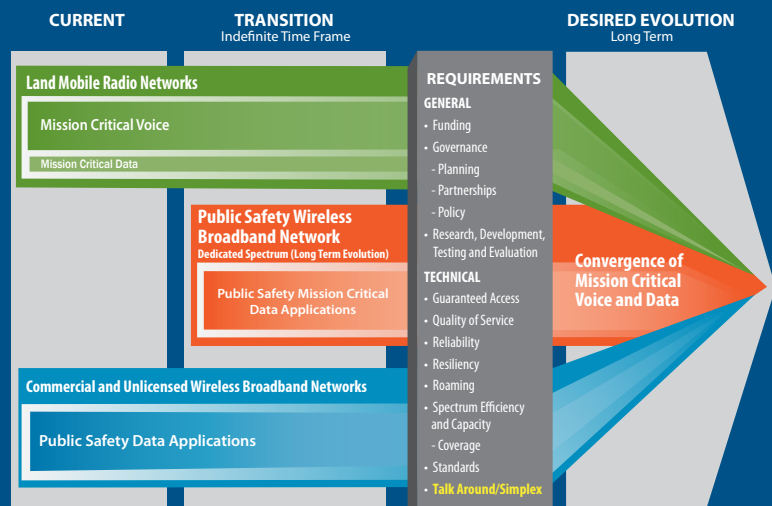




Public Safety Communications Evolution

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Homeland Security

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The Department of Homeland Security's Office of Emergency Communications (OEC) developed this brochure in collaboration with SAFECOM and the National Council of Statewide Interoperability Coordinators, with the support and input of public safety officials at multiple levels of government across the country. This brochure will 1) help educate the public safety community and elected and appointed officials about the future of emergency communications; 2) describe the evolution of emergency communications and how traditional land mobile radio (LMR) communications used today may converge with wireless broadband in the future if specific requirements are met; and 3) further discuss some of the most important requirements that must be met to achieve the desired long-term state of convergence.

The public safety community has made significant strides toward strengthening national preparedness and improving emergency communications capabilities. First responders, however, continue to be limited by fragmented networks and decades-old wireless technologies. Deploying a cost-effective, nationwide public safety wireless broadband network will provide public safety agencies with access to advanced, cutting edge technologies and applications to improve their emergency response capabilities. The nationwide public safety wireless broadband network needs to be closely aligned to commercial deployments of Long Term Evolution (LTE) wireless services to keep pace with changes in technology and leverage cost efficiencies. It must also deliver mission critical voice and data communications to public safety agencies in State, local, and tribal jurisdictions across the Nation, as well as Federal responders and secondary users (such as transportation or utilities). However, the transition from LMR to broadband will not occur overnight, and Federal, State, local, and private sector entities must work together to develop requirements and standards to assure mission critical operations.

In the near term, wireless broadband will complement LMR, not replace it. Wireless broadband does not currently meet the requirements for emergency response voice communications, therefore LMR will be around for years.

Investments in LMR will continue to be necessary now and well into the future. Even with the emergence of broadband, it will still be years before emergency responders can rely on broadband technologies for their mission critical communications. Public safety must continue LMR investments as appropriate in this context.

Public safety is using broadband today for data applications, but not for mission critical emergency response voice communications. Although initial data applications will not provide LMR type voice capabilities, they are vital and can dramatically improve emergency response.

In the future, broadband could support mission critical voice. However, requirements must be met and multiple challenges must be addressed. Some public safety agencies will use broadband for emergency response voice communications if requirements are met and solutions to these challenges are determined and implemented. Until broadband is technically capable of supporting emergency response voice communications and the nationwide public safety wireless broadband network is fully deployed, some agencies may need to continue to use LMR for their communications.

Public Safety Communications Today

Currently, the public safety community relies on traditional LMR systems to support mission critical communications. These radio systems provide a reliable means for personnel in the field to communicate with each other and with command and control centers. As LMR systems evolved over many decades, there are a number of varying, often incompatible systems in use nationwide. As a result, public safety has struggled to communicate across jurisdictional and agency lines.

In addition, public safety agencies use a combination of low bandwidth and high-speed broadband data (largely commercial networks) to support response efforts and perform functions such as digital dispatch, license plate queries, text messaging, and

transmission of low resolution images.

While important, the majority of current broadband data solutions have limited ability to support emergency responders because most are not interoperable or built to public safety standards.

What is Wireless Broadband?

