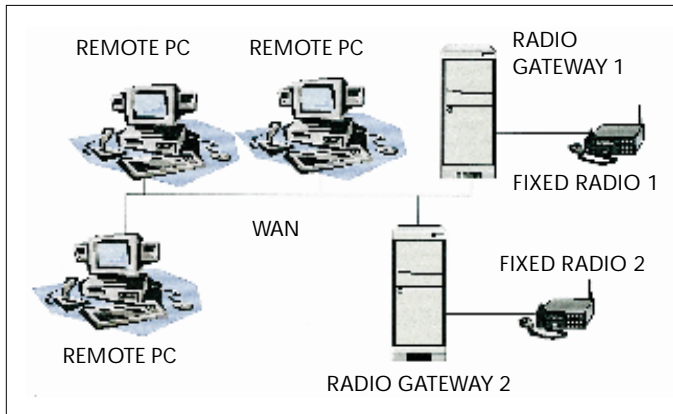


weekend dispatch and special assistance functions for different regions. The cost of installing or

Even if a company is willing to pay for dedicated circuits to connect a new location, providing the desk space and managing all the radio units needed for given job functions are problematic, Smith said.

radio system serves police, fire and public works across two central Virginia counties and two cities. Martin said VoIP is a useful tool for interoperability among municipalities that need to communicate but that may have different radio systems. Having the radio consolidated into an existing PC is another plus because it frees desk space of cumbersome dedicated radio clutter.



The architecture of an IP Radio system provides a gateway between mobiles and PC dispatch stations that may be hundreds of miles apart.

“Incompatible radio systems or the need to consolidate the work groups of the two companies may also present problems. Different companies may have different frequency bands or even worse, different trunking protocols.”

“Not only can IP Radio tie different agencies together, it provides cost savings to our users by linking offices to field workers and reducing the amount of work space required,” Martin said. The system also increases the value of the city’s existing investment in fiber optics by allowing radio traffic to be routed across the fiber network in the same data stream with other computer applications, he said.

relocating leased telephone lines and radio equipment is prohibitive,” Smith said.

Barry Martin, director of emergency communications for the city of Lynchburg, VA, also sees interoperability advantages. Lynchburg’s

At AEP, using the existing radios and infrastructure was also important because the company couldn't justify the cost of connecting the four areas of its Western Region. All of AEP's 248 transmitter sites are 800MHz EDACS (Enhanced Digital Access Communications System), Com-Net Ericsson's trunked radio system. As such, they can take advantage of second-generation VoIP through any transmitter site.

The VoIP approach places a mobile radio anywhere within the coverage area of each operating company. The audio from each mobile radio is fed across AEP's WAN—not only to the help-desk and network operations center, but also to other employees who want to take advantage of the technology's features.

The time and money AEP once

spent on telephone calls is now a thing of the past. Before the company installed VoIP, field workers had to find a pay phone and make a long-distance call to the help-desk when they had problems. These hidden costs didn't show up on any department's profit-and-loss statement, but they were real. Worker frustration was also real, and it was a drain on productivity.

Now, field workers use the two-way radios in their trucks to talk directly with the help-desk. The time, money and hassles associated with pay phone calls have vanished, and productivity has risen.

At NiSource, Smith was initially concerned that voice quality would be lost by routing radio transmissions over a WAN instead of over dedicated phone circuits. He had experimented with some of the free Internet telephony services and

was unimpressed. Smith found that VoIP didn't suffer from the gaps, distortion and delay of some Internet telephony applications.

"Most radio users don't even know they are talking through the computer network," Smith said "Even the first syllable is routed every time. The voice quality is superb."

"We've developed a better-than-VOX solution," said Curtis McKim, technical leader at Catalyst. "Working with Virginia Polytechnic Institute, our team created this technology specifically for land mobile radio users. The

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approach provides true push-to-talk functionality. In addition, when one PC talks, all the other PCs can hear the transmission.”

Smith had additional concerns that this VoIP product would consume excessive bandwidth on the utility's network, but according to McKim, “IP Radio routes audio packets only when someone is talking. Thus, when the talk group is idle, there is virtually no network traffic. When someone is talking, the audio is sent out only once, even if a dozen PCs are listening, using a computer-networking technique called *multicast*. The audio is compressed before it is routed, further reducing network traffic.”

NiSource was able to easily integrate VoIP into its operations, Smith said. “It rides on top of our existing network traffic, without causing congestion or other WAN problems. We hardly even know it's there.”

Desktop dispatch

By shifting from a hardware-based approach (traditional telephone-set-like remotes) to a software-based technology (PCs), placement of radio access positions is much more flexible than before. The initial installation is quick and straightforward. Later, when the inevitable office moves occur, relocation is even simpler.

