. Some units may be available for disaster backup, although it is likely those units will already be in use by those departments. The Radius GP350 from Motorola is a popular, rugged portable unit. It is available as a VHF or UHF model and comes with programmable frequencies, multiple private lines or digital private lines, programmable power output, programmable internal VOX, time-out time, and the Quik Call II feature for paging. The 16-channel model includes priority scan and signaling capabilities. A two-channel VHF unit, which operates in the 146–174 MHz range, will cost about $730. The 16-channel version is about $100 more. For the UHF models, running in the 403–470 MHz range, add about $50 to the cost of either of the VHFs.

Icom, America, based in Bellevue, Washington, has a pair of simple, portable radios with a minimum of switches and keys to keep operation easy. The IC-F3S is the VHF model and the IC-F4S is the UHF model transceiver. Both use SmarTrunk II for telephone interconnect and unit-to-unit calling. Conventional mode with CTCSS and DTCS encode/decode is available for operation in out-of-service areas. The VHF units operate in the 163–150 or 146–174 frequency range. The UHFs are keyed to 400–430 or 440–470 MHz, according to version.

Maxon has a good line of two-channel and four-channel radios, especially suited for areas where interference is not expected to be a problem or for applications where cost is a major consideration. The CP-0510 is a five-watt VHF unit with a forgiving, flexible whip antenna. It comes with a charger, belt clip, and one-year warranty for under $190 at most distributors. Maxon also makes a line of mobile/base-station radios.

Another line of low-cost units is put out by Uniden. For under $150 they have a two-watt, single-channel model available in a range of fixed VHF or UHF frequencies.

> During one multiday disaster caused by flooding, it was a life-saver for those of us in the field to know that a fellow was coming around with batteries for communications equipment, spare bulbs for flashlights, fresh units to replace failing ones, and fresh coffee...

All come with a rechargeable battery and a one-year warranty. Uniden's top-of-the-line SPH225 and SPU554 are far more powerful and feature 99 channels and a phone-like keypad as standard features. They are programmable by channel for 12.5–15 kHz narrowband or 25–30 kHz wideband operation. That feature allows compatibility with the mixed narrowband/wideband systems which will become more common as the new FCC rules are applied to the marketplace.

Several dealers, including Radio Shack, offer CB-band walkie-talkies. Good for short-range use, or linking to a mobile unit with a CB radio, they can provide good service as long as the operation can find a channel that is not being used by locals for chit-chat or the conversation is nothing confidential or requiring discretion. Watch out for GMRS units. That means general mobile radio service and the radios are intended for personal use only. Sometimes they are marketed as "family" radios. While they are fine radios with decent range (up to two miles) and features, commercial use of the radios is not permitted.

Buying the extras

Depending on the application, a number of add-ons make using the radio more effective and more convenient for people in the field during a disaster. Headsets are handy for workers to use in noisy environments or when they need to perform a function (like a repair) and still have both hands free while someone back at the base talks them through the procedure.

A whole host of antennas are available, both for base stations and for mounting on pickup trucks or other mobile units. Remember, in a disaster it is likely that some workers with 4 x 4s or similar vehicles will volunteer their personal transportation for the common good. For this reason, a variety of mounts should be considered, such as those with screws for mounting on the car's side gutter and those with magnets for the roof or trunk. In buying a VHF antenna, the higher the gain figure the more expensive the antenna is likely to be. Expect to pay about double for a 4.5 dB gain unit compared to the asking cost for a 3.0 dB unit.

For base station radios, consider an extra-long microphone cord. It can be a real lifesaver when you

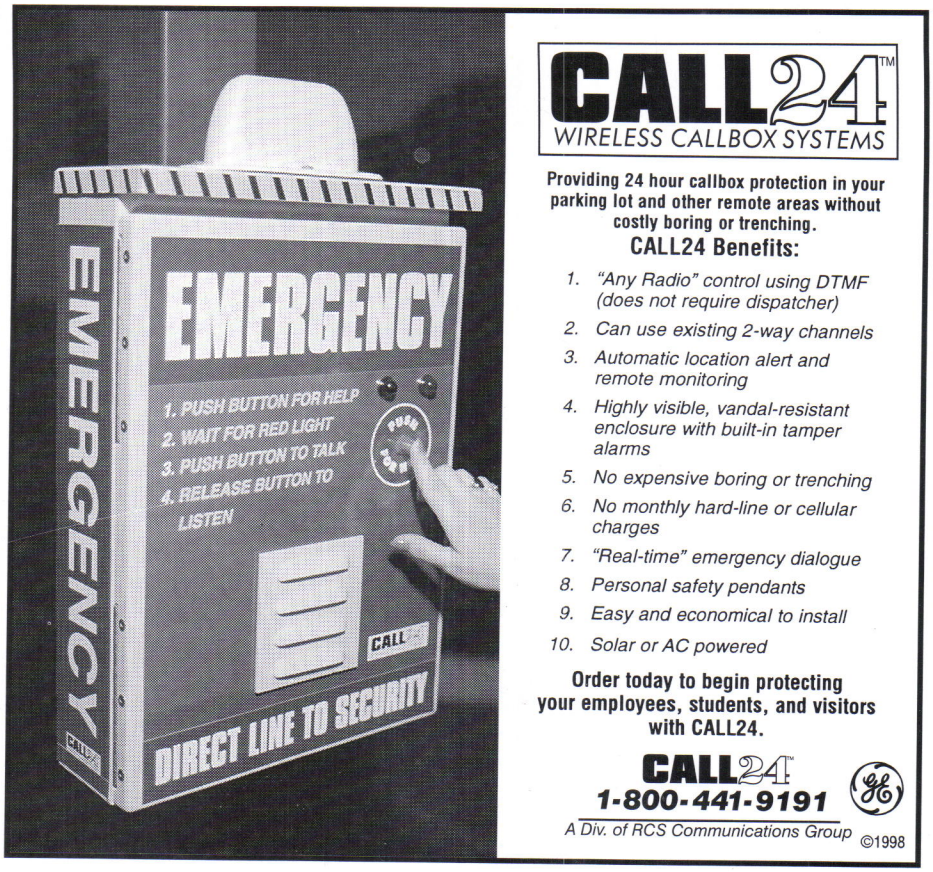
are trying to maintain radio contact and pull the right folder out of a cabinet.

When considering any purchase, take the radio and play with it for a while. If it will be used with a belt holster, wear it and see whether the antenna pokes the wearer in the ribs. Heavy is good if it means tougher design; heavy is bad if the unit will be carried around on a belt or in someone's hand for a long time.

Many firms are designing units which look more presentable. "Two-way radios are being used in a variety of businesses that want a cut above the old brick-style radio units," says Sal Farina, Uniden's national sales manager. He notes that ergonomics and visual aesthetics are key considerations in portable radio design.

More likely, simple availability of equipment is going to be a challenge in any disaster that lasts longer than a few hours. Set up your sources well in advance. Be sure the local electronics store is going to have a half-dozen walkie-talkies available for you at a moment's notice. Make arrangements for someone to open the shop if the disaster occurs after hours. Be sure someone knows how to configure the radios so they all will operate on the same channel. Be sure the channel is available and not assigned to some other group that is likely to be involved in a separate recovery activity during a disaster.

Portable battery packs are convenient to have for those who will be out in the field for a long while. So are fast chargers. If a lot of radios are in use, consider a gang charger. They usually will recharge a half-dozen or more radios at once, and they eliminate the mad scramble to find open power outlets at the end of the work day.



One good commercial source for accessories (as well as radios from many manufacturers) is BearCom. Headquartered in Dallas, the company has outlets in many major cities. Consult catalogs from Radio Shack, Lafayette, and other electronics outfitters before making decisions. Bear in mind that there is a lot more to efficient power systems than just recharging the battery.

The need to plan purchases ahead can not be over-stressed. In a disaster three years ago in New York City, a Fortune 500 firm tried to buy 1,000 of any type IBM-compatible computer to replace those lost in a fire. They found it impossible to fill the order, even after going to multiple dealers in the greater New York area. There simply were not 1,000 machines available, and they ended up purchasing a few boxes here and there until they were up to two-thirds of their immediate requirements. If as commonplace an item as an IBM PC is not available, think of the hassle you'll encounter tracking down specialized radio equipment under pressure.

Finding batteries in quantity can be an equally tough task, especially for the communications manager unlucky enough to have a disaster shortly after Christmas. If the disaster appears likely to be a protracted one, have workers pick up supplies of batteries from unlikely sources like drugstores and groceries as they make their way to disaster central. Keep the disaster workers well supplied. During one multiday disaster caused by flooding, it was a lifesaver for those of us in the field to know that a fellow was coming around with batteries for communications equipment, spare bulbs for flashlights, fresh units to replace failing

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ones, and fresh coffee to revive failing spirits. His assignment was simply to make the rounds and serve as a general store for anyone involved in the recovery effort. It kept those of us with jobs out working rather than fighting our way back to headquarters every two or three hours. He was able to deliver tools to those who needed them. And there was only one person driving around rather than having several moving to and fro.

