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Accelerating enterprise wireless transformation with converged access & private LTE networks

Overview

Businesses are undergoing an unprecedented digital transformation driven by adoption of cloud-native applications and services, IoT, analytics, AI, augmented reality and blockchain. While the degree of implementation of these technologies is dependent on what industry an enterprise is in, one common factor binds all of it together—mobility. Mobility in today's business environment is not possible without an enterprise having access to a high-speed wireless network that provides guaranteed quality of service and business continuity across locations.

While Wi-Fi has become the de-facto in-building wireless network for enterprises and will continue to be the key enabler of the digital infrastructure, LTE-based shared spectrum small cell technology—Citizens Broadband Radio Service (CBRS; branded as OnGo[1])—is creating new opportunities for enterprises to build a cost-efficient, robust, indoor and outdoor wireless infrastructure—a super-efficient business enabler.

This whitepaper outlines why enterprise CIOs and IT Managers should consider deploying the CBRS-based private LTE network and what opportunities it could enable for them.

[1] In May 2018, CBRS Alliance launched the OnGo™ brand, which represents uncompromised wireless connectivity enabled by spectrum sharing in the 3.5 GHz band. The technology is intended to fuel innovation in industrial IoT (IIoT) applications and expand indoor and outdoor coverage as well as capacity for new private LTE and neutral host business opportunities.

Limitation of public LTE networks:

- Limited availability of network in remote locations
- Lack of ubiquitous in-building wireless coverage
- No dedicated capacity for high bandwidth enterprise applications
- Limited control for IT Managers
- Monthly recurring cost

Limitations of Wi-Fi:

- Lacks predictable latency, quality of service and throughput for mission critical applications under network overloads
- Not suitable to cover large outdoor areas

Why enterprises need private LTE

Why do enterprises need their own LTE networks? Why can't they rely on their Wi-Fi networks or the public LTE networks?

The answers to these questions depend on the evolving nature of enterprise wireless and the need for leveraging the wireless network to increase adoption of IoT, improve productivity through automation and machine communication, enhance customer engagement and accelerate digital transformation across all business locations—remote and corporate.

Wi-Fi in the enterprise has come a long way and has evolved from being just an enabler for basic Internet access (browsing, email, etc.) to now serving as the prime backbone for facilitating enterprise mobility and collaboration. A typical Wi-Fi network today handles many different types of devices and applications (smartphones, video, telepresence/video conference, RFIDs, smart TVs, projectors, printers, security cameras, etc.). Also for many enterprises, the customer-facing network with guest devices accesses the same Wi-Fi network as the enterprise applications. This causes performance issues for business-critical applications as low priority guest applications compete for the same spectrum and wireless resources as enterprise applications.

While a combination of high-performance Wi-Fi and public 4G LTE networks addresses most enterprise wireless needs, mission-critical applications and use cases that require stringent privacy and an assured level of predictable network performance (such as high throughput and guaranteed low latency), warrant enterprises to have a more controlled, purpose-built private LTE network. Such use cases span across multiple industries including discrete and process manufacturing, retail and distribution, shipping and logistics, energy and utilities, mining, oil and gas, and healthcare.

In many industries such as mining/oil/gas exploration, utilities, manufacturing, construction, and public safety, private mobile radio systems or two-way radios have been used for ages for critical communication. However, communication has evolved beyond voice and these industries are now using newer technologies and applications (like augmented reality collaboration, remote troubleshooting, etc.) that a two-way radio network cannot handle. A private LTE network offers these industries an opportunity to replace their existing two-way radio systems that are limited to voice only. The replacement alternatives are either over-the-top, yet carrier-grade, Push to Talk over Cellular (PoC) solutions, having no dependency on carriers; or modern smartphone-like devices that combine VoIP, Push to Talk, messaging, and other data-oriented applications accessible only via user control policies of private LTE networks.

Here are a few possible use cases that show how private LTE can drive efficiency in mission-critical operations in different industries. It is important to note here that in almost all industries, private LTE presents a strong case for either replacing or complementing Wi-Fi and replacing the legacy two-way radio systems.

