

## THE LAND MOBILE RADIO (LMR) BACKGROUND SUMMARY

LMR systems are terrestrially-based, wireless communications systems commonly used by federal, state, local, tribal, and territorial emergency responders, public works companies, and even the military to support voice and low-speed data communications. LMR systems have been deployed since the 1930s to support mission-critical voice communications. Over time, many public safety agencies have migrated from basic LMR systems to more advanced communications systems.

LMR systems typically consist of handheld portable radios, mobile radios, base stations, a network, and repeaters.

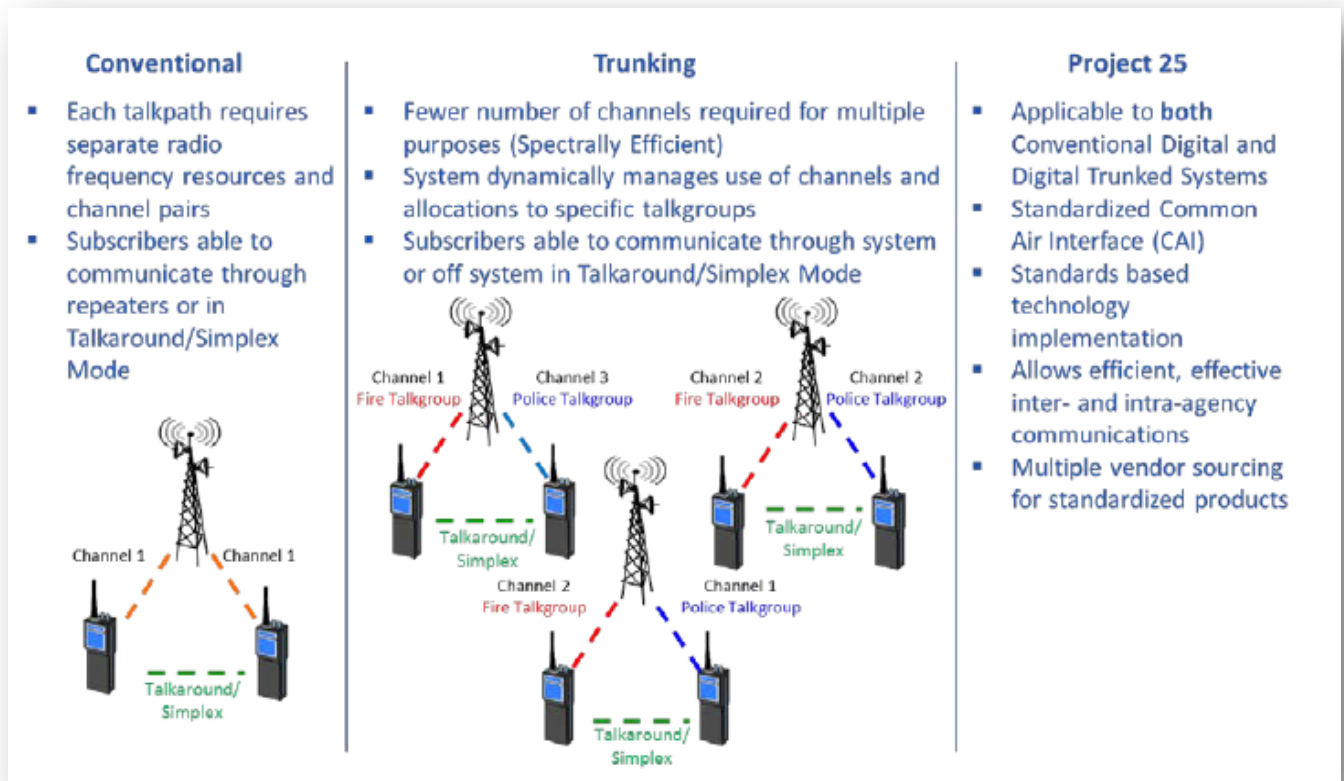
- Handheld portable radios are carried by public safety personnel and tend to have a limited transmission range.
- Mobile radios are often located in vehicles and use the vehicle's power supply and a larger antenna, providing a greater transmission range than handheld portable radios.
- Base station radios are located in fixed positions, such as public safety answering points or dispatch centers, and tend to have the most powerful transmitters.
- A network is required to connect the different base stations to the same communications system.
- Repeaters are used to increase the effective communications range of handheld portable radios, mobile radios, and base station radios by retransmitting received radio signals.