Thanks for the Memory

The best way to be sure batteries are available is to use rechargeable batteries. Whether your operation is using a radio, a cellular phone, or even a flashlight, keep in mind that most rechargeable batteries have a "memory." That is, the typical nickel-cadmium battery will "learn" how long it is used and eventually adjust its operating life to that time period. To avoid losing battery life, operate any unit until the rechargeable ni-cad battery is completely spent. Then recharge the battery. Do not treat batteries like a cup of coffee, topping them off with a fresh charge every so often.

Most radios come with trickle chargers that work overnight. It is possible to buy rapid chargers that can do the same job in an hour. That can be convenient when crunch time comes. A rapid charger costs about double what a normal charger would run. Just be sure the high-speed charger is matched to your battery.

The best way to handle any unit with a battery is to allow the battery to discharge fully before recharging. It is a good idea to avoid over-

- charging a battery, allowing it to sit in the charger base for excessive periods.

With some units, it is possible to erase the short-term memory effect. Try operating the unit until the ni-cad is completely discharged, then recharge it fully. Repeat the process at least three times. By the third time, the battery should be giving a much longer service life.

TracFone, from Uniden, is an ultra-compact portable cellular phone well suited for occasional use.

Assign one individual responsibility for overseeing the recharging process at base. That way, a radio that is put aside for a couple of hours during a disaster will be refreshed and ready to go when the worker is rested or when a new person is ready to go into the field.

Cellular Solutions

A host of cellular solutions exists to simplify disaster recovery operations. The first line of defense, of course, is the cell phones already assigned to school personnel. All such units should be drafted into service. Many workers will have no problem volunteering their own cell phones as long as they are paid for air time. Establish a good relationship with the local telco and the odds are good they will make any supplies available when crunch time comes.

When purchasing cellular phones specifically for disaster use, keep in mind that the phone is likely to be used only in a limited area—around a campus or within the city limits. Purchase a plan which allows the most unlimited local calling and forget about adding on low-cost roaming capability or the other niceties one might purchase if the phone were being used by a world traveler.

A couple of companies offer instant cellular-in-a-box products. As with adding spare radios, make arrangements with a local dealer to have access to phones when needed (one good place to start may be the student bookstore — stake a claim to all radios in stock in case of an emergency). If your location is the only one with a problem, getting phones or radios will be easy. If it is a general emergency, the school will be competing with utility, emergency, hospital, and other worthy groups for available equipment.

Topp Telecom's TracFone, from Uniden, is an ultra-compact portable cellular phone well suited for occasional use. The advantages of the TracFone include its low initial retail price ($99 at RadioShack or Circuit City, which includes 60 minutes of air time), no monthly fee, and limited exposure to abuse, since the phone requires a credit card for every call. This latter could be a nuisance for frequent daily use, but for occasional emergency or backup use it provides a means of controlling

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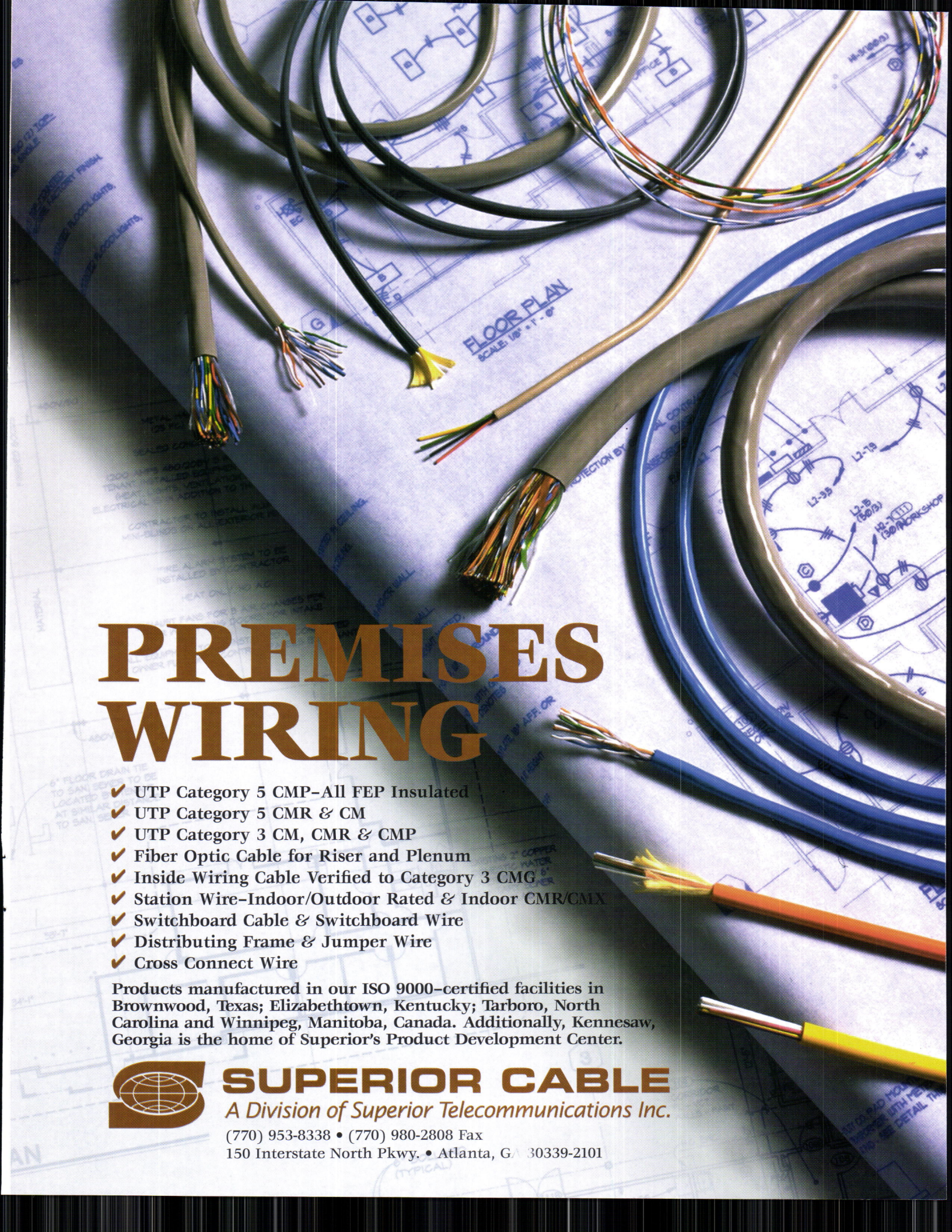

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who makes calls. Each unit has its own phone number, and local calls run about 80 cents per minute.

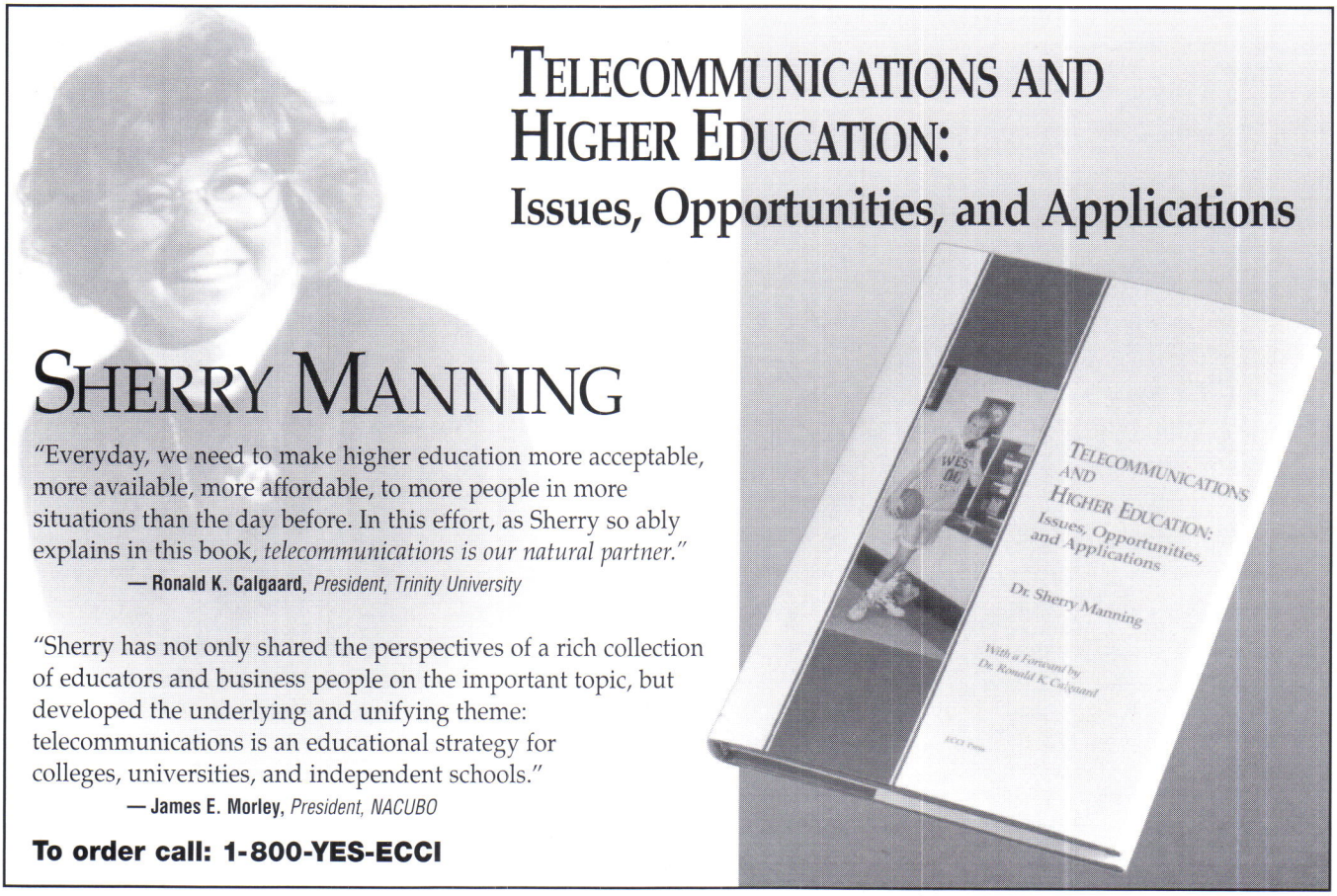
On the other hand, a service like Midland USA's RoameR One is billed on a flat monthly charge no matter how much time is used. It is a 200 MHz wireless service, available now in a half dozen markets including Los Angeles, Phoenix-Tucson, Minneapolis, and Kansas City.