Table 1. Private LTE Use Case Examples

Industry	Use Case	Description
Mining and Oil/ Gas Exploration	Remote Diagnostics and Predictive Maintenance, Mission Critical Voice Communication Enhanced by Access to Video Feeds, Email	Support critical business, safety and production systems for digital operation applications such as real-time video surveillance, secure remote site monitoring using drones, push-to-talk, and push-to-video real-time communications. Today, many mining companies use Wi-Fi and multiple other technologies which are not always ubiquitously deployable, scalable and reliable. **Benefits of Private LTE** Private LTE can offer a consolidated network platform, improved reliability, and resiliency for all critical services and the ability to prioritize traffic (QOS)—all at reduced infrastructure investment. Private LTE also offers mining/oil/gas exploration companies an opportunity to modernize their existing Private Mobile Radio (PMR) systems that are limited to voice only.
Manufacturing, Retail & eCommerce	Automation & Robotics/ Industry 4.0, Indoor/Outdoor Voice Roaming	Most autonomous or robotics operations today rely on ethernet or Wi-Fi networks. For instance, several manufacturing companies have deployed thousands of cloud-connected robots that rely on either an Ethernet or Wi-Fi connectivity. Ethernet provides reliable connectivity needed for such operations but requires huge investments in complex cabling. Similarly, Wi-Fi may have several mobility-related limitations in powering such deployments. **Benefits of Private LTE** With low latency and higher QoS, private LTE can more efficiently manage shop floor robots or run autonomous forklifts in a warehouse; and ensure critical machine-to-machine, machine-to-human, and human-to-human communications.
Transportation	Smart Airport Operations, Two-Way Radio Replacement	The airport is one of the most complicated indoor and outdoor public venues to implement a wireless infrastructure that ensures secure and faultless communication between multiple constituencies such as terminal staff, airlines, air traffic control, runway lighting, airport rails, emergency systems, passengers, retailers, airport security, etc. Digitalization of smart airport operations using IoT, mobility, AI and Big Data analytics are adding mission-critical requirements such as low latency and service-aware traffic prioritization. Current implementations such as Wi-Fi, DAS, 3G/4G, and special purpose mobile radios, though reliable, are generally disjointed, do not provide a consistent experience, and add complexities and cost to automate end-to-end business operations – indoor and outdoor. **Benefits of Private LTE** Private LTE can support all mission-critical airport services and operational communications—indoor and outdoor. Smart devices with mobile applications leveraging private LTE networks completely replace the legacy two-way radios for more effective communications and operations. It can also ensure smooth passenger experience and efficient airport operations through new IoT technologies that require a highly available network.
Utilities	Critical Utility Applications/ Grid Automation	In utility networks, low latency is critical for applications like SCADA (low 100 ms), tele-protection (very low <10 ms) and distributed energy management (low). Reliability and security are equally critical. **Benefits of Private LTE** A private LTE network can support all these requirements and much more. With a robust private LTE network in place, utilities may not need a separate voice-only two-way radio network. Similarly, a private LTE network can be used for grid automation as well as substation applications including Field Force Application, Smart Grid Applications, etc.
Logistics	Port Operations	Port operations require wireless infrastructure that can accurately enable remote operation of cranes and other machinery, sensors, tracking of shipping containers, remote control of drones and robots, autonomous vehicle management, etc. Use of current Wi-Fi and the public cellular network is insufficient to ensure low-latency under different network conditions or provide secure communication to track a large number of real-time updates on each shipment's statistics. Similarly, as automation becomes key to port operations, two-way radio communication networks will become irrelevant. **Benefits of Private LTE** Private LTE solutions ensure guaranteed bandwidth and QoS, assuring low-latency required to automate digital operations; while providing a more robust infrastructure to ensure critical communications
Healthcare	Hospital Operations	Hospitals need the highest level of reliability and security in their networks to ensure patient safety and privacy. Currently, hospitals mostly use Wi-Fi for managing medical devices and running hospital operations. Hospital workers access patient records over Wi-Fi, which is prone to interference and carries security risks and may result in violation of HIPAA. Larger hospitals often turn to neutral host DAS systems to enable coverage and capacity for their staff and patients, a costly and often incomplete solution as not all operators join the system. Similarly, many hospitals use voice only two-way radio to run their security, maintenance, and emergency operations when these can be made more efficient with newer applications. **Benefits of Private LTE** With private LTE, hospitals have an option to deploy a highly secure and resilient network that can make their operations and services more efficient and provide a ubiquitous solution for reliable communication.

