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Updating Legacy LMR-Based Communications with CBRS Private LTE

Many industrial sectors like oil and gas, construction, manufacturing, mining, logistics, and transportation have been using two-way private Land Mobile Radio (LMR) systems for decades to provide their workers a reliable and efficient technology for mission-critical as well as short task-based voice communication needs.

However, with the advent of high-speed, low-latency mobile broadband, the very nature of mission-critical communications is changing. Organizations are increasingly using bandwidth-hungry applications like video streaming, group video conferencing, real-time location services, and real-time collaboration to make communications more effective, especially in crises.

As industrial and business establishments move away from "voice only" approach to mission-critical communications and adopt new applications and tools that require high-speed data connectivity, they are increasingly becoming aware of the limitations of Land Mobile Radio (LMR) systems.

The Current State of LMR Systems

LMR systems continue to improve. The evolution from analog to more advanced digital systems offered in P25 and TETRA provides end-to-end encryption, more efficient radio-trunking protocols, IP-based interoperability with cellular-based push-to-talk and improved voice quality. However, despite these technological advancements, they remain narrowband systems that provide good service for applications requiring long-range and low power, such as voice. They are not sufficient for handling latency-sensitive data and video that are helping teams make clear and informed decisions during critical situations. And, while there is an evolution from the analog LMR system to the P25 digital system, there is currently no interoperability between the systems, meaning that departments within the same organization cannot communicate effectively.

Today's LMR systems have inherent limitations — both in terms of technology and cost of deployment — that prevent it from becoming a critical communication solution of the future.

Challenges with Traditional LMR Systems with the Changing Communication Needs

There are five key challenges that LMR systems face in today's high-speed Internet-driven communications environment:

(1) Low Data Rates: Data rates in LMR is limited to a peak of 96 Kbits/s (APCO-25 has a fixed data rate of 4.4 Kbits/s for voice communications and 9.6 to 96 Kbits/s for data only system). This limitation essentially means that these systems are not suitable for today's real-time video collaboration, audio, and video streaming, and file sharing that organizations in sectors like oil & gas, construction, mining, and transportation use in day-to-day operations. It is noteworthy that in today's work environment – whether outdoors or indoors – immediate access to videos and images are an indispensable part of both one-to-one or many-to-many communications in most situations.

(2) Limited Coverage: There is no wide area coverage in LMR networks. While multiple repeater sites are generally deployed to extend coverage, this CAPEX continues to grow as the business area grows. And when the user encounters a new site, they encounter a problem – the technology lacks support for seamless mobility, meaning that users cannot continue their discussions across RF boundaries. When users move to a new zone, their ability to continue communications requires manual interactions, as users must change channels when they go from one cell or system to another.

(3) High Cost of Using the LMR System: Many organizations who use LMR systems rely on – and pay significant fees to carriers – to both set up and manage their LMR networks. In addition to the management fees and the CAPEX invested in the legacy LMR system, businesses are also leasing handheld devices on a monthly recurring basis. These recurring high costs for voice-only services are providing a lower value when compared to modern communication systems available today.

(4) Limited Collaboration Capabilities: Many industrial sectors have facilities spread across multiple locations, and most organizations don't maintain all types of resources and competencies in all locations. When field personnel needs something clarified, they must have a communication path to the right set of resources. Multi-party collaboration across different locations is critical for more than enhancing productivity; crisis management is also an important driver. The current LMR systems cannot support multi-party collaboration applications like real-time video collaboration, audio/video streaming, file sharing or newer forms of remote troubleshooting that leverage virtual reality / augmented reality due to its limited bandwidth. There are limitations even with voice-based multi-party communications in LMR systems due to the channel capacity constraints that prevent or block the number of users available for inclusion group communication.

5 **Restricted Administrative Abilities:** From an administrative point, LMR does not provide an easy way to administer groups. The LMR system assigns the members to groups with a certain role and sends this information to the device, effectively restricting the access of the user to only those pre-defined groups. And when the user has listen-only abilities, that is all they have - there is no flexibility in adjusting this role assignment in LMR groups. While it optimizes the use of the radio bandwidth, it prevents this listener from contributing to the conversation.

PoC Solves Many LMR Challenges, But Limitations Persist

The key service in LMR is quick two-way radio communication, but as people move around the service area, their need to change radio channels during conversations restricts their communications.

The Push-to-Talk-Over-Cellular (PoC) solution became a cost-effective alternative to address this key communication limitation that leveraged the public cellular network to deliver two-way and multi-party calls on a variety of platforms that LMR did not support.

While PoC offers a significant step forward over LMR, it does take away some of the control and privacy that enterprises enjoyed with on-premise private LMR systems. Also, most PoC solutions do not offer the requisite real-time low-latency video and file sharing, and real-time video collaboration capabilities that enterprises need for secure and fast resolution of issues. Additionally, though the cost of deployment of PoC solution is more attractive than private LMR systems from CAPEX perspective, it adds an ongoing operational expense of leasing the devices from the carriers as well as ongoing maintenance fees.

Advancing from Private LMR to CBRS Private LTE networks and Smart Communication Applications

The inadequacies described above are the key reasons why many enterprises are beginning to consider CBRS (Citizens Broadband Radio Service and branded as OnGo by CBRS alliance) based private LTE networks and smart applications for mission-critical communications.

Private LTE networks have existed for some years now. So what changes with CBRS?