Mother May I?

In any commercial application, it is vital to obtain an FCC station license. At the lowest end, the manufacturer takes care of the licensing, and the range and output of the units is not sufficient to be much concern—that is, unless your workers start to step on some licensed operator (like a taxi company or other vendor) who has assigned frequencies. The FCC requires a certificate of frequency coordination for any large-scale use. This would include most mobile uses where a base station is in touch with trucks operating around town. The Personal Communications Industry Association (PCIA) (500 Montgomery St., Suite 700, Alexandria, VA 22314-1561) provides frequency coordination for businesses and educational users. Any reputable radio dealer has the FCC applications and frequency coordination forms available. The forms should be free. Depending on the area where the radio is used, a consultant may make the coordination process a bit easier to handle.

Today's wireless technologies not only facilitate our efforts to respond to emergencies and cope with disaster more effectively; they frequently are responsible for lives being saved. But without planning, even the best technology is of little use. Knowing what is available and having access to it will help you master a disaster when it comes to your campus.

Curt Harler is a freelance writer and a contributing editor for the ACUTA Journal. *Well respected for his insights into the telecommunications industry, Harler is also a frequent speaker at events across the country. He can be reached at charler@mcimail.com*



Interview

Leo A. Wrobel: Staying a Step Ahead of Disaster

Leo A. Wrobel, president and CEO of Dallas-based Premiere Network Services Inc., addressed ACUTA's Spring Seminar in Cincinnati on physical and environmental security and control. After his presentation, he spoke one-on-one with ACUTA publications committee chair Terry Robb from the University of Missouri at Columbia. The following is a transcript of that conversation.

Terry Robb: Any analysis of disaster recovery must begin with threats, the causes of disasters. Could you describe the major threats to telecom facilities, and can you prioritize which are the worst out there?

Leo Wrobel: Figures I've seen state that about 70 percent of all telecom disasters are caused by people. So people have to be at the top of the list. For example, one campus was doing a major conversion, and the telecom manager had been working 14-hour days for weeks and weeks. Finally the weekend came up for the conversion. Everything went flawlessly, and the following weekend they told her to take a four-day weekend, enjoy her little boy, get a life. She still called the office, and they said everything was working fine, but she just had to go in anyway. So she's standing there in the equipment room with her five-year-old son. Unknown to her, the key to the UPS is about 12 inches off the floor. The little boy just couldn't resist. He shut the whole place down. But those things happen.

Other people factors include disgruntled employees and cable cuts (otherwise known as backhoe fade). Ultimately, it's usually people, and the ironic thing is, that's something we can do something about. So it boils down to an issue of standards, controls, access restrictions, and so on. If I had to pick the one single-most frequent cause of a crisis, it'd have to be people.

Robb: Of course, there's power?

Wrobel: Power's right in there, but power is also something we can do something about, particularly in the telephony area. Let me give you an example of that. We had a large client who was down a long weekend due to power. They figured as long as they were on UPS they were covered. What happened was a water pipe in a riser opened up and hit the UPS. The one place it couldn't go was where it went. He shut down a 13,000-seat call center. The client had a DMS 100 in there with station batteries on it because it's designed for a central office. When they delivered that thing they said, "Where do you want the batteries?" It's not an option. So that component stayed up.

They also had about five AT&T G3s which are CO-sized switches, but batteries are optional. Because they had a UPS, they opted out of batteries. So this user had crossed that invisible boundary between being a large *user* and actually being a *telephone company*. When a user does that, they need to adopt the *standards* of a telephone company. That means you need a one- to three-day supply of batteries, for example. That buys you forgiveness while you figure out what happened to the UPS; because when you get water in it you're not going to reenergize until you're sure that it's okay. So they had to spend several hundred thousand dollars, but after this they went back and took our recommendation and installed batteries.

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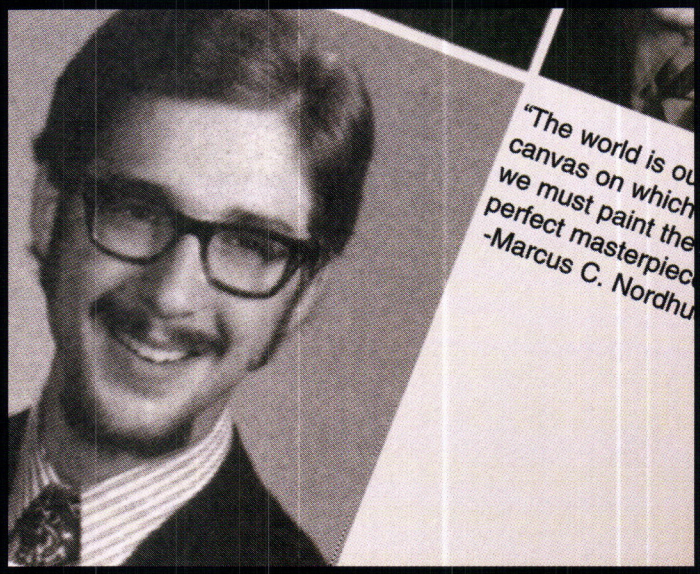

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As far as power and the hard-core telecom stuff, I think that's pretty rigidly defined in the specifications. I'd look at batteries and that type of thing. In the data world, I would look at redundant power supplies. But I don't think power is that big an issue except in extended outages.

Robb: If our members don't already have a disaster-recovery plan, where do they start? Are there some small things they can do immediately to secure their facilities against disaster and be prepared to restore business as usual in an emergency?

Wrobel: There's nothing to prevent someone from doing a walk-through of their facility, and that could be accomplished in a day. Obvious points you want to inspect are the risers; make sure they're fire-stopped with an approved material. Make sure doors are locked and access is controlled. Look for large water pipes over equipment.

If you find something wrong and you haven't had funding approved to correct it, you've got a different kind of problem. You've got to convince the powers that be to do something about it. But at least you can flag it for later.

For a preliminary analysis, there are probably enough things in print now so that you can put together a checklist. For the company I talked about a little while ago with the water problem, we had performed a vulnerability analysis 90 days before and pointed out that they could have this problem. (We got teased quite a bit there, asking how much we paid to get that done.) But it does drive home the point.

From a technical standpoint, there's quite a bit you can do. Most companies that don't have a written recovery plan do, in fact, have a recovery plan—it just resides in the minds of a few key people. If your key people show up, they're the ones who know the vendors' telephone numbers, the escalation procedures, where every piece of wire runs, where the telco facilities enter the building. Get them to document what they know, so that if they aren't there and someone else had to come into this building, they would have what they need. Start pulling together floor grid diagrams, schematic diagrams, and telephone numbers—especially cellular numbers. The problem you're going to run into is that it's the operations people who get asigned this and they're already up to here with day-to-day issues, and time is a constraint.

Robb: What are some of the rules of thumb for disaster-recovery planning? For instance, you might have so many LEC lines to bypass your PBX and go back to the central office. For 5,000 PBX lines, maybe you set aside 50 LEC lines.

Wrobel: I think that's one of them. A lot of times we'll recommend 20 workers will have PBX lines but every supervisor has a centrex line. Centrex is cheap backup. And then those numbers are published in the directory as supervisor numbers. Remember, if anyone calls the department they're not going to get a cute recording saying sorry we just had a fire. They're just going to ring open and they're not going to know what's going on. The natural response to that is to call the boss, and even if they get a lot of blockage and busies, eventually they'll get through.