Why CBRS is a better fit for enterprise private LTE networks

Private LTE networks have existed for some years now. So what changes with CBRS? A key ingredient required for setting up a private LTE network is a suitable 3GPP spectrum. Though LTE spectrum is usually licensed to mobile operators on a national or regional basis, 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 involved, and the dependency on mobile operators.

CBRS Provides Enterprises LTE-Based Robust & Secure Wireless Coverage at Lower Cost & Better Autonomy

CBRS changes all that. With CBRS small cell infrastructure, businesses can have their own private LTE networks without the need to buy or lease expensive licensed LTE spectrum available today. 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 CBRS Priority Access License (PAL), still a comparatively inexpensive alternative, to ensure priority access to the spectrum. Ultimately, CBRS offers two critical benefits to enterprises: robustness of LTE cellular technology and economies of Wi-Fi.

Economic advantages of CBRS LTE

CBRS provides an economical way to build an enterprise LTE network via a couple of key structural changes in how mobile networks are built today:

- Minimal or No Spectrum Costs – No upfront spectrum costs are involved in case an enterprise wants to deploy CBRS LTE using only the GAA spectrum—and even when using PAL, the spectrum costs are minimal.
- Investment Similar to Wi-Fi but Significantly Lower than DAS & Traditional Small Cell – An enterprise can build a CBRS small cell-based LTE network with investments in the technology comparable to Wi-Fi. It is noteworthy that when compared based on just cost of equipment, Wi-Fi will be cheaper than CBRS LTE; however, Wi-Fi has limitations for many new enterprise use cases.

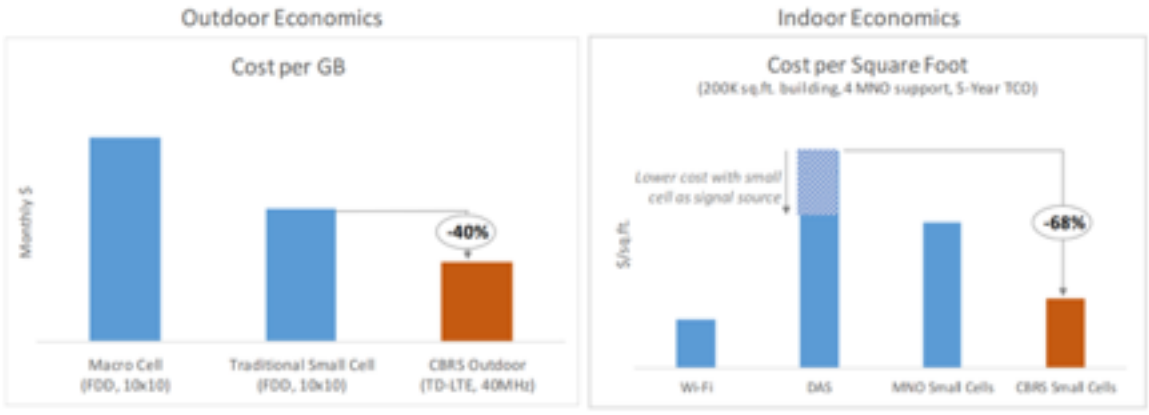
What is CBRS?

CBRS—first announced by the US Federal Communications Commission (FCC) in April 2015—allows for shared commercial use of 150 MHz of spectrum in the 3550–3700 MHz band (3.5 GHz Band), also called Band 48, on a licensed basis.

CBRS is a three-tier dynamic spectrum-sharing model. In the model, incumbent users operate at tier 1 with the highest priority, and tier 2 comprises commercial users with priority access licenses (PAL; those who acquire spectrum through an auction process). Tier 3 will comprise general authorized access (GAA) users (any user with an authorized 3.5 GHz device).

The main objective of these new rules is to promote innovation in the wireless broadband space through the shared use of spectrum and drive much needed coverage and capacity through CBRS small cell technology.

