Makes Public-Safety Inroads

Commercial push-to-talk (PTT) technology basics and how it could augment public-safety communications

By Todd Johnson and Nick Falgiatore

First responders have long depended on hardened LMR systems, featuring public-safety-grade radios and infrastructure, to serve their mission-critical communications needs. These networks and devices are entirely different from those offered by commercial providers, as the latter are not designed to stand up to the rigors required by first responders. Moreover, while public-safety networks are engineered to provide sufficient capacity during events that require a multijurisdictional response, commercial networks are often overloaded during major incidents.

One feature that public-safety and some commercial networks have in common is push-to-talk (PTT) functionality. For decades, PTT in the public-safety sector was provided exclusively by agency-owned LMR systems. However, commercial PTT services have emerged in the public sector as a whole, including public safety, public works, public transportation and public utilities.

Commercial PTT technology has evolved dramatically because of the evolution of cellular networks, the emergence of smartphones and new PTT-enabling technology, and the advancement of quality of service (QoS) for VoIP services.

Given the high cost of public-safety-grade radios — a Project 25 (P25)-compliant portable digital radio can cost up to $5,000 per unit compared with a smartphone that sells for about $800 — there has been increased interest in leveraging commercial PTT technologies for non-mission-critical users, such as those in public works, transportation and utilities, as well as local government officials, school personnel, animal control agents and others.

Even the first-responder community is leveraging commercial PTT to supplement public-safety-grade radios, usually by command staff who do not have a daily need for an LMR device, but also by law enforcement, fire and EMS personnel who have to venture into areas within a jurisdiction without adequate LMR coverage, but with commercial coverage. Consequently, the line between public-safety and commercial PTT is becoming increasingly blurred.

The Evolution of Commercial PTT

The first commercial PTT service in the United States was launched in 1996 by the former Nextel, which was acquired by Sprint in 2005. The service leveraged iDEN technology unveiled by Motorola two years earlier. The platform, which employed FDMA and TDMA technology, as well as speech compression, was unique in that it enabled both one-to-one and one-to-many transmissions, the latter being analogous to the traditional walkie-talkie. Nextel's service originally was targeted at companies engaged heavily in dispatch operations, such as taxi services and commercial trucking, as a less expensive alternative to traditional LMR-based paging networks. Later, Nextel moved into the consumer space, marketing the service to those who desired both cellular voice and paging.

After the acquisition, Sprint phased out Nextel's iDEN-based service, starting in 2010 and ending in 2013, in favor of its own PTT offering that operated on the carrier's CDMA platform. Meanwhile, several other commercial PTT services emerged, notably from the two largest U.S. cellular carriers, Verizon and AT&T, but also from smaller regional entities, such as Southern Linc, which still operates on the iDEN platform. Among the four major U.S. national carriers, only T-Mobile USA does not offer commercial PTT service.

While commercial PTT service has been attractive to public works, utilities, transportation and schools, use cases that directly benefit first responders also have been identified. LMR

systems have historically provided superior coverage compared with cellular networks. However, cellular coverage in some jurisdictions has expanded considerably to be equal or better than what's provided by public-safety LMR systems. This can be attributed to factors such as explosive growth, which can cause public-safety radio frequencies to be congested, and in some cases, overloaded. The result is that some LMR systems, even those installed as recently as a decade ago, are, in some instances, unable to provide the rural and in-building coverage that's provided by cellular networks, which typically adapt faster to changing market demands. Additionally, public-safety radio systems are designed to operate only within an agency's jurisdiction, leaving first responders unable to maintain communications when responding to events outside of their footprints.

The emergence of PTT applications that integrate with traditional LMR systems is helping to address these shortcomings. By augmenting LMR devices with a PTT application on their smartphones, first responders can maintain communications with their agency's radio system when their agency-issued radio cannot.

Another use case involves command-level personnel, such as police and fire chiefs, who do not need a radio because they do not engage in emergency response on a day-to-day basis but do need to communicate with incident commanders when a major event occurs. The PTT application that interfaces with the agency's LMR system is quite useful. This also applies to personnel who might be responding from outside the jurisdiction — creating instant interoperability — and government officials, such as the mayor, who need to be kept abreast of developments.

Clearly, public-safety agencies are not abandoning LMR systems in favor of commercial PTT offerings. But just as clearly, such offerings are serving as an effective adjunct to first-responder networks. And because PTT simply is just another data application, and because the vast majority of first responders use their smartphones while on the job, the marriage between commercial PTT and the public-safety sector is a natural progression.