We've already mentioned publishing cellular numbers. I wouldn't underrate scripting your callout procedures either. Don't just call someone's house and say "the office just blew up and we need Terry to come to work." And Terry's wife says Terry's already *at* work. Now you've got two problems. So I would say to script and document callout procedures.

Robb: Years ago we had a disaster-recovery presentation by someone who survived Hurricane Andrew. They were relying on a cellular system as a backup. and it turned out they couldn't even get on the cellular system because it was a general disaster. Cellular wasn't even an option then.

Wrobel: That's right. In fact, the older analog cellular systems only have 44 send-and-receive frequencies per cell. So, if you lose a university with a couple of thousand lines, you're going to eat those up real quick. Manually controlled two-way radio would be more valuable to you than cellular. Some of the newer systems do have more capacity, and our largest clients invest in microcells. They put their own cell site on site which has a dedicated link back to the cellular company. A microcell works just within a building, but it's on the cellular system. Those work real well. Anything you can do for command and control is good.

Robb: What are the major components of a disaster-recovery plan?

Wrobel: If you split it up into three phases, I would characterize phase one as an executive commitment phase. Basically that would include a preliminary business impact analysis. You need hard figures—you can't bring anything else to an executive. But basically you say "we would lose one-and-a-half million dollars a day if these systems failed," and have the backing of people who know the data behind you. That's just a few weeks.

The second phase is more a logistical phase: training people in planning methodologies, documenting standards. By standards, I mean the changes that need to be

made in the operational environment to assure that the disaster-recovery plan executes gracefully. So if your plan says "get a list and call everybody back to work," then you need to be sure that the list (a) exists and (b) is up-to-date, and that (c) you know where to go get it. That's a standard.

Also, you should document recommendations for hardening the network in the long term. You'll find things that you want to do to the network now but you can't do until you're ready to retire the equipment. So you document these things in phase two, and then in two or three years when you turn over that PBX and install another one, you buy something with the characteristics you've identified back here.

Also, you must choose a template. Are you going to use LDRPS? Compass from Comdisco? Harris Develin? Or are you just going to write it in Word? You have to decide what it's going to live in. That's phase two, and it might be another six months.

Phase three is the "go do it" phase, the actual implementation, testing, and so on. That's basically how we see it.

Phase one is a high-cost item because generally you're going to have to bring somebody in to do it. Phase two is still expensive because *you're* expensive, and it requires your time. Phase three is lowest because you can use more logistical people.

Robb: You mentioned some of the software tools. Is there a format that asks you questions and guides your responses?

Wrobel: We haven't found anything yet that's really a fill-in-the-blank recovery plan. We've been writing them for twelve years and haven't done any two exactly alike. You could probably get away with using a template for probably 50 percent of it. For someone who doesn't understand the team concept or emergency procedures at all, it gives them a template to start with. After that, you do get into the intricacies of the company or organization and their actual business processes. No two organizations' business processes are the same; that's why no two plans are the same. But there are some common questions, and there's quite a bit out there in books and articles and on the Internet to get you on the way.

Robb: What are the biggest mistakes you can make when planning for disasters and recovery?

Wrobel: The most common one is to assign it to the operations department. In today's lean, mean, right-sized organizations, you don't find people who are working at 75 percent capacity in case someone finds something else for them to do. Organizations are not large anymore. So what will happen,

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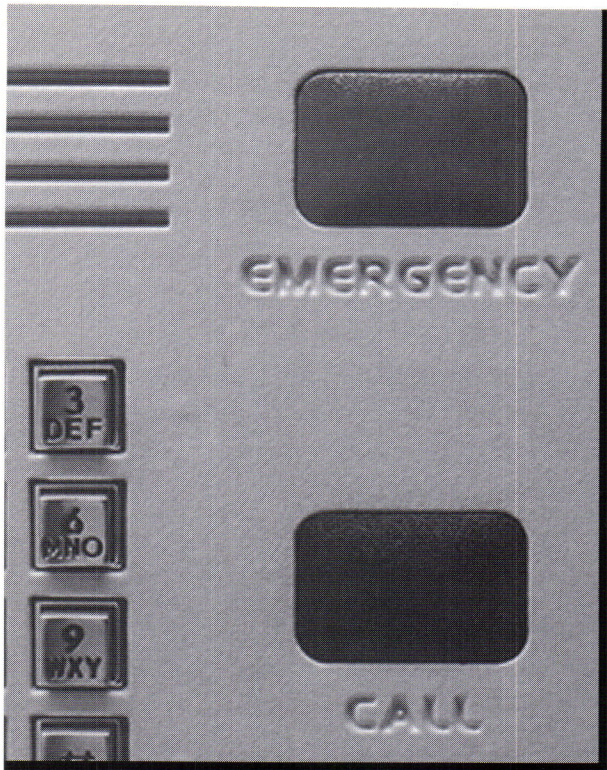

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especially in telecommunications, is you have people working 50 hours per week, and they take home another 10 hours a week of coffee-table work. Disaster planning has to be done free from constant interruptions. Even so, management tells this busy group, "In your copious spare time, knock out a plan."

Not to say they're not capable—in a lot of ways, they're probably *the* most capable people to do it. But recovery planning is a very methodical, very intense kind of work, and it doesn't work if, just about the time you get rolling, your phone rings.

Robb: Who would you give the task to, if not the operations people?

Wrobel: You would expect me to say go outside with it, but seriously, you should parcel out as much as you can. One of the benefits of telecom reform, for example, is that what used to be rather lackadaisical local telephone companies may be inclined to bring more as far as services in kind to the table for disaster recovery. Anything they can offer that adds disaster recovery to the environment is something you lose if you go to a competitor. So from a value-added standpoint, farm some of this out on them. It's free.

An organization could outsource phase one, for instance. We've all had the experience where you badger management for two years on something that needs to be a priority, and it never gets noticed. Then they bring in an outfit like Price Waterhouse and they spend 45 minutes in the corner office and then suddenly everyone comes out of the office waving their arms and it gets done. What did they do? Well, they speak management's language. Technologists speak technology and a lot of the time that doesn't bridge. Internal and external auditors and/or a consultant can sometimes help management see it as a priority. That simplifies things for operations as far as personnel and funding.

Another thing you can always do is find opportunities in the telecom environment, either attendant with local competition or whatever. Let's say you convert a private line network to frame relay and you save your organization 25 percent on the line costs. Management is going to be just as delighted if you save 20 percent. Rather than going to them and saying "hey, I've saved 25 percent," go in and say "look, I've saved 20 percent and I've strengthened the network immeasurably." Now you've added value to what you do, and you still saved some money; but if you can use some of the savings for work that needs to be done, you just won't have to go in and ask for it later. If you can engineer it in, you've done something worthwhile.

Contact Leo Wrobel through Premiere Network's Web site at www.rewireit.com. Reach Terry Robb at mtterry@muccmail.missouri.edu.

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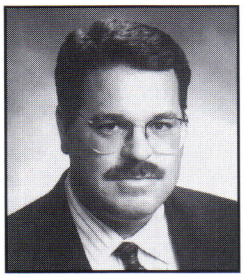
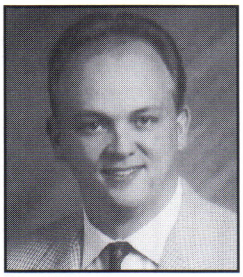


Bill Ryman
Service Segment Manager, EDI



David Zember
Senior Project Manager, EDI

Technically Speaking

An Ounce of Prevention...

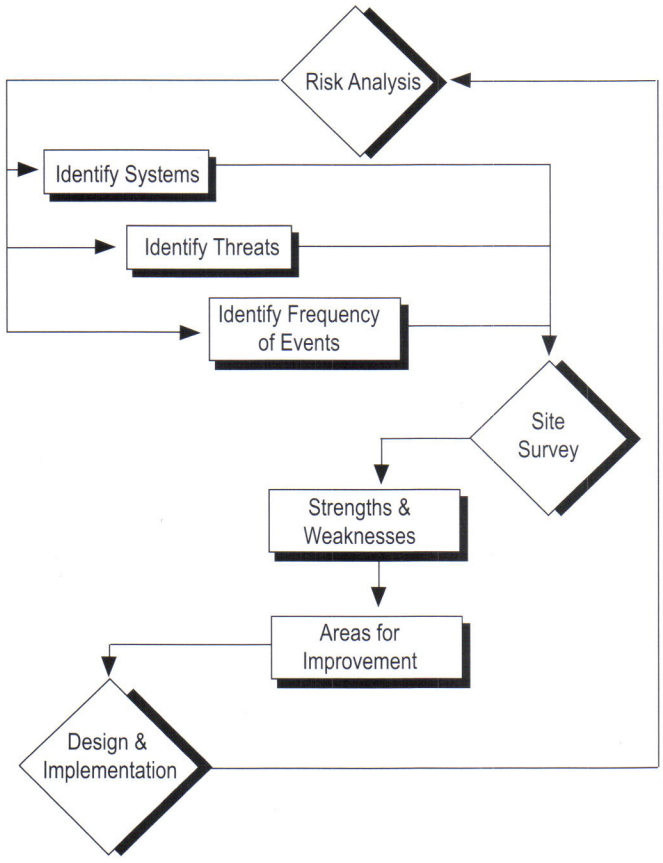
by Bill Ryman and David Zember, PE

Campus security is more than just keys and security officers. Real campus security is a system of policies and procedures, intelligent equipment, and properly trained security personnel, uniquely coordinated to provide a safe and secure learning and living environment.