A study done by Mobile Experts shows that the average cost of CBRS based indoor enterprise wireless infrastructure is estimated to be less than 50% of most traditional choices.



Source: Mobile Experts [2]

[2] https://spectrummattersindeed.blogspot.com/2017/06/cbrs-has-big-cost-advantage-over-small.html

Technical advantages of CBRS LTE

A CBRS-based private LTE network offers the technical capabilities and advantages of public LTE networks in a closed environment. These advantages include:

- Better Cell Edge Performance and Coverage – Being a cellular technology, CBRS LTE is designed to provide better cell edge performance than Wi-Fi. This means that an enterprise can deploy fewer CBRS LTE small cells compared to Wi-Fi access points to cover the same area.

- Low Latency and High QoS – As LTE takes a more hands-on approach to scheduling a radio resource assignment, it can manage latency and deliver higher QoS even in environments with higher usage.

- Spectral Efficiency & Capacity – CBRS LTE offers better spectral efficiency leading to higher data rates and capacity because of inherently higher capabilities at both the link and MAC layer.

- Ability to Prioritize Traffic – In CBRS, LTE traffic can be prioritized to support QoS levels (latency and throughput) of specific applications and services.

- Better In-Building Penetration – CBRS could help fill in-building cellular coverage gaps. For instance, energy-efficient glass is known to block cellular signal penetration, and tall buildings can block outdoor signals for their shorter neighbors. While high-frequency spectrum can't penetrate these blockages, LTE networks in the 3.5 band deployed indoors can, which could result in exponential connectivity improvements for enterprises.

Overall, when compared with multiple technology choices for enterprise wireless deployment, CBRS provides a very attractive technical and commercial choice for enterprise IT managers.

Applications	CBRS	DAS	Traditional Small Cell	Repeaters	Unlicensed Small Cell (LAA)	Wi-Fi
Multi-Operator	Yes	Yes	No	No	No	Yes
Seamless Mobility	Yes	Yes	Yes	Yes	Yes	No
Capacity	Yes	Yes	Yes	No	Yes	Yes
Ease of Deployment	Yes	No	Yes	Yes	Yes	Yes
Reliability for Critical Applications	Yes	Yes	Yes	Yes	Yes	Data only
Ecosystem Support	Low (Evolving)	High	High	High	High	High
Cost per Sq. Ft.	Moderate	High	Moderate to High	Low	Moderate	Low to Moderate

Technology Choices and Capabilities for Enterprise Wireless Deployment

CBRS private LTE and Wi-Fi: enabling better value with coexistence

A critical issue that needs to be deliberated is how CBRS small cells should be treated in relation to Wi-Fi, which is currently the most ubiquitous wireless technology within enterprise environments.

As Wi-Fi runs on the unlicensed shared spectrum, it is sometimes prone to interference as usage goes up. However, Wi-Fi is still a great wireless technology and will continue to be used for supporting everyday needs of customers and staff for non-mission critical applications.

However, for instance, if you are an e-commerce or a logistics company considering deploying an IoT platform that relies on robotics and programmable automation to pack customer orders at a warehouse, then a CBRS private LTE network would be more reliable. Or, if you are a mining company with mines in remote locations, then a private LTE network is the best bet for supporting critical business, safety and production systems.

CBRS private LTE and Wi-Fi can coexist and complement each other, as well as enable enterprises to build a robust indoor and outdoor wireless network for all types of applications, non-critical and mission-critical alike.

CBRS-based private LTE network enables enterprises to:

- Cost effectively assure quality of service, low latency, and reliability for applications such as Industrial IoT, M2M communications, robotics, location-based asset tracking, high-bandwidth video streaming and virtual reality experience
- Enable an extremely secure wireless infrastructure for on-campus voice and video communication
- Build dedicated wireless coverage and capacity for a growing number of connected devices

Summary

The need for highly reliable and scalable networks is growing in businesses. Enterprise networks must support new software-driven operating models, data and analytic-rich collaborative business models and increasing levels of automation throughout the business. Tomorrow's network will help them switch to a new era of digital transformation and Industry 4.0 technologies. CBRS has all the ingredients to support the enterprise journey through the Fourth Industrial Revolution.

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