Wireless broadband provides high-speed data communications in a mobile environment. Because of public safety's unique mission, emergency responders require wireless broadband services and devices with guaranteed access and a high level of reliability, coverage, and security not likely to be offered by commercial systems.

The Nationwide Public Safety Wireless Broadband Network

By providing mobile access to real-time, multimedia information, a nationwide public safety wireless broadband network holds the promise to drastically advance the public safety community's ability to communicate among response agencies and access the information necessary to make the most informed decisions possible. For example, public safety will be able to access video images of a crime in progress, download building plans of a burning building to a handheld device, or connect rapidly and securely with personnel from other towns and cities. Just as smartphones have changed the way businesses operate, these technology advancements will dramatically change the way emergency responders communicate and operate.

Public Safety Communications Evolution

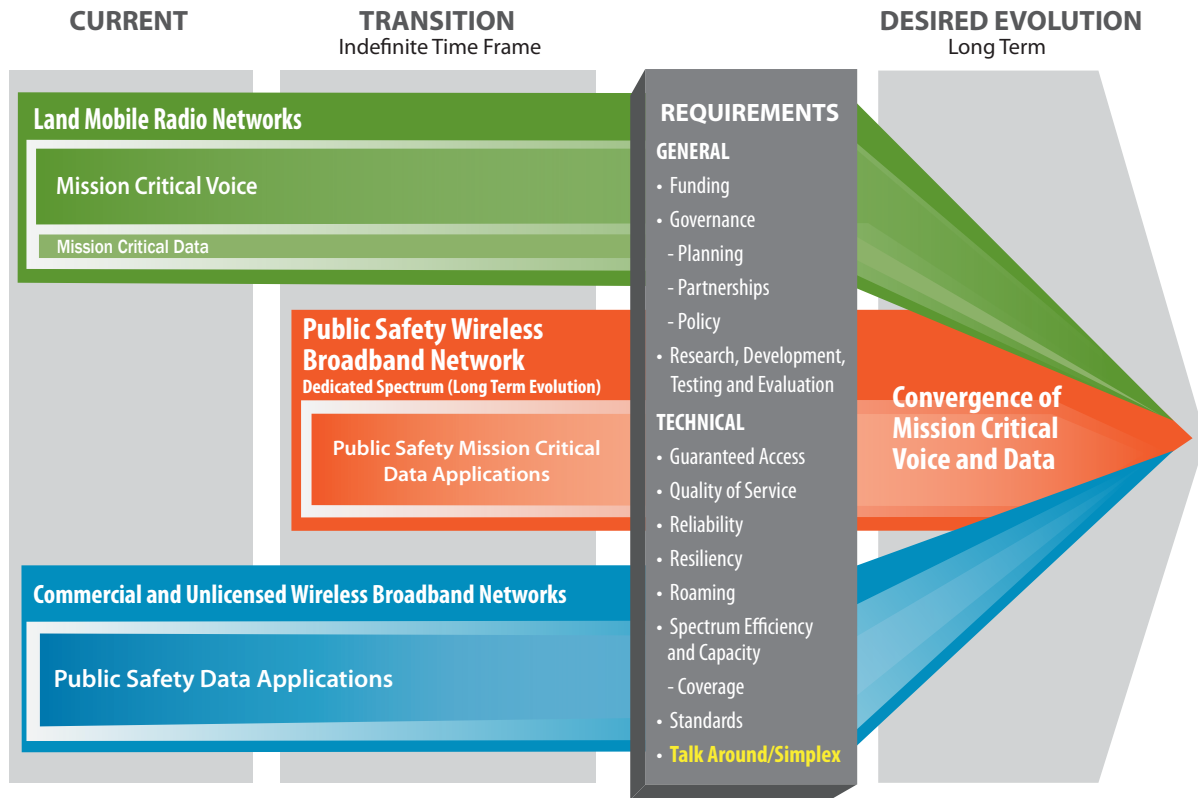


Figure 1: This graphic illustrates a public safety communications evolution by describing the long-term transition toward a desired converged future.

Recent advances in wireless data communications are increasing mobile access to applications and providing real-time information needed by public safety. Whether used in routine daily activities or large-scale responses, these new capabilities will improve emergency communications and response effectiveness. The Advanced Automatic Crash Notification example demonstrates how wireless broadband applications can provide instant actionable knowledge to emergency response personnel. The right information (e.g., weather reports, drivers' licenses and photos, prison records) provided to the right people at the right time will result in

Advanced Automatic Crash Notification will provide pre-arrival information to hospitals and enable responders to make faster and well-informed decisions about resources to send to a scene. This will allow for faster diagnosis and treatment of patients by Emergency Medical Technicians (EMT) or even a virtual physician in the back of the ambulance to expedite proper lifesaving treatment.

more effective emergency response. These and other emergency response applications are only possible with the support of high-speed wireless broadband.