In order to be successful, the efforts of campus security must be coordinated with the MIS and telecom organizations because of the shared use of infrastructure and the physical vulnerability of the information resources to damage or loss. This vulnerability is best considered in the context of an integrated campus security system.

A Better Approach

It is feasible to implement a separate security system for network and telecom spaces. However, this philosophy will normally result in an uncoordinated approach to campus security. A better approach is to address the overall security requirements of the campus in an organized and structured manner.



An approach that has proven to be successful and cost effective includes three separate phases:

1. Risk analysis
2. Campus site survey and security review
3. Security system design and implementation

While these three phases may be addressed within the context of protecting telecommunications facilities and equipment, the concepts can be applied campus-wide in the development of an integrated campus security program.

Phase 1: Risk Analysis

Performing a risk analysis is the first step in successfully building the security system. An effective risk analysis will help you make decisions that improve system security and reduce the impact of a potential disaster without overspending.

Risk can be defined as an exposure to financial loss as a result of damage or destruction to personnel or property. In order to assess our risk, we must examine our exposure on two levels: First, what value can we assign to the personnel or property that we need to protect? Second, what is the probability that we will experience a loss?

The risk analysis phase allows you to choose what types and levels of losses can be tolerated. A good risk analysis provides the cost justification for security improvements and will improve security awareness.

As you move through the risk analysis, remember to identify and classify risks that are specific to your organization. For MIS and telecom this may involve the identification of several factors:

- Systems that require protection
- Threats to these systems and spaces
- Frequency and magnitude of past losses

You should repeat the risk analysis process at least every other year. You must be able to adapt your programs and policies to address new or different threats.

Phase 2: Campus Site Survey and Security Review

The second step toward a successful system implementation is the campus site survey and security review. Phase 2 involves an on-site review and analysis of your facilities, focusing on current security policies and procedures, while identifying weaknesses.

During the security review, assess your current security policies and procedures. Documentation is important not only during normal operations, but also during and after emergencies.

During your survey, try to answer these questions:

- Who has access to sensitive areas and how is access controlled?
- Are these areas monitored by alarm systems and cameras?
- How is your security staff equipped, trained, and allocated?
- Are there any insurance carrier requirements with which you must comply?
- Are there any additional legal requirements with which you must comply?

Many times the existing campus security organization can perform this survey. However, these services can be contracted to an outside firm

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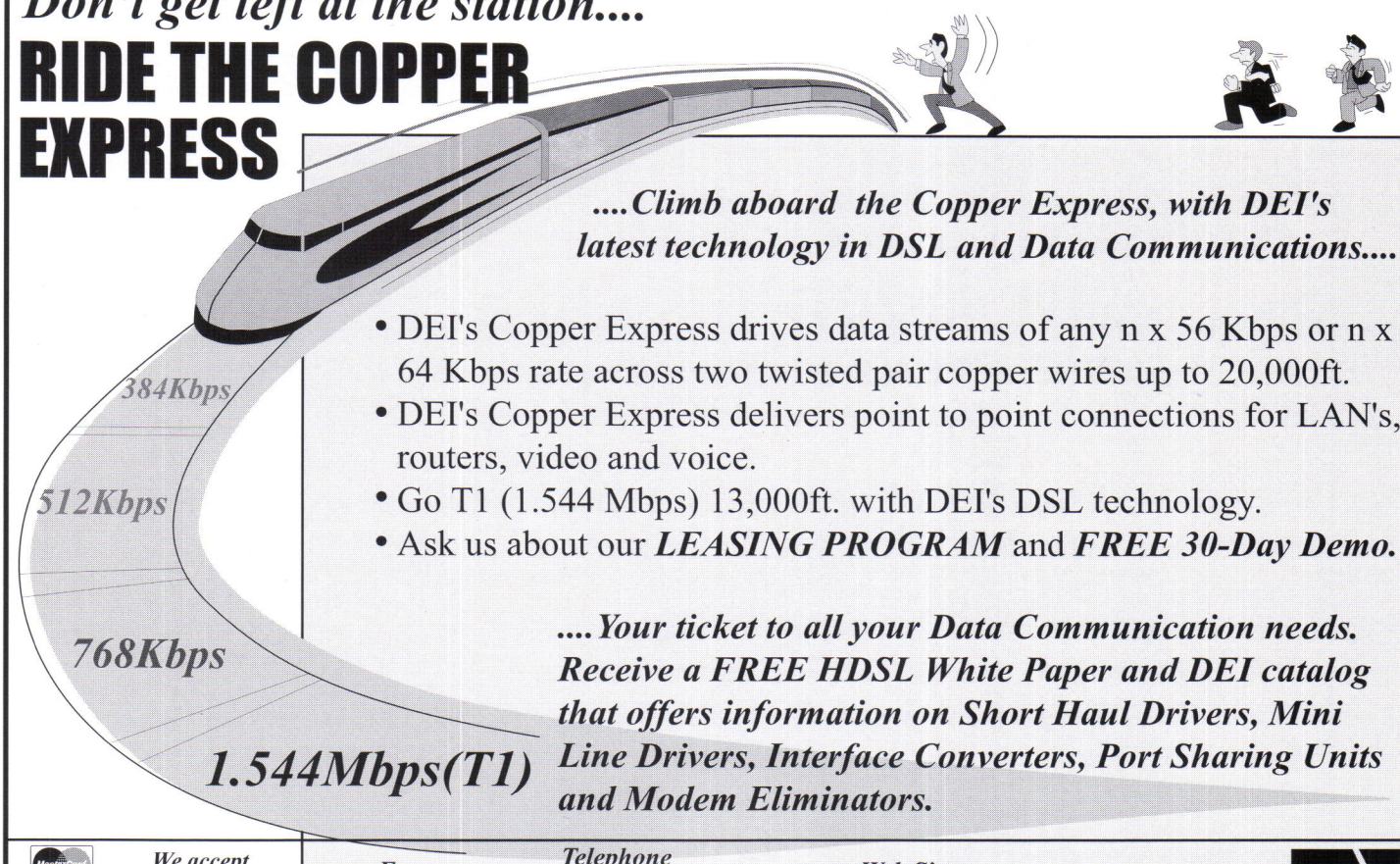

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for an independent review. In either case, the output of the security survey should be a detailed report of conclusions and recommendations. The report should also indicate what some of the system alternatives are and what the approximate costs would be. It is this report, in conjunction with the risk assessment, that will form the basis of a new security program.

Phase 3: Security System Design and Implementation

The third and final phase is the design and implementation phase. Assuming that requirements and budgets have been defined in the first two phases, the final phase is a simple design and implementation exercise.

There are two key elements associated with a system design: (1) policies and procedures and (2) systems.

Policies and Procedures

Polices and procedures must be put in place that support the functions of the campus security organization and protect the university, faculty and staff, students, and guests. Procedures and policies must comply with local, state, and federal laws. Most importantly, people must be trained to follow the polices and procedures.

Systems

The security system will have qualities similar to a modern telephone or data network. It must be flexible (the ability to reconfigure the system to accommodate change) and expandable (the ability to add components and features without a system replacement, i.e., a "modular system").

The heart of the system should be a fully integrated, microprocessor-based access control and alarm monitoring system. The system must be able to combine alarm reporting, access control, closed circuit television, and remote-control functions into a centralized and highly effective command center.

Some of the components to consider during the design process would include:

- Card readers (proximity and/or swipe)
- Door position monitors and alarms
- Programmable automatic door locks and controls
- Surveillance cameras and monitors
- Motion detectors
- Emergency call stations

Conclusion

The best method for protecting your technology investments is to include the MIS and telecom security requirements in the overall campus security program. There is no better protection than prevention, and there is no prevention without effective planning.

If you have additional interest in this subject matter, some additional on-line resources include:

- Security on Campus, Inc.: http://www.soconline.org
- Department of Education: http://www.ed.gov
- Accuracy in Campus Crime Reporting Act of 1997 (HR 715) http://thomas.loc.gov

Bill Ryman is the service segment manager for the Security and Special Systems Group for EDI Ltd., Consulting Engineers. David Zember is a senior project manager in the Communications and Network Technologies Group. EDI is a consulting engineering firm headquartered in Atlanta, Georgia.

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First-hand experience—with floods, earthquakes, and a toxic spill—has taught Richard Kaye and the University of California at Davis the value of planning.

by Vickie Mitchell

If all the hype about the *Titanic* and El Nino doesn't motivate you to think about dealing with disaster, what will?

