Wireless Communication Standards

Awareness Guide

Homeland Security

Today, the Nation is experiencing significant growth and population clustering in urban and urban interface areas. These changes have placed new and challenging demands on emergency response providers, who face threats of extreme life and property loss, not only from natural disasters—hurricanes, floods, fires, earthquakes, and the like—but also from terrorist threats and civil disturbances. Unfortunately, major emergencies have become more the norm than the exception. They require rapid response and coordinated information sharing by all emergency response agencies—law enforcement, fire, and emergency medical services (EMS)—at the local, tribal, state, and Federal levels.

Many computer users remember when personal and business computers from competing manufacturers were completely incompatible. Peripheral equipment from one source did not work with disks and files from a second source or with other system components from a third. The inconvenience was extremely frustrating. In addition, equipment costs were high, and consumer choice restricted.

Today, wireless emergency response communications systems suffer from similar incompatibility problems. With these radio systems, however, convenience is not the issue. Wireless emergency response communications exist to help save lives and protect property. Law enforcement personnel, firefighters, EMS professionals, and other emergency responders need to be able to communicate with each other to effectively coordinate their efforts.

Instead, all too often, emergency responders must make extra efforts to communicate effectively. Nearly all emergency response personnel use two-way radios

for communications, but when several agencies or jurisdictions respond to an emergency, they often cannot talk with each other. Police and firefighters in a given region, for example, may not be able to communicate via radio. Likewise, rescue personnel may be unable to communicate via their radios on a network operated by colleagues in the next county. These problems result from a number of possible factors, such as inadequate coordination, insufficient funding, and the use of different frequency bands. Another major impediment is the technical incompatibility of emergency response systems because of the development and proliferation of wireless communications equipment that uses incompatible proprietary technology schemes.

Interoperability of wireless emergency response communications systems has an effect on everyone in the Nation. If emergency response personnel cannot communicate with each other because of incompatible communications equipment, they risk their own lives and those of the citizens they have pledged to protect.

Clear, unimpeded, immediate interoperable communications are vital to the success of public safety personnel in saving lives and safeguarding property.

What Is the Problem?

The need for open standards in wireless emergency response communications became urgent about 20 years ago. Previously, the technical compatibility of voice communications systems relied on common use of frequency modulated analog signaling—analog FM. This was, in effect, a de facto standard. In time, manufacturers, working independently, began making improvements to enhance the functionality and efficiency of their products. Better systems emerged, but unfortunately, some manufacturers used unique signaling protocols to provide enhancements such as trunking, and the equipment from different manufacturers was incompatible. The problem was exacerbated a few years later when manufacturers again developed unique, proprietary protocols, this time to provide over-the-air encryption of sensitive information. This practice has continued, and vendors continue to build wireless equipment based on incompatible, proprietary protocols.

Equipment manufacturers give various reasons for their reluctance to fully adopt open standards. Some contend it is problematic to build infrastructure equipment that fully complies with open standards because the standards usually contain intellectual property rights, or "IPRs." They argue that obtaining licenses for IPRs makes standards compliance too expensive. Some manufacturers also assert that building to current standards is too risky because of perceived uncertainties about "true standards," and because standards continually evolve in response to changes in technology and user needs. Nonetheless, many manufacturers have been very active participants in standards development, and their contributions have been invaluable in achieving the progress made to date.

The emergency response community generally believes that industry addresses IPRs in other standards, e.g., those involving commercial technology. For example, manufacturers license several IPRs included in the cellular standard (IS-95) published by the Telecommunications Industry Association (TIA). As a result, emergency responders believe that IPRs should not impede equipment research and development for life-saving emergency response systems. In addition, most emergency response agencies have already endorsed a suite of standards developed through an American National Standards Institute (ANSI)-accredited process, so industry's concern about a lack of "true standards" should be minimized. These standards have been developed—with significant industry assistance—by TIA and the Electronic Industries Alliance (EIA), and the standards suite is called the TIA/EIA-102, Project 25 (P25) Standard. The emergency response community also considers it reasonable for standards to continue to evolve. Its members believe that new standards-compliant equipment can be made backward-compatible to ensure reasonable interoperability with legacy equipment, such as analog systems. Further, the new standards-compliant equipment can be forward-compatible with new standards being developed to protect the emergency response community's investments in a manufacturer's equipment.

In fact, to increase its robustness, the present set of open standards must continue to evolve, and manufacturers need to continue to play a major role in this evolution. Standards addressing the "inter-subsystem interface," which includes the fixed-station and console interfaces, are strengthening the existing suite of voice and data standards. When these standards are put into effect, they will promote increased competition because radio infrastructure components for a system will be supplied by multiple vendors. If an agency needs to join an interoperable network, or expand coverage by adding a tower site using an existing trunking controller, it will not be limited to buying the new equipment from the manufacturer that built the rest of the system infrastructure. The heightened competition that results will lower component prices and increase buyers' choices.

