

Protecting Citizens and Critical Services with Broadband Communications Solutions

By M. Shannon

Governments and local authorities rely heavily upon communications systems to prevent crime or injury, detect threats and respond to man-made and natural disasters. Enhancing resources to enable recovery has proven difficult. This is especially troublesome when failures and incompatibilities in existing communications systems can be catastrophic, resulting in chaos, confusion, delayed response and lost lives.

Some of the pressing issues inhibiting effective wireless communications for public safety are:

- Incompatibility of communications equipment between agencies
- Inability to share data between command and control and first responders
- Inconsistent budget cycles and funding
- The absence of standards for communications evolution

In this article, we review the state of emergency management agencies and describe requirements that critical network infrastructures must address to support the evolving first responders' mission.

Beyond Land Mobile Radio Technology

While the complexity of the first responders' mission has increased in recent years, the availability of information to assist them to do their job has also dramatically increased. This includes closed-circuit television video, HazMAT information, diagrams, blueprints, data and voice communications. Getting essential information to the right people rapidly is crucial. The recipients could be first responders on the ground or decision makers with the authority to deploy resources. The inability to share information among agencies and first responders can put people and missions at risk.

Many national, state and local governments use communications networks and systems that handle voice well, but not voice, data and video traffic. These aging systems manage limited amounts of data transmissions at very low rates.

First responders use two-way radios to communicate during times of crisis. Radios connect multiple agencies to disparate dispatch centers. Most of these systems rely on the functionality of Land Mobile Radio (LMR) technology, which cannot relay real-time multimedia information.

The need for multiple agencies (such as police, fire, emergency medicine and crisis-related first responders) from multiple jurisdictions (including national, federal, state and local governments) in times of crisis has brought to the forefront the importance of communications systems that facilitate coordinated efforts. Government leaders need a seamless communications network, based on open network standards and operating procedures across wireless and landline networks, that supports all public safety agencies and affiliated groups.

Managing the Complexity of the Mission

The need for communications interoperability is not new. But the wealth of digitized information from multiple sources is new and has dramatically increased in recent years.

In the wake of the attacks on the United States in 2001, international progress has been made to develop standards for first responder communications. The Association of Public Safety Communications Officials International (APCO) and the National Association of State

Telecommunications Directors (NASTD) are collaborating with federal agencies and industry representatives to establish APCO 25, a standard-setting initiative for uniform digital two-way radio technology for public safety organizations. Their efforts are guided by a four-part strategy to:

- Enhance functionality with equipment and capabilities
- Improve spectrum efficiency
- Ensure competition among multiple vendors through open systems architecture
- Allow effective, efficient and reliable intra-agency and inter-agency communications

Converged IP Broadband Networks for Public Safety

Fortunately, major technology developments in networking, especially multimedia-capable mobile handsets, have caught up with the vision for how life-saving information can be exchanged in the field in real time. Enabling this vision are converged any-to-any networking infrastructures enabled by the transition from analog to digital technologies and the consolidation of dedicated and disparate networks. Broadband networks now deliver data, video and voice communications to multiple destinations.

A growing number of Emergency Management Services (EMS) operations around the world recognize the need to arm their responder personal devices with wireless high-speed data access. Communicating to a central command center and to other responders improves response time and community safety, ensuring all parties receive up-to-date accurate information.

New technology and market developments – such as real-time video surveillance, mobile interactive video and remote database access – require increased bandwidth to operate effectively. Leading first responder organizations are using technologies such as WiMAX or CDMA to deploy broadband wireless networks which support these multimedia needs. Existing critical voice communications continue to remain on separate established technologies; however, broadband can be used for noncritical voice communication, which helps alleviate the congestion on LMR networks.

New broadband network infrastructures must be able to automatically recover from inevitable outages that occur during emergency situations and ensure communications availability.