Unfortunately, it often takes a disaster of its very own to convince a college and university to give an emergency preparedness plan the serious thought and attention it deserves, says Richard S. Kaye, the senior information technology consultant at the University of California–Davis and a self-described "safety fanatic."

From personal experience, Kaye and others at his school have learned that the best time to have a well-developed, widely disseminated, and thoroughly tested plan is before the proverbial ship sinks or pounding storm hits. His formula: anticipate, predict, forecast, and plan.

"If you don't do your planning, if you don't prepare, something unpleasant is going to happen to you and people who depend on you," Kaye warns.

As proof, Kaye offers two examples from his campus, where he is a member of the emergency preparedness policy group and chairman of the health and safety committee:

- In January 1997, Kaye and others found themselves sloshing through water in the UC-Davis data center, located in the basement of an academic building, after a torrential rain. Luckily, the rain stopped before floodwaters reached electrical outlets and transformers. But then the staff faced another problem. The pumps they had planned to use to remove the water couldn't handle the load.
- Campus operators had to be evacuated after two chemicals being used by workers produced toxic fumes that spread through their building's ventilation system. An emergency plan that covered such a situation was being drafted and had not been distributed.

So how do you avoid problems like these? Kaye strongly believes in planning, which he learned a lot about in the Marine Corps. "In the military, a majority of time is spent in planning for what we hope will never occur. The entire military structure is based on the principle of preparedness. Being ready is what it's all about."

Here are a few of Kaye's ideas for getting your campus ready for disasters and emergencies:

History is the Best Teacher

There is much to be learned from what has happened on your campus, Kaye says. "Pay attention to what has happened in the past, particularly in your environment, and learn from that."

UC-Davis has learned from past mistakes. For example, the school plans to move the center, eventually, from its flood-prone basement to higher ground. In the interim, a plan has been developed to minimize the risk.

The toxic chemical incident underscored the importance of having a plan in place and training everyone to do their part.

History can also teach you which problems are most likely to ➤

paralyze your campus. This analysis and planning is the first step in creating an emergency preparedness plan. "While you can't plan for everything, you can sure lay a good foundation," Kaye says.

College and universities face different hazards depending on factors such as geography, the physical plant, and the school's mission. For example, the northern California valley where UC-Davis is located floods frequently. Earthquakes rattle the ground. The university sits on the Sacramento International Airport's flight path. The university's research mission makes it more susceptible to toxic chemical spills.

In addition to the havoc that nature wreaks through floods, hurricanes, tornadoes, and earthquakes, campuses face universal threats such as human error, power outages, terrorism, fire, hostage situations, bomb threats, biological and chemical releases, cyber crime, cable cuts, and civil disorder.

"Every situation is different," says Kaye. "Your campus has its own unique requirements and considerations. If you understand what the hazard means and what it can do to you, then you make better judgments in terms of how to avoid the hazard or mitigate or minimize it."

Lessons can also be gleaned from the experience of others. Kaye cites the World Trade Center bombing and the North Ridge, California, earthquake as real-life examples of effective emergency plans.

Despite the best planning, disasters will occur. When they do, the actions taken in response must be documented. "When something does happen, you need to go back and learn what went well and what went awry," Kaye says. "Keeping accurate logs records the event forever. It becomes much easier to critique the way things went."

Be Prepared

After you identify the threats to your campus, you should gather all the players who have a role in recovery and develop a plan. At UC-Davis, the emergency response team involves more than 20 departments—from the chancellor's office and the police and fire departments to housing, food service, accounting, and transportation.

"People involved [in disaster planning] on this campus are in almost every department," Kaye says. "Almost everybody has a role to play."

After a plan has been developed, it is critical that staff be trained and have a clear understanding of their part in recovery. "Bring the people involved in early and make sure they are informed," says Kaye. "You have to know who the key players are and how they are going to operate."

Kaye's role on the emergency preparedness team is to ensure that telecommunications services are provided and maintained during an emergency. "In times of crisis, reliable, continuous communications between and among participating agencies is crucial," he says. "Most campuses are equipped with the latest in telecom capabilities which, when properly planned and coordinated, can be counted on to maintain continuity."

Kaye says it is up to telecom professionals to educate other departments on ways telecom tools can be used to prevent costly, irrevocable losses. It doesn't take a department chair long to see the value of a sensor that signals when power is lost to a refrigerator that contains irreplaceable research samples, he says.

Kaye has many ideas about how communication systems can be used to help emergency response. UC-Davis recently installed a $2.7 million radio system with 700 radios to serve as a backup if the campus loses its telephone system. Kaye has also compiled a directory of all university-funded cellular phones on campus. "If need be in the future,

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I can go and commandeer the equipment."

He recommends that universities look into backup communication systems. "Pay telephones are one of the sleepers," he says. "If you were to lose everything—your fax, your phone, your radio system—pay telephones can save you."

An Ounce of Prevention ...

Many disaster-related problems can be avoided or minimized by preventive measures, Kaye says. "I have become almost fanatical about things like fire extinguishers—where they are and whether everyone knows how to operate them."

In earthquake zones like northern California, bracing for equipment is a key to limiting damage. The toxic chemical incident at UC-Davis could have been avoided if a required sheet describing potentially toxic chemical combinations had been with the chemicals in use.

Although many emergencies are the result of human error, even these problems can be avoided. One potential hazard is the work-aholic employee who may become careless due to fatigue. "There are some employees who truly love what they do and don't want to go home at night," Kaye said. "You have to guard against that."

Practice Makes Perfect

Colleges and universities that have a disaster plan but fail to test it are making a major mistake, Kaye says.

"They may do some planning, but how good is it?" he asks. "Do they exercise it, do they rehearse it, do they exchange ideas with other organizations? Is there a plan to train people? Because it takes so much effort to put a rehearsal or exercise together, it almost always tends to be postponed, or the magnitude of it tends to be subdued or decreased."

Kaye has an excellent example of the value of testing a plan. When he and his colleagues tested a plan for handling a third-story fire in the main science building, they realized that the water used to extinguish the blaze would flood the data center in the building's basement. " So," says Kaye, "you do learn from your exercises and rehearsals."

The UC-Davis policy group meets regularly to discuss changes that may be needed in the plan as the campus, technology, and threats change. "Most large colleges and universities have a plan, but you can always improve upon the plan." Kaye says. "As time passes, you learn new things, new regulations are established. You have to be able to change so that you are up-to-date, you are prepared."

Effective preparation, according to Kaye, begins with the four simple words that serve as his outline for a disaster preparedness plan: anticipate, predict, forecast, plan. And then relax!

Vickie Mitchell is a freelance writer from Lexington, Kentucky.

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Campus Profile

Networking Northern Arizona University: Fiber for the Future

by Carol Everett

As Northern Arizona University (NAU) in Flagstaff closes the chapter on their first centennial, they are now writing the next page for a new era and a new millennium. One of their greatest accomplishments for the first century that holds tremendous promise for the next is the foundation that they have laid for high-speed networking. Recently they completed the installation of a total fiber-optic backbone to gear up for the future of high-bandwidth, gigabit-speed applications for datacom, as well as voice and video. "We saw the writing on the walls (and I'm not talking graffiti) to install the most advanced groundwork for our networking system. That meant fiber-optic cable to all our buildings," states Danny Henderson, supervisor of telecommunications systems.

Nestled at the base of the San Francisco Peaks, NAU consists of 85 on-campus and 25 off-campus interactive teaching facilities. The on-campus buildings include administration facilities, classrooms, library, and of course dorms and student apartments. The administrators and network facilitators wanted to make available to all students and faculty access to the World Wide Web as well as provide wiring to their own intranet system and interactive video classrooms. The wish list included providing networking capabilities to 18,000 enrolled students—14,000 in Flagstaff and an additional 4,000 at off-campus locations.

Chromatic Technologies' fiber-optic cable is terminated with Methode ST connectors to the fiber-splice boxes in the IDFs.

NAU is famous for its commitment and ability to provide educational services to students at off-site locations—as far south as Nogales and as far north as the Grand Canyon. To successfully put in place interactive

Fiber-optic cable runs through conduits in underground steam tunnels.

instructional television (IITV) and to future-proof for tomorrow's applications, NAU realized the importance of a fiber-based system. With the new fiber-based backbone, a teacher can teach interactively at up to eight locations simultaneously. The television screen is divided into eight locations. So when a student raises his or her hand, everyone else can see that. It is like a virtual classroom.

The telecom group at NAU designed its own networking system and selected Adkins Cabling, a division of Wilson Electric (Phoenix, Arizona) for the installation. Together Adkins Cabling and CSC (Phoenix, Arizona) specified a multipurpose fiber-optic cable from Chromatic Technologies, Inc. that could conform to the unique topology of NAU's campus and networking requirements.

Three-Star Topology

The backbone network was designed as a three-star physical topology with the central hub located in the Communications Building. The location of this hub, which is in the TV services room, was chosen because of the expectations put upon interactive TV classrooms, which need to feed back to the TV control. The other three nodes are located in the Information Technical Building (Central Campus), the Plateau Center (North Campus), and South Dining (South Campus). All of the nodes have PBX systems.