While the public safety community has long recognized the importance of wireless broadband, they also recognize certain challenges must be overcome and requirements met for this technology to meet all of their communications needs. It will take time to address these requirements and integrate wireless broadband into public safety operations. In the future, the public safety wireless broadband network will dramatically enhance the capabilities of emergency responders if these requirements are met.

The Nationwide Public Safety Wireless Broadband Network will allow first responders to match a subject's photograph (taken with a smartphone or Tablet PC) against databases such as the Department of Motor Vehicles or booking databases to determine identity.¹

What about the SAFECOM Interoperability Continuum?

The five critical success elements outlined in the SAFECOM Interoperability Continuum (Governance, Standard Operating Procedures, Technology, Training and Exercise, and Usage) not only apply to LMR communications planning, but also to broadband and are important to consider when planning and implementing interoperability solutions for all public safety communications technologies. The Continuum will continue to be used as a guiding framework for interoperability planning.

Public Safety Communications Evolution

The community's vision of the evolution of public safety communications as it transitions from today's technology to the desired long term state of convergence is depicted in the graphic (Figure 1), which outlines a conceptual framework for building wireless broadband communications while maintaining LMR networks to support mission critical voice

1 United States, White House, The Benefits of Transitioning to a Nationwide Wireless Broadband Network for Public Safety, June 2011.

communications. This section describes the elements of this framework in more detail, including a description of the desired converged environment and the requirements that must be met to achieve this desired evolution.

In the current state of communications, LMR networks, commercial broadband networks, and a nationwide public safety wireless broadband network are evolving in parallel. As communications evolve, public safety will continue to use the reliable mission critical voice communications offered by traditional LMR systems; at the same time, agencies will begin to implement emerging wireless broadband services and applications. During the transition period, public safety will begin building out a dedicated public safety wireless broadband network and public safety organizations will begin to transition from commercial broadband services to the public safety dedicated network. If and when the technical and non-technical requirements can be met and are proven to achieve mission critical voice capability, it is desired that over time agencies will migrate entirely to this broadband technology. Since wireless broadband technology does not yet currently support a mission critical voice capability (talk around/simplex/direct mode), there will be a significant period of time where both wireless broadband and traditional LMR are necessary.

Land Mobile Radio Networks

Mission critical voice communications have historically been delivered using LMR systems built to public safety requirements and operated by individual agencies or jurisdictions.

Mission Critical Voice

Reliable voice communications are essential for day-to-day operations, large-scale responses, and other tactical situations. Voice communications provide emergency responders with instant, reliable, and continuous connectivity between dispatch agencies and responders and also among multiple responders. Presently, mission critical voice is achieved by dedicated LMR networks. The ability

to talk responder to responder or one responder to many responders is a critical feature.

Mission Critical Data

The emergency response community uses limited data communications to complement mission critical voice communications. Emergency responders currently use data services for basic functions such as digital dispatch; license, vehicle, and wanted person queries; text messaging; and transmission of low resolution images. Emergency response agencies have achieved wireless data capabilities by either building their own systems or using a commercial wireless service. Although functional, current public safety data services are generally limited in speed and do not support advanced, real-time applications needed by emergency responders.

Public Safety Wireless Broadband Network

Public safety envisions a dedicated network built to public safety requirements using dedicated spectrum. The public safety community has identified LTE as the standard technology for development of this network. As this capability is built out using LTE technology, public safety will continue to work with industry and all levels of government to advance the technology and address the requirements necessary to reach the desired evolution. During the transition period, public safety will begin using LTE for mission critical data applications. In the meantime, the public safety community will be working to develop wireless broadband technology that can support all of public safety's mission critical communication needs including voice.

Commercial and Unlicensed Wireless Broadband Networks

Emergency responders are increasing the use of commercial and unlicensed broadband networks to augment their mission critical communications. Although not built to public safety standards, commercial and unlicensed networks are

valuable as a complement to reliable LMR voice networks. As commercial broadband capabilities are made available, public safety agencies are beginning to use these services to complement their current LMR communications. Agencies will use their LMR networks for mission critical voice communications, and will use commercial wireless broadband for non-mission critical data communications. Over time, reliable public safety broadband networks based on LTE technology will be built to public safety requirements. As a nationwide public safety wireless broadband network is built out, real-time mission critical broadband applications will migrate to this network as their capabilities are validated by responders.