Building a Common Platform

Designing a public safety network is a complex undertaking. Each public safety agency has specific needs based on operational objectives. But deploying a network has many constraints, including geographic location, terrain, regulatory framework and spectrum availability. All these factors must be considered when designing the network.

Reducing response times, while coordinating emergency personnel, is essential to public safety. The foundation for coordination is an integrated, mission-critical mobile communications network that is reliable and secure and can be upgraded with new services and capabilities as needed.

Although individual agencies require their own network, the challenge is ensuring integrated communications across multiple agencies, enabling coordinated intervention by an array of first responders.

Many public service organizations have existing, analog-based voice networks and need to migrate to new networks with IP capabilities. These agencies must ensure a smooth transition from their legacy systems to a digital Private Mobile Radio solution based on industry standards such as Terrestrial Trunked Radio (TETRA) or APCO 25.

To operate effectively, first responders require crucial, large bandwidth services, such as, real-time video surveillance, mobile interactive video and remote database access. For many organizations, the solution is to deploy a separate wireless broadband network using mass-market radio access technologies such as WiMAX or CDMA.

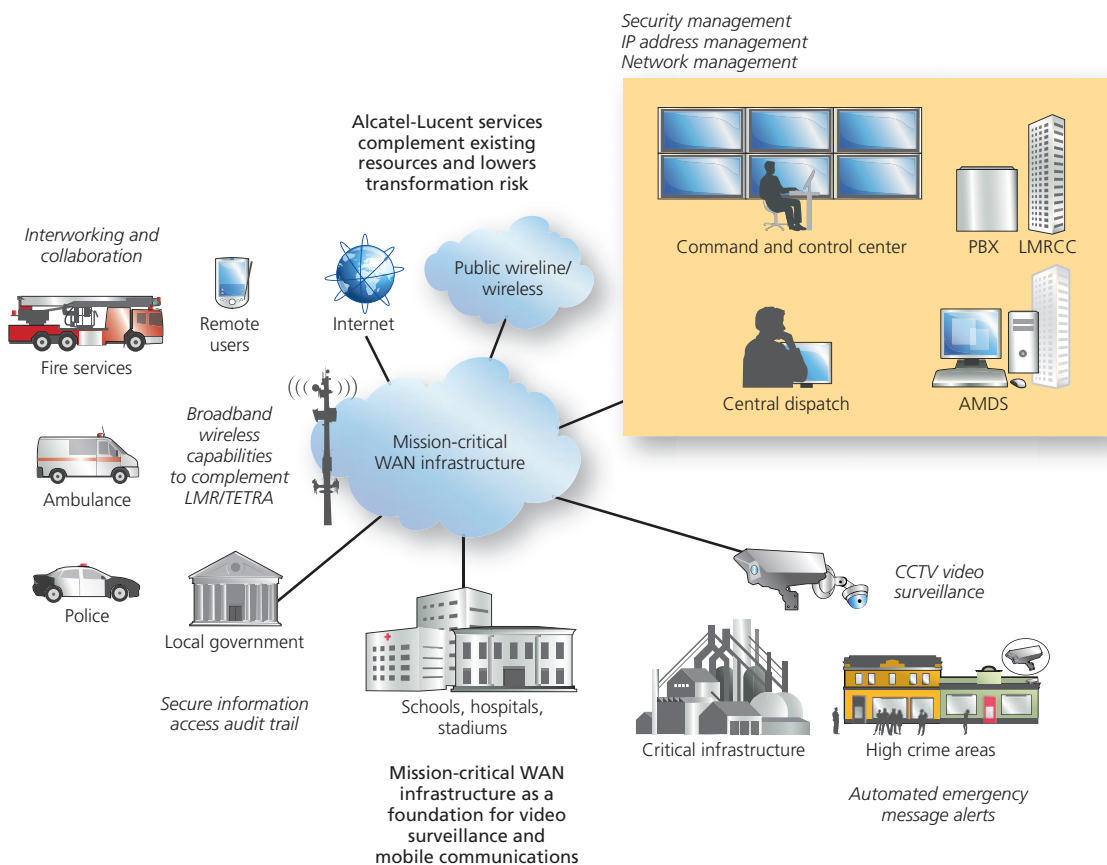
Since first response operations are usually publicly funded, they often face budget constraints and public scrutiny. Traditional purpose-built components used in proprietary LMR networks have proven expensive given the limited volume the market drives. New public safety broadband communications solutions built upon commercial, off-the-shelf carrier-grade products lowers the cost of ownership by leveraging economies of scale, reducing equipment, network operations and maintenance expenses. This also enhances reliability and offers a variety of cost-effective devices.