High fiber counts and alternate cable pathways between these buildings were specified to protect the system from any major outages. If one segment went down, there would be an alternate pathway and separate cables. Between the nodes are hybrid cables which consist of 48 strands of multimode and 120 strands of singlemode.

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NAU's 100-year-old campus presents unique challenges.

"We simplified the installation of this job by utilizing all existing conduits and tunnels between buildings," states Henderson. "Since this school is 100 years old, it has quite an extensive tunneling system built for utilities. It has housed steam pipes and later on telephone cabling."

"During the installation, we had to clean the old conduits and blow them out. We also had to take care of water seepage in the tunnels and string power cords for lighting," explains Jack Hulse, marketing director for Adkins Cabling. "For an older campus, we're surprised it went so smoothly."

In the early '80s a copper-based system had been installed. This copper cabling is still being used until it can be updated and tied into the new fiber backbone. "The old four-pair copper cabling is 'CAT Nothing' since it was installed before there was categorized copper cable," states Matt McGlamery, director of computing and communications at NAU. The old copper runs the 10 Mbps ethernet system and the fiber optic backbone is connected to that. "With the new fiber backbone, we can run 100 Mbps ethernet. When gigabit becomes cost effective, we will employ that," says McGlamery.

Flexible Fiber Counts for the Long Run

"When you're dealing with a new network, cabling is the lifeline of that system. In a quick decade we have seen the evolution of dedicated PCs and laptops and the influential growth of LANs. These technologies have quickly become obsolete and replaced with new technology. Not so in the case of cabling. Once it's in, it's in for the duration for at least 15 years or longer," states Hulse. "Therefore

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Adkins Cabling specified a heavy-duty, versatile, loose-tube, gel-filled fiber-optic cable from Chromatic Technologies. "The selection of this particular cable was credited to its flexibility and durability of performance in a variety of installed environments. This cable can be installed in conduits, direct buried, or put in underground ducts, trays, or even aerial lashings and is available in multiple fiber counts and as a hybrid," notes Hulse.

"This outdoor heavy-duty cable goes quickly through our warehouse because of the demand for a versatile and easy-to-install cable. For the NAU job, these cables exceeded material specifications and kept well within the budget." states Marvin Thompson, CSC, the stocking distributor.

Extreme temperature fluctuations are found in Flagstaff, which is 7,000 feet above sea level and can see temperature variations of 60 degrees in a single day. "We designed this cable for these types of vacillating outdoor conditions—from arctic to equatorial. The fibers are well protected with a gel so that it can allow for jacketing expansion and contraction experienced in large temperature and humidity variations," states Dale Oliver, western regional manager for Chromatic Technologies, Inc.

"Fiber was selected as the backbone, not only for its properties but for its versatility to offer a variety of fiber counts, multimode or singlemode, depending on the building and the applications," explains Oliver. To every building are 18 strands of fiber—six multimode and twelve singlemode—and those are terminated with Methode ST connectors to the fiber termination boxes and patched to the copper cables. From each building, they come back to the four main nodes.

Multimode fiber was installed for voice and data. The singlemode is primarily used for the bandwidth-intensive instructional video. Additional fiber was included for future high-speed data demands. On campus there is a master control for TV services located in the Communications Building. This includes a dedicated campus channel. "Our video services are either one-way teaching piped over the campus cable TV, direct two-way, or off-site interactive teaching," states McGlamery. "This is what

separates NAU from most other higher education institutions, including the Ivy Leaguers."

A Port to Every Pillow

"Currently there are 9,000 active phone ports on campus. We are still using the old copper system, now connected to the fiber backbone," states McGlamery. "However, the next phase of this project, which is currently underway, is to connect a 'port for every pillow.'"

NAU put into place a ResNet (residential networking) program dedicated to bringing high-speed ethernet connections to the residence halls. One of the goals was to get the ethernet connection from a phone line to data ports. "Students were complaining about the busy signals, so we wanted to give them free Internet access while keeping their phone lines free," states Henderson. The ResNet connection is free of charge to all students.

NAU has contracted their own crew of eight dedicated personnel to install CAT 5 cable to run 100-Mbps ethernet. Their first priority was to pull CAT 5 to every student in every dorm room. They have already completed 15 buildings. With 6,000 dormies, they hope to have this completed this year so that each student will have their own phone jack and data connection. Although there is only one phone number assigned to each room, there could be more than one outlet. The data port is specifically dedicated for networking and Internet capabilities. Students who are waiting for the installation of CAT 5 can still use their phone lines and dial in.

To assure that the fiber-optic cable is guaranteed for its life span, Adkins Cabling marked all the conduits and tagged strand counts. "If a fiber breaks, an OTDR [optical time domain reflectometer] can shoot the distance of the break, and we can follow the pathway to that break," states Hulse. "The networking department at this school certainly did their homework and planned intelligently for the future," concludes Hulse.

Carol Everett, principal of Everett Communications (Ashland, Massachusetts) is a freelance writer for the industry and has numerous published articles on cabling infrastructures.

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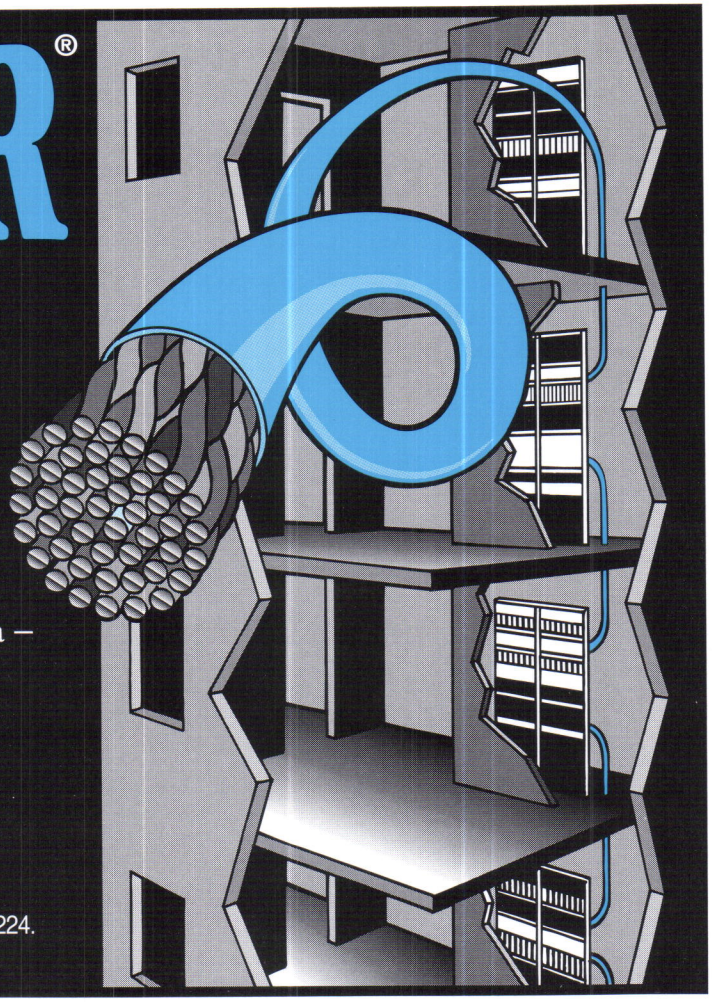

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Postscript to a Flood

Grand Forks One Year Later

by Rich Lehn

What a difference a year makes. Last year the only running water we had was the flood waters that ran through our homes and businesses. We had survived eight blizzards, a major fire, and then, in the spring of 1997, a flood that required the largest evacuation of a community in history.

The University of North Dakota Telecommunications Department played a pivotal role in providing telecommunication services for the university and the community during the catastrophic flood of '97 and the recovery afterward. In addition to providing service to other campus departments, the Emergency Operations Center (EOC), Police, FEMA, SBA, City Services, and other flood-fighting entities, staff from the telecommunications department were busy saving the communications system.

Staff were on site 24 hours per day for nine days (sleeping on the switch room floor) and worked twelve- to sixteen-hour days for an additional five days before returning to normal shifts. They pumped water from the main cable vault and cable manholes and even from nearby steam tunnels in hopes of staying ahead of the water levels and protecting the telephone system. Cables in the main vault were raised to allow additional distance between the rising waters coming into the building and splice cases.

While the main telephone system and cable vault were kept operational, some of the telephone equipment located in campus buildings did not fare as well. A number of buildings suffered damage or total destruction to the cable entrance facilities. This affected both the copper and fiber-optic cable, along with cable protectors and termination blocks.

Additional damage to the main telephone system was averted because quick-thinking staff disconnected wiring at the main campus distribution center as lines began to short out where buildings had taken on water and telephone entrance facilities were getting wet. Had this measure not been taken, circuit pacs would have shorted out and the whole system would have lost power as increased current flows were drawn through the system's power supplies.