CBRS Private LTE Provides a Cost-Efficient Private Network

A key ingredient required for setting up a private LTE network is a suitable 3GPP spectrum. An enterprise can gain access to this spectrum either through spectrum leasing or spectrum sharing. Spectrum leasing is possible today, but it's not a popular option for enterprise users given the cost, complexities of compliance with license conditions, and the dependency on mobile operators.

CBRS shared spectrum model changes that. With CBRS small cell infrastructure, businesses can have their private LTE networks without the need to buy or lease expensive licensed LTE spectrum. Enterprises can either use the free 80 MHz of spectrum set aside for General Authorized Access (GAA) to build high-quality private LTE networks or choose to buy/lease CBRS Priority Access License (PAL), still a comparatively inexpensive alternative, to ensure priority access to the spectrum.

CBRS Private LTE Solves Inherent Challenges of LMR Networks

The CBRS private LTE network solves several of the key LMR challenges. CBRS 3.5 GHz spectrum supports high-bandwidth applications due to the inherent high-speed throughput of LTE. In comparison, LTE delivers data rates that average, depending on the number of users in the area, from six to ten Mbps, which is magnitudes higher than the LMR's 96 kbps. And this data allows full-duplex audio communications with simultaneous real-time video transmission; LMR only limits speaking to one person at a time and does not support real-time video communication.

CBRS Private LTE Enables One Network for All Critical Communications

Implementing a private LTE network also means that organizations can consolidate their communications on a single secure network. The consolidation brings significant CAPEX and OPEX savings for the business organization by avoiding a need to deploy a single-purpose LMR network that carries voice-only traffic.

The low-latency and traffic prioritization capabilities of CBRS private LTE enables businesses to use low-cost over-the-top push-to-talk (PTT) applications for all voice, video, data, and critical communications needs. In addition to seamless voice communications, PTT applications offer solutions to some of the limitations in LMR. A key upgrade over LMR is the ability to let the enterprise manage the group membership and to allow a higher priority caller to take over from lower priority callers during a group call. And since the PTT application leverages the LTE network, many of the current services like location information provide PTT with significantly better service options for dispatch control than LMR.

Another benefit of using the private LTE network and over-the-top application is that workers carry a single device for all communications, eliminating the need to carry multiple devices – one for mobile communications and another for LMR.

Key technical advantages of CBRS Private LTE:

1   **Better Coverage** – Enterprises are able to place CBRS-small cells where needed to provide seamless coverage throughout an area, which makes user communication convenient and simple.

2   **Low Latency** for real-time services – Designed for efficient scheduling and radio resource assignment, LTE can manage latency and deliver better performance in environments with high usage. Low latency is crucial for applications like real-time video-based collaboration or remote troubleshooting.

3   **Ability to Prioritize Traffic with QoS** – In CBRS, LTE traffic can be prioritized to support QoS levels (which manage latency and throughput) of specific applications and services in the enterprise network.

4   **Spectral Efficiency & Capacity** – CBRS LTE delivers high data rates and high capacity because of inherently higher efficiencies in comparison to other wireless technologies, like LMR and Wi-Fi.

5   **Enhanced Security** – With SIM-based authentication, private LTE networks offer enhanced security that can prevent unauthorized network access. Also, organizations can control what goes on the network, prioritize traffic accordingly and ensure no sensitive information leaves their network unless authorized so.

Summary

The mission-critical real-time communications are important, but so is the secure transfer of any information – be it last-minute updates to the airway bill for an overseas flight or the remote operation of the valves controlling an oil pipeline, or the automation of manufacturing systems. The ability to have private, secure, real-time responsive networks is critical to the success of many businesses.

CBRS-based Private LTE is an attractive low-cost alternative network that enables more efficient, higher bandwidth communications infrastructure. Enterprises looking to improve from the options available in today's LMR systems should leverage the flexibility and significantly lower costs offered by CBRS Private LTE and over-the-top PTT applications by consolidating all day-to-day and critical communications on one network. Even businesses that have recently invested in a digital LMR system can augment their existing network with Private LTE to gain the benefits of the new real-time, low latency, high capacity possibilities delivered by LTE.

Samsung Unified Wireless Solutions for Digital Enterprises

Enterprise IT managers recognize the need for a unified standards-based wireless infrastructure that is easy to implement and easy to manage, provides gapless coverage in complicated indoor RF environments and supports mission-critical communications. Samsung has more than 40 years of research and development experience, as well as a track record of successful implementation, supporting technology-forward enterprises and wireless operators. Assisting enterprises and operators who are managing some of the most demanding global Wi-Fi, small cell, 4G and 5G networks has led Samsung to develop a comprehensive line of in-building and outdoor wireless solutions to address the ever-changing end-user demands.

The Samsung portfolio of small cells serves three diverse environments—home, enterprise and outdoor—and uses different spectrum bands, including licensed LTE, CBRS, LAA, and Wi-Fi, in addition to a cloud-managed service for the deployment of the products. They are easy to install, easy to camouflage, and cost-effective.

Samsung's CBRS small cell portfolio supports the use of up to 150 MHz of shared spectrum in the 3.5 GHz band. Samsung's CBRS solutions range from products designed for indoor and outdoor use (in operator or enterprise deployments to create private LTE networks for mission-critical services to macro RAN equipment for MNOs and MSOs to offer fixed wireless access services.

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