

Standards for P25 over LTE



Photo courtesy Caselidian Communications

Standards groups are addressing the need for a public-safety harmonized interoperable Project 25 (P25) push-to-talk over Long Term Evolution (PTToLTE) solution.

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Interoperable mission-critical communications, both narrowband and broadband, remains a top priority for first responders, public-safety agencies and vendors. With the advancing deployment of dedicated Third Generation Partnership Project (3GPP) Long Term Evolution (LTE) networks for public safety, it's critical that the industry move to develop and adopt a standard for Project 25 (P25) push-to-talk (PTT) voice communications over LTE to ensure that interoperable communications remains an achievable goal.

Several entities, including the Association of Public-Safety Communications Officials (APCO) International and the National Public Safety Telecommunications Council (NPSTC), commented that during the deployment of the dedicated public-safety LTE networks, which initially will provide broadband data services, mission-critical users will still have to rely on narrowband mission-critical voice systems for some years. Therefore, it's important that interoperability between P25 and LTE be considered.

The effort to develop a standard for P25 PTT over LTE (P25 PTToLTE) was discussed at the latest 700 MHz public-safety broadband demonstration network stakeholder meeting, organized and hosted by National Institute of Standards and Technology (NIST). The meeting, held March 6–7 in Broomfield, Colo., provided stakeholders with an update on NIST Public Safety Communications Research (PSCR) program activities supporting the 700 MHz national public-safety broadband network (NPSBN). One manufacturer

contribution was an overview of industry efforts to define a standard for interoperable P25 PTTtoLTE. With the passage of H.R. 3630 defining the spectrum, licensing and funding for the NPSBN prior to the meeting, the efforts to develop a standardized solution for voice communications between P25 and LTE took on greater importance and provided an opportunity to further solidify industry direction.

Standards Options

Representatives from manufacturers and users have held discussions in the Telecommunications Industry Association (TIA) TR8 (Mobile and Personal Private Radio Standards) and APCO Project 25 Interface Committee (APIC) subcommittees during the past two years to consider possible standardization efforts for LTE interoperable PTT services specific to P25 voice services.

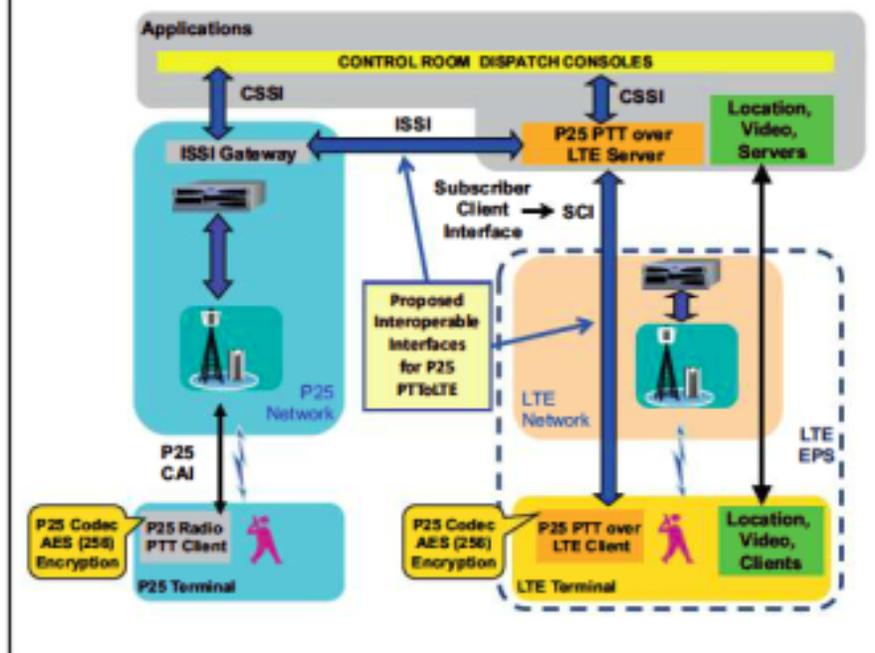
The preliminary discussions centered on obtaining a general concurrence on the standards forum that should initiate the work on the proposal, the general scope of the work and whether the P25 Inter-RF Subsystem Interface (ISSI), which includes the Console Subsystem Interface (CSSI), defined in the TIA-102.BACA-A and associated TIA-102 standards documents, could be leveraged as the foundation for the standard. The standards forums considered were 3GPP, Alliance for Telecommunications Industry Solutions (ATIS) and TIA.

In January 2011, concurrent with the industry discussions, the FCC asked about "interconnection with legacy public-safety networks" in a fourth further notice of proposed rule-making (NPRM). Of the industry members providing comments — Cassidian Communications, Harris, Motorola Solutions and TIA — all said that the TIA P25 ISSI provided an appropriate basis for consideration of a standardized P25 PTTtoLTE solution. Because there was publicly stated consensus to use the P25 ISSI as a foundation, the TIA TR8/APIC P25 forum became the choice to initiate work on a PTTtoLTE standard.

When the P25 ISSI work was initiated in TIA and APIC some years ago, much discussion centered on which standard to use for packetized call setup and control of an ISSI link between compatible P25 systems, ITU H.323 or IETF Session Initiation Protocol (SIP). Because H.323 was targeted toward circuit-switched telecom architectures and SIP was an IP protocol, to build a future-proof solution, the

committees agreed to pursue a SIP-based architecture. The decision was not easy, and doubts were expressed. Those doubts were quickly dispelled, however, with the speed that city, county and state network backbones transitioned from circuit-switched voice and packet data to all-IP networks because of efficiency and cost improvements over circuit-switched topologies.