Public-Safety PTT Apps

There are essentially two classes of PTT apps that integrate with LMR systems: those available from traditional LMR vendors and those available from third-party providers. The apps offered by Motorola Solutions and Harris fall into the former category.

Motorola Solutions' WAVE and Harris' BeOn apps enable public-safety agencies to extend LMR talkgroup traffic to user-provided smartphones operating on commercial data or Wi-Fi networks. While there are some fundamental architectural differences concerning how each vendor provides

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its PTT service, the functionality is similar in that both applications allow the radio system to pass along emergency identifications (IDs), PTT IDs and alias information. This is appealing because it allows users of the PTT application to access the same information and emergency features as primary public-safety radio system users.

The primary limitation of these solutions is that they are proprietary and typically sold to buyers of large and expensive P25 digital trunked radio systems, leaving smaller agencies without a viable alternative. While these solutions can be scaled to interface with smaller conventional systems, it is usually cost prohibitive.

Fortunately, the latter class of apps exists, featuring offerings from commercial wireless carriers such as AT&T, Verizon and Sprint, along with third-party vendors such as ESChat. These vendors all have unique service offerings and capabilities but fundamentally provide the same core solution — a PTT system integrated with an agency's LMR channels. Further, these solutions are not proprietary to the radio system vendor, enabling competition within the procurement process, and have price points better suited to smaller systems. The market for these applications continues to evolve, with Motorola's purchase of Kodiak, the vendor responsible for developing the PTT applications used by AT&T and Verizon, being the most recent development.

Regardless of their source, all PTT applications need a way to interface with an agency's public-safety radio system to exchange two-way traffic between the user's smartphone or tablet device and the LMR system. Excluding Harris' BeOn application, which is integrated with the vendor's P25 controller, the two primary integration modes are via the P25 Inter RF Subsystem Interface (ISSI) or a conventional interface.

The ISSI originally was developed to integrate two P25 radio systems. PTT application vendors have used this interface as a means of passing radio traffic between a P25 system and a PTT service by emulating the signaling provided by a P25 system to make the system think it is communicating with another P25 system. The primary benefit of an ISSI is that a large number of talkgroups can be passed from the system to the PTT service without additional equipment required for each talkgroup. In addition, an ISSI supports additional features, such as unit IDs, emergency alarms and encryption, which are not available through other interfaces.

The two primary limitations of the ISSI are that it is only available for trunked P25 systems and the list pricing from radio vendors typically is expensive. Consequently, agencies buying a new P25 system should secure ISSI functionality upfront, when greater discounts and purchasing incentives are available.

The alternative to an ISSI is a conventional interface, which typically requires a donor mobile radio to pull the audio from one radio channel. The PTT vendor then interfaces with the backplane of the radio, typically through a four-wire audio interface, although the PTT vendor can use any data available through the ports on the back of the radio. Conventional interfaces are well suited for agencies that may use only a few channels or may need only a few channels interfaced to their PTT service. However, conventional interfaces do not allow each end-user device to have a unique ID or use other features, such as emergency alerts.

The Future

The day will likely come when public-safety communications will rely on a PTT application riding on a broadband network — think of the nationwide public-safety broadband network (NPSBN) being implemented by the First Responder Network Authority (FirstNet) — but until that time arrives, there are many benefits that can be realized by interfacing an existing public-safety LMR system with a commercial PTT service.

The following takeaways should be considered. PTT service may extend the coverage for public-safety users and/or eliminate the need for a radio altogether for command-level personnel. Regardless of radio system manufacturer or system size, commercial PTT solutions are available from a variety of vendors. Consider publishing a request for proposals (RFP) to solicit for PTT service to ensure the best pricing and the ability to evaluate different service offerings.

When investing in a commercial PTT service, agencies should make sure that they understand the interface being offered and the pros and cons of that interface. Agencies planning to purchase a new P25 system should secure an ISSI upfront as part of the package to ensure the best pricing and the ability to interface to a commercial PTT solution in the future.

Make certain that whatever PTT solution you implement has a long-term plan for migration to mission-critical PTT (MCPTT), the Third Generation Partnership Project (3GPP) standard under development and scheduled for implementation next year, which will provide a common interface for PTT applications. ■

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