For decades, first responder public safety communications has been synonymous with push-to-talk (PTT) voice service provided by Land Mobile Radio (LMR) technology, i.e., the two-way radios used by police, fire, medical, and other emergency management personnel.

Many agencies have moved from basic, conventional systems to more complex trunked systems. Conventional radio systems have dedicated frequencies and channels assigned to individual groups of users. When a user makes a call, and selects a channel, other members of the group cannot use the channel until the call is over. Trunked systems are computer controlled, and assign a pool of channels for use by multiple individuals. When a call is made by a user on a trunked system, an available channel is automatically selected by the system from the pool of channels, leaving the remaining channels available for others. While trunked systems are more complex and require more infrastructure than conventional systems, they allow for the sharing of channels among a large group of users, increase capacity and interoperability, reduce congestion, and enable the more efficient use of communication channels.<sup>3</sup>

Some states, regions, and large urban areas have migrated from basic systems to computer-based, or Internet Protocol (IP) based systems, which has allowed agencies to increase capacity (i.e., the number of users on a system), enhance capabilities, and improve interoperability. Figure 3 provides an example of a regional or statewide IP network.

Figure below illustrates the progression of LMR technology, beginning with conventional analog voice service, progressing to trunked radio systems, and finally to the current interoperable Project 25 (P25) digital standard.



### Current Interoperability challenges of LMR implementations:

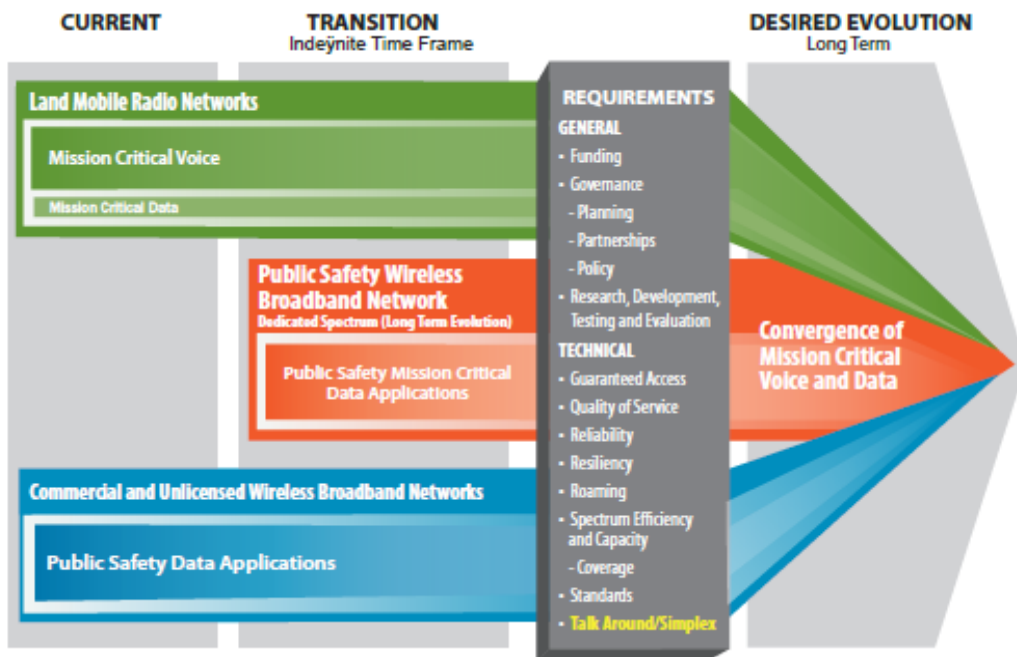
As LMR systems and technologies evolved over many decades, agencies have a variety of communications systems in place today. Some agencies have basic LMR systems in place. Some agencies have more advanced systems in place. Not all of these systems are compatible with each other, inhibiting the ability of public safety responders and officials to talk to each other during emergencies. Below are some of challenges facing agencies and jurisdictions interested in upgrading to interoperable public safety communications systems.

