

The Need for Speed

by Pierre Plangger

"A few seconds may not seem like a long time, but when we have a caller in an emergency situation, a few seconds is an eternity."

--Pat Eyestone, PSAP Manager, Brainerd, MN

Nowhere in our society is the need for speed more compelling than it is in the public safety sector.

Yet with an estimated quarter-million 9-1-1 calls being placed daily throughout the U.S. and large cities reporting upwards of five million 9-1-1 calls per year, at no time has the need been more urgent to process calls quickly and efficiently.

While we would all like to simply add more staff to handle call volume, this isn't always the best answer. An audit in Philadelphia just four years ago found that, despite hiring 153 new patrol officers and 61 new dispatchers, response times actually increased and the system became more expensive to operate.

The current staffing crisis makes the possibility of adding staff even less of an option. Agencies around the country are reporting they can't find enough qualified applicants, are operating below authorized strength, and are requiring their employees to work mandatory overtime.

To be sure, it's people that make 9-1-1 work so well. They're the heart, the soul, the very essence of our public safety network. But to meet their agency's goals and their community's expectations, people are counting more heavily than ever before on technology.

So what exactly can technology deliver? What's available now and what's just around the corner? What are the costs, the benefits, the opportunities? With so many vendors, applications, and potential solutions, it may seem that these and other questions are more difficult to answer than they were even a few years ago. However, understanding the key developments now shaping the industry can help you evaluate new technologies and determine how your agency and community can benefit from them today and into the future.

ISDN: A new backbone for E9-1-1

One of the most promising technologies for improving the speed of receiving 9-1-1 calls isn't exactly new.

The Integrated Services Digital Network (ISDN) has been growing steadily in the public market since the early 1990s, when an industry-wide effort was begun to establish a specific implementation standard for ISDN in the U.S. In fact, nearly all voice switching in the U.S. is already digital within the telephone network.

Although the final connection from the local central office to the customer equipment is still largely analog, competitive pricing, inexpensive ISDN connection equipment, and the desire for people to have low-cost, high-bandwidth Internet access have made ISDN more popular in recent years.

Meanwhile, most public safety answering points (PSAPs) continue to be served by analog (CAMA) trunks. Used since the beginning of 9-1-1, analog trunks now lack the speed of call delivery, capacity, and other benefits of ISDN trunks. Here are some reasons why.

With an analog trunk, it is necessary to have a separate phone line for each device you wish to use simultaneously. For example, one line each is required for a telephone, fax, computer, bridge/router, and so on. With ISDN, it is possible to combine many different digital data sources and voice on a single trunk. Since the trunk is digital, it is easier to keep noise and interference out while combining these signals.

The modem was a big breakthrough in computer communications, allowing computers to convert their digital information into an analog signal to travel through the public phone network. Although the upper limit to the amount of information an analog telephone line can hold is about 56 kbps, most routinely go about 45 kbps. By contrast, ISDN allows multiple digital channels to be operated simultaneously, and can support an uncompressed data transfer speed of 128 kbps. In addition, the latency, or amount of time it takes for a communication to begin, is typically about half that on an ISDN line compared to an analog line.

Finally, instead of the phone company sending a ring voltage signal to ring the bell in your phone (In-Band signal), the ISDN network sends a digital packet on a separate channel (Out-of-Band signal). The Out-of-Band signal does not disturb established connections, and call setup time is very fast. For example, a V.34 modem typically takes 30-60 seconds to establish a connection; an ISDN call usually takes less than two seconds. The Out-of-Band signal also permits information updates during a call, important for 9-1-1 operations since it would enable such things as updating the location of a mobile unit while a call is in progress.

Overall, faster call set-up with ISDN means fewer abandoned calls. In fact, people now EXPECT fast response from their telephone system and are prone to hang up faster on slow, analog 9-1-1 response. For these and other reasons, it's not surprising that standards are being developed for introducing ISDN into public safety. Telcordia adopted the first standards for E9-1-1 ISDN in 1997. The American National Standards Institute soon followed, and in May 1999 NENA approved recommended generic standards for E9-1-1 ISDN PSAP equipment utilizing Basic Rate Interface (NENA 04-003).

What does this all mean to PSAP directors? For starters, they can expect faster call setup, fewer abandoned calls, faster tandem transfers over ISDN networks, ability to transmit data and voice simultaneously over a single line, more reliability, better audio quality, and expandability of call information delivered in the future. Further, ISDN will support

the transmission of XY coordinates directly with the call, providing faster and more reliable location data than is currently available with analog trunks.