Requirements

General and technical requirements must be met for the desired evolution to be achieved.

General Requirements

Funding

Emergency response agencies face the challenge of having to support their current mission critical systems while planning for the build-out of emerging technologies, including wireless broadband. To successfully do so, Federal, State, and local funding will be needed to pay for the costs associated with the build-out and sustainment of a wireless broadband network. OEC is working to coordinate Federal grant guidance related to emergency communications via the Emergency Communications Preparedness Center. Coordinated grant guidance will help to ensure consistency in Federal grant policy, promote technical standards that improve interoperability, and ensure compatibility among Federally-funded investments. Coordinated and consistent guidance across all programs will also enable stakeholders to leverage grants from various agencies to support emergency communication improvement projects.

Governance—Planning, Partnerships, and Policy

Coordination and collaboration among interoperable communications stakeholders makes the success of any governance

structure possible. A nationwide interoperable public safety wireless broadband network requires a nationwide architecture and governance structure. In addition to technical and managerial competence, governance requires the active engagement of interoperable emergency communications stakeholders operating at the Federal, State, local, and tribal levels, across jurisdictions and disciplines.

Planning: It is critical that public safety stakeholders engage in nationwide, statewide, regional, and tactical planning. Planning and coordination among entities such as Statewide Interoperability Coordinators, Statewide Interoperability Governing Bodies, Regional Interoperability Committees, and Federal partners form an essential foundation for achieving statewide communications interoperability goals and initiatives.

Partnerships: The willingness of different disciplines and jurisdictions to partner on compatible solutions is often more important than the technologies they intend to use. As wireless broadband communications evolve, partnerships will continue to be critical, particularly with respect to developing and deploying a nationwide, open-standards network that aligns with commercial wireless broadband technologies and applications. Further, the development of a dedicated nationwide public safety wireless broadband network will require closer coordination and partnering between industry and government. Public safety agencies need to evaluate their governance bodies to ensure they include those stakeholders that rely on and deliver communications during emergencies as well as industry subject matter experts. The partnerships built through governance provide agencies with access to knowledge (e.g., best practices and lessons learned) and resources previously unavailable.

Policy: It is critical for all levels of government to proactively and collaboratively develop policies and plans for emerging emergency communications technologies. A nationwide public safety wireless broadband network, in particular, will require a nationwide governance structure, in collaboration with States,

localities, and tribes to develop new initiatives, strategies, and time frames related to investments and deployment. These will need to be documented in the National Emergency Communications Plan and each State's Statewide Communication Interoperability Plan.

Research, Development, Testing, and Evaluation (RDT&E)

RDT&E efforts will ensure that emergency responders have reliable, effective, standardized, and interoperable wireless broadband capabilities and applications. Research and development are critical to determine how systems will meet emergency response requirements, and if these capabilities will sustain functionality in the harsh environments in which emergency responders work.

Technical Requirements

As wireless broadband networks evolve, the emergency response community will increasingly leverage these networks to support their operations. To achieve a converged evolution state, the nationwide public safety wireless broadband network will need to support the following technical requirements:

Guaranteed Access

Emergency responders must have guaranteed access to reliable and instantaneous communications at all times to effectively respond to emergency incidents. Guaranteed access is a critical feature for public safety, especially when using commercial networks.

Quality of Service (QoS)

Public safety requires a network that can guarantee a certain level of performance for critical applications. As all public safety communications move toward a converged broadband wireless environment, some data on the network will be more important than others and will need to be prioritized. In a network, QoS specifies how certain types of data are handled and how that data is prioritized among various users and applications. QoS ensures reliable performance.

Reliability

For emergency responders to be able to rely on a network for mission critical communications, it must be

designed to minimize capacity loss and service degradation.

Resiliency

Systems that support emergency response must be developed with resiliency in mind. Highly reliable and redundant power, components, infrastructure, and communication paths must be included to reduce the possibility of disruption in service.

Roaming

To perform their jobs efficiently, emergency responders require the ability to seamlessly roam between public safety and commercial networks, as necessary.