- Agency-specific systems. Many systems have been designed to meet specific agency missions. Vendors offer customized LMR systems and equipment, designed to serve specific agency missions; vendors build systems to proprietary standards, and offer vendor-specific features that served single agency missions, but may not be compatible with surrounding systems.
- Spectrum issues. Agencies and jurisdictions must secure licenses to operate their communication systems on the radio spectrum. The Federal Communications Commission (FCC) assigns spectrum to public safety agencies, according to their needs and use. Public safety communication systems operate on different spectrum frequencies (e.g., very high frequency [VHF], ultra-high frequency [UHF], 700 megahertz [MHz], 800 MHz). Systems that operate on different frequencies are not always interoperable. Agencies often invest in bridging devices, and other equipment that connect disparate systems to enable interoperability between systems and responders.
- Non-standards-based systems that are vendor-specific or customized, and therefore are not compatible with neighboring public safety LMR systems.
- Advanced technologies that are not backward compatible with current systems, including advanced LMR features, Internet Protocol (IP, or computer-based) systems, and broadband technologies that cannot interoperate with older LMR systems.

- Backup communications solutions that include commercial cellular voice and data networks as the primary or only source of back-up; these networks may be overwhelmed by congestion and capacity issues during emergencies.
- Encrypted communications that are proprietary, or not standardized, prohibiting interoperability with radios that are not encrypted in the same way; if encryption is used, it should be standards-based, and implemented inclusively to ensure existing interoperability is maintained.

**Public Safety Communications Technology Evolution.**

Long term technology evolution is expected to bring about convergence of mission critical voice and data to fully enhance public safety emergency communications. Some promising developments are seen in the industry to that end. For example, LMR is being emulated as an app on smart phones, Text to 9-1-1 service is becoming more available, and some jurisdictions are requiring body cameras be worn in addition to radios by officers on patrol. The figure below summarizes the concept, the requirements list at the figure’s center indicates just some of the many aspects yet to be developed, adopted, and implemented in order to make the objective of a converged mission critical platform a reality.



LMR technologies provide mission-critical voice communications that are tailored to public safety needs. While the community considers new and emerging technologies to supplement communications, current LMR capabilities must be sustained until other technologies provide the reliability that LMR offers. Decision-makers should consider the impact of funding decisions on their agencies’ ability to communicate during day-to-day incidents, emergencies, and natural and manmade disasters. The federal government and public safety agencies have spent billions building a vast LMR infrastructure and training users. Without continued investment to operate and maintain LMR systems, emergency communications could be compromised.

## Resources for Public Safety Agencies Investing in LMR

### [SAFECOM Guidance on Emergency Communications Grants](#)

The SAFECOM Guidance provides information for grantees developing emergency communications projects for federal funding. Decision makers and grantees should read the SAFECOM Guidance, coordinate proposals with the Statewide Interoperability Coordinator, and encourage compliance with the recommendations contained therein. For Department of Homeland Security (DHS) grants, grantees must comply with the SAFECOM Guidance as a condition of funding.

### [P25 Technology Interest Group \(PTIG\)](#)

The PTIG website provides information on all topics concerning P25 standards. Free registration is required to view content.

### [P25 Suite of Standards](#)

The Telecommunications Industry Association's website contains P25 standards development activities that address all technical matters for private radio communications systems and services, including definitions, interoperability, compatibility, and compliance requirements. P25 standards documents are available for purchase. Qualified government entities may obtain copies of P25 standards via the PTIG website.

### [P25 Compliance Assessment Program \(CAP\)](#)

The P25 CAP establishes a process for ensuring that equipment complies with P25 standards and is capable of interoperating across manufacturers. P25 CAP is helping emergency response officials make informed purchasing decisions by providing manufacturers with a method for testing their equipment for compliance with P25 standards.

State of Oregon's LMR program is managed by Oregon Department of Transportation (ODOT) and assisted by Oregon State Police. For more information on strategy and state of the service contact ODOT site link.

Link: <https://www.oregon.gov/ODOT/Maintenance/Pages/Wireless-Communications-Section.aspx>