Catalyst's approach uses a client-server architecture, with the client running on a standard PC. This approach calls for at least a 233MHz processor in the desktop PC, at least 64M of RAM and an off-the-shelf duplex sound card so that users can hear radio prompt tones on each transmission. McKim's team identified a few sound card types incompatible with Windows NT, but found most modern PC hardware sufficient.

For NiSource's Smith, the ease with which he can add clients to the network is a plus, and his customers like the flexibility for varying access among users.

“It's a two-step process,” Smith said. “First, we enable the client on

the appropriate server. As we add more servers we'll be able to control access for some users by restricting which ones they can use. We can also specify whether or not the PC user will have 'supervisory' privileges.”

Both supervisory and standard users can make and accept individual calls. Supervisory users can also change trunked talk groups and systems, preempt standard users and activate the radio's scan function. Allowing only a few people to change the settings reduces confusion about which audio office-based users are listening to, further increasing efficiency. This flexibility is one of the benefits of the software-based VoIP approach.

The second step in the process is loading client software on the remote PC. Typically, this involves sending the user an email that tells him where to find the setup file on the network. The setup file runs a wizard to install the software on the machine, and the client can be ready for action in less than 15 minutes.

Relocations of dispatch positions are even easier. At AEP's facility, the help-desk changed floors without rerouting coaxial cable and dedicated circuits. They just unplugged their PCs on one floor and plugged them back in on another.

Direct access

AEP's network operations center can provide faster service to customers and is using less manpower to get the job done. When a field technician is working a problem, it's critical that the situation be resolved immediately. In the past, the field technician would relay information through a local dispatcher who would call the NOC by telephone to pass on the information. Now, the technician can speak directly to the NOC.

Direct-radio access is also key for AEP's mobile data users. When truck-based mobile data computers need to be rebooted, the utility can broadcast instructions to all MDC users through its direct VoIP link, saving time and money. VoIP

also saves manpower when mobile data users need to talk one-on-one with the help-desk. Such conversations can be restricted to only those involved so that other users are not distracted.

Just knowing who is calling can also speed operations. When a radio is transmitting, the system detects the unique identification number of the calling radio, translates it to a full first and last name

and displays the name on the remote PC.

Likewise, when another PC is transmitting, the receiving PCs not only “hear” the audio but also “see” the user name of their caller.

At NiSource’s Indiana facility, VoIP gives users a tool for talking one-on-one by raising the EDACS individual call feature to a new level. “Office personnel can access a full directory of radios,” Smith said. “They can sort the list by first name, last name, department and home region. They can even search the list electronically. They find the person they want to talk to, double-click and transmit. It’s that quick.”

Field workers can also make an individual callback to support employees. The PC rings if no one responds in the first 30 seconds. This was an important feature added to the second-generation product. During development, utility engineers realized that ringing alone was insufficient. With many different regions feeding the same PC, it could take time to determine where the call was coming from. The product’s global view window provides a summary presentation of all the server locations. But when multiple locations were simultaneously routing individual calls, it was hard to tell which one had not been answered, so Catalyst added a ringing icon to the global view window.

“The combination of the ringing and the icon alerts them to the need and directs them right to the caller almost instantly,” McKim said.

The PC-based approach lends



Remote client with headset and speaker volume control.

itself to other advanced capabilities like call history, on-line help and a presentation that's easy to learn as you go. The call-history window presents the most recent 32 calls from each location. If a PC user is busy on another call or away from his desk, he can see who called, when the person called and how long they talked. It also indicates if another PC user took the call and responded.

These are features that public safety agencies especially value, said Martin. "IP Radio provides critical, real-time information to knowledge workers about who is using the radio system and how much they are using it."

Emergency communications workers also benefit from tools such as on-line help. Detailed descriptions of how to operate the system, along with intuitive visual presentation, reduce training time and eliminate uncertainty for new workers.

"Experts that used to convey their knowledge via a dispatcher now feel comfortable clicking on their PCs and talking directly with the field," Martin said.

The graphical user interface on their PC screens helps users understand what's going on, Martin said. "For instance, the interface changes when a user makes a group call versus an individual call. Radio users often get mixed-up. They think they're transmitting to



Eddie White uses IP Radio in the network operations center.

only one person when they are actually broadcasting to many. This creates confusion and wastes time. The PC screen makes it clear to whom they are talking, saving vital minutes."

VoIP users find that once they have it, they can quickly discover new ways to take advantage of its flexibility. At NiSource, the system will enable the testing of radio systems across the company's nine-state territory, Smith said. "We'll be able to test every system we have from one PC at company headquarters."

In Virginia, Martin envisions using VoIP technology as a backup for public agencies' full-featured consoles. "Because it uses different hardware, software and connections, the technology provides a lot of useful redundancy," he said. "When you also consider that VoIP remotes can be brought up quickly in almost any location across the region, the technology opens up powerful possibilities, not only for backing up a disabled operations center, but also for supplementing recovery efforts during storms and other disasters." ■