A Case in Point

One example of a standards-based mission-critical broadband wireless infrastructure is the Alcatel-Lucent public safety solution based on CDMA2000® 1xEV-DO Revision A (DO Rev A). DO Rev A meets the special requirements of mission-critical first responder high-speed data communications.

Operating in the 700 MHz band, DO Rev A dramatically exceeds the limited range of solutions deployed in the 4.9 GHz public safety band (approximately 300 yards or less with line-of-site coverage). Broadband technologies in the 700 MHz band range up to 29 kilometers (depending on the terrain) in urban, suburban and rural environments, ensuring lower cost, higher capacity coverage per square kilometer. And, broadband delivers the speeds and low latency needed to support real-time multimedia communications (Figure 1).

Figure 1: Mission-critical WAN infrastructure for public safety applications



With peak transmission rates up to 3.1 Mb/s, DO Rev A technology supplements existing LMR networks supporting a range of advanced multimedia services, such as streaming video, multimedia messaging, web access and backup push-to-talk service.

The solution supports a growing spectrum of advanced communication capabilities (Table 1).

Table 1: **Broadband-enabled applications for public safety**

<ul style="list-style-type: none">• Streaming video (surveillance, remote monitoring)• Broadcast (multicast) audio or video sent simultaneously to multiple handsets• Digital imaging• Automatic vehicle location• Computer-aided dispatching• E-mail• Mapping/GIS (geographic information system)	<ul style="list-style-type: none">• Remote database access• Text messaging• Telemetry/remote diagnostics• Push-to-talk with fast call set-up• Web access• Voice over IP, including interoperability with legacy and new LMR infrastructure through the use of gateways
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The standards-based CDMA solution leverages the economies of scale of commercial 3G network deployment and allows interoperability between public safety broadband and commercial 3G wireless networks. As commercial CDMA networks evolve to 4G, the public safety 700 MHz solution will integrate and leverage the improved capabilities of new technologies such as LTE.

A Turnkey Mission-critical Solution

Key to the broadband wireless solution is the fixed wide area network (WAN) that connects the antennae sites. This mission-critical infrastructure enables reliable broadband traffic between antennae sites and fixed locations with scalability to support evolving and growing information flow. A combination of microwave, IP/MPLS and optical technologies are often utilized in this infrastructure. In addition, this WAN enables the consolidation of traffic from the agency's fixed sites and mobile first responders for increased efficiency and flexibility.

Many public safety organizations are faced with limited in-house expertise to support new broadband wireless capabilities. To maximize network performance and availability, Alcatel-Lucent provides day-to-day management of the overall broadband network while the agency retains control over priorities, policies and network operation.

Conclusion

Field-proven expertise and a broad product portfolio uniquely position Alcatel-Lucent to deliver broadband wireless networks that meet the most stringent requirements of homeland security and public safety first responders.

Mission-critical infrastructure solutions include wireless, IP, microwave, optical and mobile radio conferring products and services designed to enable vital and secure communication in the field, as well as full interoperability among multiple agencies and jurisdictions. State-of-the-art network management solutions deliver real-time provisioning and troubleshooting to ensure mission-critical networks always operate at peak efficiency.

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