From April 18 to May 7, 208 telephone lines were installed. In some cases lines were moved to new locations as departments and agencies moved. One of the first major moves was when the EOC was forced to evacuate from the Grand Forks Police Department to the campus. Others from the city moved to the campus, including the Grand Forks Police and the Public Service Answering Point.

Without the university's capability to provide telephone services and the dedication of the staff, who worked endless hours to provide these services, the university would not have been the staging area for disaster teams who arrived in Grand Forks nor would it have been able to accommodate the community in the ways that it did. Coordination efforts would have been extremely hampered and the potential of greater loss, including life and limb, would have existed.

For the past few months, life has been, for the most part, kinder and gentler. Winter was milder, and spring came and went without any serious flooding.

While life will never be the same as it was before the flood, the Grand Forks area and the University of North Dakota have accomplished a lot during this past year. Although at times things seem to be moving slowly, we are told that we've come further than most communities that have experienced a major disaster. In fact, lessons learned from our disaster will be used by FEMA and other agencies.

Most of the physical damage has been repaired, but some losses are difficult to overcome. There is a perception that the campus isn't operating at full capacity, which is not true. Enrollment is down as a result of that perception and because many students have taken high-paying construction jobs in the wake of the flood.

It is surprising how a catastrophe can change our values. It's hard to see people's lives piled in a heap on the curb. The best you can hope for out of a disaster such as this is that you learn some lessons you never have to use.

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Jeri A. Semer, CAE

From the Executive Director

Be Prepared: A Motto for All Times

Disaster preparedness is the theme for this issue of the *ACUTA Journal.* Coincidentally, as I wrote this column, I heard that for the first time since the disastrous floods of a year ago the entire Monday, March 16, edition of the *Grand Forks Herald* was actually printed in the city of Grand Forks, North Dakota. And a couple of weeks ago as I gazed out on the Ohio River while enjoying dinner at a riverside restaurant, I realized that exactly one year ago that night the devastating flood began that eventually engulfed many of the riverside businesses and flooded many small towns throughout Northern Kentucky and Ohio. A whole year has passed so quickly for me, but the people who were affected by these disasters are still immersed in the difficult process of recovery.

Having personally lived through Hurricane Andrew in Miami in 1992 and the Northridge earthquake in southern California in 1994, I know firsthand what it's like to lose control of your environment and to face the challenges of returning business and personal lives to normalcy. As we all know, the restoration of communications is a vital milestone on the road to recovery.

Those who haven't been affected personally by great disasters can never fully comprehend their physical, financial, and psychological impact. However, we do have the opportunity to learn from the experiences of others and to help our schools, companies, and even our families prepare for their effects.

ACUTA offers a unique forum for this learning to take place. With our World Wide Web and e-mail resources, printed publications, and one-to-one interchange at educational programs, we can share the experiences of members who have successfully overcome natural and man-made disasters. In fact, an entire two-and-a-half-day educational track at the recent Spring Seminar in Cincinnati was devoted to disaster preparedness and facility security.

Without exception, ACUTA members faced with disaster recovery have exemplified the ideals of service to their educational community and the community at large. They have literally moved mountains (lakes and rivers too) to maintain or restore vital communications to campuses, public safety agencies, healthcare providers, and surrounding communities. They have even postponed attention to their own homes and families in order to focus around-the-clock efforts on their institutions and their communities.

As often as I hear of ACUTA members who have spearheaded recovery from the effects of disasters, I am impressed with their ingenuity, creativity, and dedication to developing effective solutions to the situation at hand.

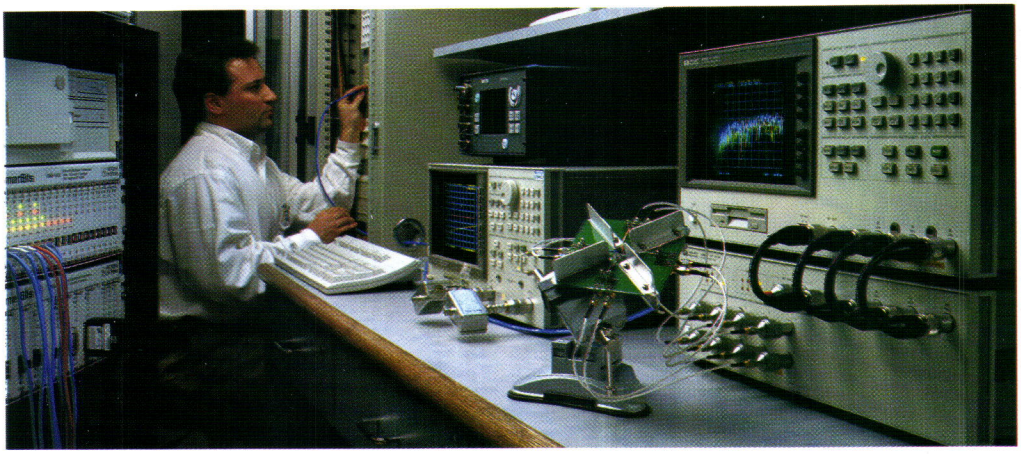
A repeated theme in these success stories is the absolute importance of preparation and planning. Agreements with equipment, network, and service vendors, redundant facilities, off-site telecommunications and data-processing facility agreements, physical plant safeguards, staffing plans, and backup procedures for vital data must all be in place before disaster strikes. And it is essential for ACUTA members to participate in campuswide disaster-planning efforts.

Disaster planning is an excellent topic for periodic brainstorming at departmental staff meetings and meetings with key vendors. Everyone's ideas and commitment are necessary if the plans need to be activated. And, of course, the results of these planning efforts need to be documented and widely distributed so they are easily at hand in the event they are needed.

In the moments, hours, and days following a disaster, telecommunications suddenly becomes one of the most visible and vital functions of the college or university campus. Those who hardly give dial tone a second thought are suddenly very dependent upon its availability. Electronic mail takes on a new importance as parents and students strive to remain in communication. Safety and health officials require communications facilities in order to do their jobs, and faculty and administrators are justifiably concerned about safeguarding their vital research, teaching, and administrative data.

ACUTA members must be prepared to sustain all of these needs, and we as an association are committed to providing the information and learning opportunities to support you in this effort.

We crash systems daily



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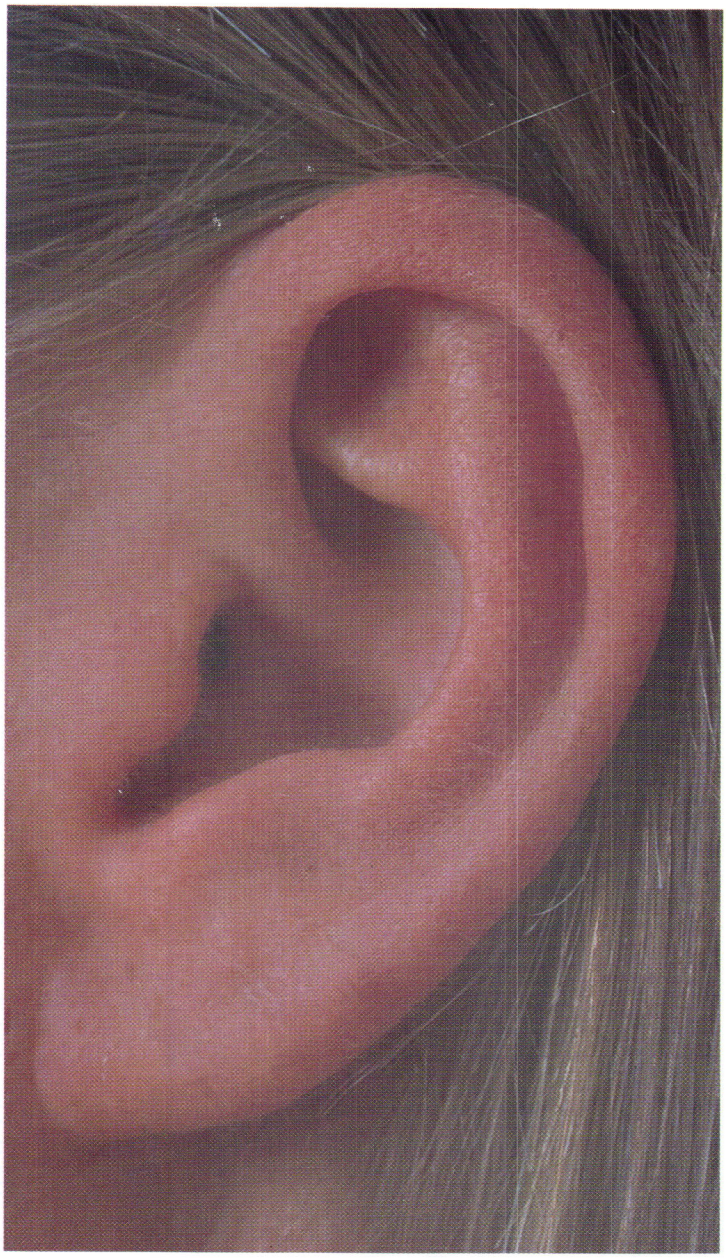

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