Standards development is usually slow, perhaps in part because emergency response participation has often been the responsibility of a few individuals. Because users have much to gain from open standards, they often bring urgency, a readiness to provide detailed input, and a set of defined objectives to the proceedings. However, when user participation in standards development is limited, conflicting interests and the need to reach consensus may frequently result in a stalemate, either temporary or prolonged. Moreover, the emergency response community has generally lacked sufficient resources to support broad, vigorous, ongoing participation in standards development. Although some groups have contributed funds and staff time to the effort, additional resources are needed to dedicate personnel, defray frequent travel expenses, and pay for the engineering and emergency response expertise to analyze proposals from a technical, as well as an operational, perspective.

Standards development is usually slow....

What Has Been Done?

Industry and individual members of local, state, and Federal emergency response agencies have engaged in a long-term standards development process known as P25. Working together, participants have established unambiguous sets of procedures and specifications that

TIA and EIA have adopted and published. The results are commonly called the TIA/EIA-102 or P25 standards suite.

This longstanding, successful partnership between emergency response and industry has developed voice and wireless data standards for digital emergency response wireless communications. Current standards specify how voice sound waves are converted into digital format and how subscriber units (e.g., mobile and portable radios) and infrastructure components communicate with each other over the air. Together, these standards represent a major accomplishment.

Some manufacturers are also overcoming obstacles and beginning to build equipment that is compliant with the open architecture standards. Increased competition has already begun, with a number of vendors supplying standards-compliant subscriber units, enabling users of mobile and handheld radios from different sources to interoperate. Likewise, at least three manufacturers now offer repeaters—equipment that expands communications coverage areas by retransmitting messages—for use in P25 systems.

In addition, states and regional consortiums are installing equipment that complies with the P25 suite of standards. The State of Michigan was the first to implement a standards-compliant system designed to provide radio communications for all state agencies. Local and Federal agencies have been invited to join the system. As a result, the fully implemented system will provide the backbone for truly interoperable public safety communications across all government levels throughout the state.

Meanwhile, some users are precipitating action on additional voice standards. For example, the Federal Partnership for Interoperable Communications (FPIC) and the Department of Homeland Security (DHS) have supported, through enabling resources, development of the inter-subsystem interface standard. For Phase II, two task forces were created—one to work on the fixed-station interface and the other on the console interface.

This new standards element will provide users with an increased selection of many trunked and conventional infrastructure components. When several manufacturers can offer an item, buyers often benefit from price and service competition.

The P25 Steering Committee has also identified the need for wideband, high-speed data standards and established an effort called Project 25/34. The Project 25/34 activities, in turn, are incorporated into the efforts of Project MESA (Mobility for Emergency and Safety Applications), which was created in 2001 by TIA and the European Telecommunications Standards Institute (ETSI) to address the common requirements and needs of emergency responders in North America and Europe. Project MESA has developed a statement of requirements (SoR) that outlines advanced, emergency responder-defined, mobile broadband scenarios and system requirements. The Project MESA SoR is being used to define technical specifications for the systems and the equipment necessary to support user services. In addition, very large, both current and potential, data transmission markets have led commercial enterprises and others to create digital standards—sometimes de facto, but still effective. Cellular digital packet data (CDPD) is a commonly used example, and Internet Protocol (IP) is another. Emergency response agencies can often take advantage of these developments, either by contracting for existing commercial services or by incorporating these technologies into their own private networks.

What Remains To Be Done?

It is important for equipment manufacturers to design and manufacture standards-compliant radio infrastructure that is available to the emergency response community. In particular, it would be valuable for industry to develop infrastructure compliant with open standards in the very high frequency (VHF) band. Although several local and state emergency response entities are replacing their current networks with equipment that operates in the 700 megahertz (MHz) and 800 MHz ultra high

frequency (UHF) band, the majority of U.S. emergency responders—most local, tribal, and state agencies and nearly all Federal agencies—continue to operate in the VHF band. Federal systems, for example, must comply with a National Telecommunications and Information Administration (NTIA) narrowband mandate that required VHF systems to move to technology with improved spectrum efficiency by January 2005 and UHF systems by January 2008. As a result, virtually all Federal agencies must replace their land mobile radio (LMR) infrastructures. In addition to the narrowband mandate, Federal systems are required to comply with the National Institute of Standards and Technology (NIST) Federal Information Processing Standard (FIPS) 197 for Advanced Encryption Standard (AES) by May 2007 to secure voice communications on LMR systems.