Spectrum Efficiency and Capacity

The rapid growth of wireless broadband-enabled applications and services has placed constraints on available spectrum capacity in the commercial marketplace, sometimes rendering commercial networks slow and unresponsive. This can have major implications for emergency responders who require access to information to successfully accomplish their missions. Sufficient capacity and spectrum efficiency is needed if the nationwide public safety wireless broadband network is to meet the emergency response community's needs. In addition, public safety requires wireless signal coverage that ensures reliable operations in wide geographic regions including major population centers as well as rural areas.

Standards

Defining technical standards is critical to ensuring that interoperability and public safety-specific features are built into wireless broadband systems.

Standards-based systems will provide backwards compatibility, which will allow emergency responders to continue to communicate effectively on their current mission critical voice systems as wireless broadband networks and applications mature and are integrated into existing systems. As previously stated, the emergency response community has identified LTE as the technology standard for the proposed 700 megahertz (MHz) nationwide public safety wireless broadband network. LTE is a technology

standard widely adopted by the private sector and endorsed by the Federal Communications Commission for use in next generation commercial networks. The LTE standard has evolved based on commercial requirements; however, over time the standard could be enhanced to meet the public safety community's needs. Difficulties lie in public safety's ability to influence a global standard such as LTE because emergency responders represent a small percentage of the LTE consumer market.

Talk Around/Simplex/Direct Mode

Talk around, also known as simplex or direct mode, is the ability to talk device-to-device. This is an important feature for public safety operations because it allows a group of responders in the field to talk directly to each other when outside of the existing network infrastructure coverage or if the network infrastructure has been damaged. For example, this is a critical feature when firefighters respond to a wildfire that is outside of network coverage or to an incident in the basement of a burning building that may be beyond the network's coverage.

Convergence of Mission Critical Voice and Data

A "converged network," a dedicated public safety wireless broadband infrastructure capable of offering mission critical voice, data, and video to emergency responders, is important because it reduces costs of developing and maintaining systems and increases the effectiveness of emergency responders in the field. However, convergence will be a long term and gradual transition as agencies integrate new technologies, rather than replace existing systems. The pace of convergence will vary from agency to agency and will be influenced by operational requirements, existing systems, and funding levels. During this migration period, solutions for connecting traditional LMR with broadband systems will be necessary. Even when the nationwide public safety network is capable of meeting public safety requirements, some agencies may need to operate separate LMR systems until the public safety wireless broadband network is fully deployed in their regions. Broadband technology for mission critical voice is not currently in place and it is still too early to define the timeframe for such a transition. Therefore, additional investments will continue to be necessary for both LMR

and a dedicated public safety wireless broadband network simultaneously.

SAFECOM is a communications program of the Department of Homeland Security. SAFECOM provides research, development, testing and evaluation, guidance, tools, and templates on interoperable communications-related issues to local, tribal, state, and Federal emergency response agencies. The Office of Emergency Communications (OEC) supports SAFECOM's development of grant guidance, policy, tools, and templates, and provides direct assistance to local, tribal, state, and Federal practitioners. The Office for Interoperability and Compatibility (OIC) supports SAFECOM's research, development, testing and evaluation, standards, and tools such as reports and guidelines. OEC is an office within the Directorate for National Protection and Programs. OIC is an office within the Science and Technology Directorate.



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Additional Information and Resources

Administration

- "The Benefits of Transitioning to a Nationwide Wireless Broadband Network for Public Safety" (June 2011)
www.whitehouse.gov/sites/default/files/uploads/publicsafetyreport.pdf
- National Telecommunications and Information Administration, Comments, FCC Docket No. 06-229, "Implementing a Nationwide, Broadband, Interoperable Public Safety Network in the 700 MHz Band." (June 10, 2011)
<http://fjallfoss.fcc.gov/ecfs/comment/view?id=6016823007>

Federal Communications Commission National Broadband Plan

- www.broadband.gov/plan

National Public Safety Telecommunications Council

- <http://www.npstc.org/broadband.jsp>

Office of Emergency Communications

- Homepage: http://www.dhs.gov/xabout/structure/gc_1189774174005.shtm
- National Emergency Communications Plan: www.dhs.gov/files/publications/gc_1217521334397.shtm

Public Safety Communications Research Program

- www.pscr.gov

SAFECOM

- Homepage: www.safecomprogram.gov
- Interoperability Continuum:
http://www.safecomprogram.gov/SiteCollectionDocuments/Interoperability_Continuum_Brochure_2.pdf