P25 PTT over LTE Server Architecture



The diagram shows the P25 PTT over LTE server attached to the LTE evolved packet system (EPS) architecture, where EPS to packet data network (PDN) interfaces occur and where application services attach to the network. The access point into a P25 network is via the standard P25 ISSI connection to the P25 PTT over LTE server.

Working Groups

Once it became clear that the TIA/APIC P25 forum would undertake work on the P25 PTT over LTE standard, further discussion in the P25 Steering Committee, APIC forum and the TIA TR8 Plenary led to the reactivation of the APIC Broadband Task Group (BBTG) and TR8.8 Broadband Data subcommittee. The two forums were tasked with addressing the need for an industry-harmonized interoperable P25 PTT over LTE solution. The APIC BBTG subcommittee will ensure that industry representatives and users who are not members of TIA have a formal voice in defining and approving requirements for the P25 PTT over LTE standardized solution.

While APIC subcommittees don't create standards, the members have input into the process, with voting rights on the decision to send standards proposals to TR8. Once the relevant APIC subcommittee approves a proposed standard, the proposal is forwarded to the P25 Steering Committee and users for review. If approved, the proposal is then forwarded to the

appropriate TIA TR8 subcommittee for further work (in this case TR8.8 Broadband Data) to create a standard for TIA ballot consideration. After this approval it becomes a TIA standard.

Goals

At this time, the APIC BBTG and TR8.8 subcommittees have presented high-level proposals, with the following goals:

- Interoperable PTT solution between P25 narrowband and LTE broadband
- Interoperable P25 PTT services on LTE
- Leverage the P25 ISSI protocol composed of SIP with session setup, in-session management and session teardown, along with IETF RFC 3261 (SIP), RFC 3264 offer/answer model with session description protocol (SDP) and RFC 4566 (SDP). The P25 ISSI protocol also includes Real-Time Transport Protocol (RTP) to convey P25 voice frames and IETF RFC 3550 (RTP).
- All IP connectivity, IPv4 based, compatible with IPv6

The subcommittees also highlighted use cases from a technical perspective. The standard must feature connect to a home P25 network as a home subscriber from an LTE network, including public-safety private networks and commercial public LTE networks, providing P25 narrowband to LTE services and LTE public/private network roaming. It also must offer the ability to connect to a geographically defined server on the local jurisdiction for voice path latency avoidance and local control and support of P25 over LTE for LTE-to-LTE network communications using P25 voice frames.

Because the P25 ISSI is being leveraged, the standard P25 ISSI features for P25 voice services must be supported:

- Voice group call and group affiliation
- Individual call
- Emergency alerts
- Authentication
- Certain supplementary services, such as priority call, dispatcher audio takeover and more

The subcommittees must also address security. Security issues require communications between LTE terminals (with voice capability), and the P25 server must be protected over and above the basic — optional advanced encryption standard (AES) — voice frame encryption and authentication, including mutual authentication, signaling integrity and encryption key management. Finally, the standard also must address mobility management of the P25 client, for both a P25 server located in the P25 network (P25 to LTE) and a P25 server located in the LTE network (LTE to LTE), re-registration on a periodic basis for security, home-based mode (P25 to LTE) and local jurisdiction mode (LTE to LTE).

Architecture

A potential architecture under discussion comprises the P25 PTT over LTE server located at an application level, attached to the LTE evolved packet system (EPS) architecture, where EPS

to packet data network (PDN) interfaces occur and where application services attach to the network. The access point into a P25 network is via the standard P25 ISSI connection to the P25 PTTToLTE server.

Included as part of the proposed architecture is a new protocol called the subscriber client interface (SCI) that connects through the LTE enhanced packet core (EPC) and radio

access network (RAN) to the LTE user terminal. Resident in the LTE terminal is a P25 PTTToLTE client. In short, the P25 PTTToLTE is a client-server based application that runs over the LTE EPS, interfacing to the P25 narrowband network via the P25 ISSI.

The proposed architecture uses standard P25 vocoders (voice coder/decoder) and allows standard P25 voice encryption services, up to AES

256 bit encryption, applied at the vocoder. The P25 end-to-end encryption is preserved even when terminated in the LTE terminal.

While work in the TIA TR8 has just begun, discussions have started to resolve high-level technical comments from various participants. It's too early to predict how long it will take to arrive at an agreed solution, and it's not possible to state that the final solution will be in the precise form discussed here. The known factor is the interest by the participants to create a uniform and interoperable P25 PTTToLTE solution for voice connectivity between P25 narrowband and LTE broadband systems, providing low-latency streamlined information sharing in critical situations. Regardless of the final solution, if it follows a similar architecture as outlined in this article, it will be compatible with 4G commercial wireless services, not just the public-safety dedicated LTE network, satisfying the need for public-safety users to roam onto commercial networks as envisioned in the bill.

Efforts are under way to create a partnership between the TIA and ATIS for the project. ATIS is one of the six organizational partners of 3GPP and is the channel for LTE standards proposals in the United States to move to global 3GPP standards. ATIS and the TIA have a formal liaison with a memorandum of understanding (MoU) for "general principles in sponsorship of joint standards activities," and work in the TIA and ATIS is formally applicable to standards efforts supporting the 700 MHz LTE NPSBN. ■

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