Standards lead to interoperability

In a related effort, the emergency response community should be made aware of available equipment that complies with accepted standards. Efforts are underway to establish interoperability processes and procedures and perform testing to verify standards compliance of LMR equipment. The results of all this work should be widely disseminated to help the broad emergency response community become fully educated consumers of wireless communications equipment. Likewise, proof-of-concept interoperability solutions using standards-compliant components should be piloted. The results of the pilots should then be showcased at emergency response forums.

It is also essential to raise awareness in the emergency response community about the importance of its involvement in the standards development process. This can be done through means such as publications, videos, and conference events. Such an awareness initiative is much too important to depend on the personal initiative of a few concerned users. It requires dedicated personnel with adequate travel funds and access to engineering expertise. These resources are imperative, given the potential outcomes—efficient investment of public funds, and effective, life-saving execution of emergency response missions. An immediate investment promises near- and long-term payoffs in dollars and lives.

At the same time, the emergency response community should not engage in more standards development activities than it has resources to support. It should assess whether to pursue the development of data standards independent of those already being created in commercial and other arenas.

Why Does It Matter?

Emergency response communications must be interoperable for everyone's sake. If emergency response personnel cannot exchange information and coordinate their response to an emergency, they risk loss of life—their own and the lives of the citizens they protect.

Open standards must be adopted and put into place. When equipment is built to open standards, components can operate with each other, regardless of manufacturer. Emergency response personnel can then share information, coordinate efforts, and maximize success in saving lives and safeguarding property.

For Additional Information

Telecommunications Industry Association (TIA) 102 Project 25 Technical Documents

To obtain a list of documents related to P25 (which is distributed for public entities by Federal provider National Communications System Technology and Programs Division (N2)), visit http://www.ncs.gov/library/fed_rec/FTR%201024B-1998.pdf. A CD-ROM is also available from the National Law Enforcement and Corrections Technology Center (NLECTC) for local, tribal, state, and Federal government agencies only. Please contact asknlectc@nlectc.org, or call 1.800.248.2742.

Telecommunications Industry Association (TIA)

For information on APCO P25 Systems and Standards Definition Documents, and other more recent documents about P25, call 703.907.7700, or visit http://www.tiaonline.org/standards/catalog/search.cfm, and enter Project 25 in the search field.

Association of Public–Safety Communications Officials, International (APCO)

For information about P25, including technical documents, updates on standards, access to online interest groups, and discussion forums, call 1.888.APCO.911, or visit http://www.apcointl.org, and enter Project 25 in the search field.

Office for Interoperability and Compatibility (OIC)

For information on emergency response communications interoperability, please visit http://www.safecomprogram.gov.

The SAFECOM program absorbed the Public Safety Wireless Network and its initiatives in 2004. The Office for Interoperability and Compatibility's communications portfolio is currently comprised of the research, development, testing, evaluation, and standards aspects of the SAFECOM and Disaster Management programs.

OFFICE FOR INTEROPERABILITY AND COMPATIBILITY

Defining the Problem

Emergency responders—police officers, fire personnel, emergency medical services—need to share vital voice and data information across disciplines and jurisdictions to successfully respond to day-to-day incidents and large-scale emergencies. Unfortunately, for decades, inadequate and unreliable communications have compromised their ability to perform mission-critical duties. Responders often have difficulty communicating when adjacent agencies are assigned to different radio bands, use incompatible proprietary systems and infrastructure, and lack adequate standard operating procedures and effective multi-jurisdictional, multi-disciplinary governance structures.

OIC Background

The Department of Homeland Security (DHS) established the Office for Interoperability and Compatibility (OIC) in 2004 to strengthen and integrate interoperability and compatibility efforts in order to improve local, tribal, state, and Federal emergency response and preparedness. Managed by the Science and Technology Directorate, OIC is assisting in the coordination of interoperability efforts across DHS. OIC programs and initiatives address critical interoperability and compatibility issues. Priority areas include communications, equipment, and training.

OIC Programs

OIC programs address both voice and data interoperability. OIC is creating the capacity for increased levels of interoperability by developing tools, best practices, and methodologies that emergency response agencies can put into effect immediately. OIC is also improving incident response and recovery by developing tools and messaging standards that help emergency responders manage incidents and exchange information in real time.

Practitioner-Driven Approach

OIC is committed to working in partnership with local, tribal, state, and Federal officials in order to serve critical emergency response needs. OIC's programs are unique in that they advocate a "bottom-up" approach. The programs' practitioner-driven governance structures gain from the valuable input of the emergency response community and from local, tribal, state, and Federal policy makers and leaders.

Long-Term Goals

- Strengthen and integrate homeland security activities related to research and development, testing and evaluation, standards, technical assistance, training, and grant funding that pertain to interoperability.
- Provide a single resource for information about and assistance with interoperability and compatibility issues.
- Reduce unnecessary duplication in emergency response programs and unneeded spending on interoperability issues.
- Identify and promote interoperability and compatibility best practices in the emergency response arena.

Homeland Security