To take advantage of these benefits, PSAPs will need a switch fabric that interfaces with ISDN. The best 9-1-1 switches connect directly to ISDN; others require an extra connection between the 9-1-1 switch and the PBX. Although digital trunks are more expensive, they can support more lines than analog ones, so fewer trunks will be needed into the PSAP. There could actually be an overall cost savings, depending on the architecture used and your agency's unique needs.

Mapping: The wireless imperative

Perhaps no single application since the introduction of computer-aided dispatch (CAD) has created more interest among public safety officials than computer-generated mapping.

Mapping applications come in a wide variety of flavors, but are designed with one main purpose when it comes to public safety: to display the location of the 9-1-1 caller on a map. This lets dispatchers see routes and landmarks that help them guide responders to the scene in the quickest possible time.

Since maps are easier to read than text-based ALI and can provide other pertinent information, they help speed response time no matter where or how the call is generated. But with the 9-1-1 network rapidly evolving from a wireline customer base to a wireless one, the demand for mapping technology has become more acute.

By October 2001, the Federal Communications Commission will require wireless carriers to transmit the location of a wireless 9-1-1 caller within certain accuracies. Computer maps provide the best solution for locating wireless 9-1-1 calls quickly and reliably. By linking mapping applications to other location technologies, including automatic vehicle location (AVL), maps provide PSAPs with an even more powerful solution for effectively allocating and directing response units to emergencies.

Applications that allow you to customize your map by determining icons, colors, road indicators, and other markers can give you the most value. Just remember that your map is only as good as the data behind it. To help with this vital task, software is being developed that will enable PSAP personnel to easily maintain and update MSAG and GIS databases for their maps.

Another thing to watch out for is the speed of the map display. If your map is slow to display and redraw, you'll lose one of the major benefits it's intended to provide: improved response time.

Putting the technology together

A telephone call reporting a fire triggers a map display that flags the address and identifies the responsible fire department, police agency and ambulance service. The map then communicates with the radio paging system calling up the correct paging sequence. Once the dispatcher verifies that the proper numbers have been identified, one click activates the sequence. All this is accomplished in seconds, mostly in the background.

Are you dreaming? Well, yes and no. Integration has the potential to deliver on the promise that advanced technology can make 9-1-1 operations a lot more manageable. But since integration can mean different things, what you get depends on what you ask for.

At its most basic, integration means that all applications are on one computer, controlled by a single mouse and keyboard. These applications are standalone with no communication between them.

At its most sophisticated, integration means a single API links all systems riding on one platform. Interactivity is the characteristic mode of operation. Every module speaks the same language.

The advantage of a truly integrated system is that you get reliable, rapid access to all the information and tools needed to respond to emergencies efficiently. No time is lost manually transferring information from one application to another; everything uses the same user interface making it easier to learn and operate; open standards allow you to reconfigure your systems and add new features as your needs change over time.

The biggest concern is what happens if (or is it when?) your server goes down. Do you lose your entire 9-1-1 system? Redundant architecture and hot standby modules help minimize this risk. So too does keeping your telephony separate from your server. If all else fails, at least you can be confident that your phones will continue to work.

Networking: Public safety's underpinnings

Often overlooked, but nonetheless fundamental to effective public safety response, is the networking of multiple PSAPs to form a single, coherent system.

A configuration in which each PSAP has its own switch and is independent of others in the network is difficult and costly to maintain. On the other hand, a solution that allows PSAPs to work as an integrated system, with calls automatically routed or rerouted as PSAPs come in or out, gives you the most robust, flexible solution for your community.

This approach also ensures that you never lose 9-1-1 calls, since redundancy and back-up protocols are automatically programmed into your system.

Digital switches can be easily programmed and reconfigured as your system changes without requiring new hardware. "Evergreen" technology further assures that you can add new features and continue to upgrade your infrastructure without having to replace it.

Where do we go from here?

Touch screen controls, one-button call transfers, cached ALI to generate faster delivery of data, and myriad other user-friendly features have moved from the "nice-to-have" to the "must-have" category as communication centers implement every strategy they possibly can to deal with growing call volumes.

Meanwhile, the World Wide Web is just beginning to make its presence felt. Applications already use the Web to provide real time information sharing in emergency

operations centers. At the same time, the development of voice over Internet protocol (VoIP) is raising new and perplexing questions for public safety dispatchers, who may have to field 9-1-1 calls with no name, number, or location data whatsoever.

Overall, it is clear that technology is providing new and effective ways of dealing with complex problems. But in the final analysis, technology is not the answer. Teamwork is. Progress is made based on partnerships among public safety agencies, and with public safety vendors and telecom providers. Working together, we can achieve the level of service you and your communities expect.

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