FEATURING DATA SPEEDS, TECHNICAL FLEXIBILITY, SIGNAL PRIORITIZATION, AND SECURITY

WHITE PAPER | PRIVATE LTE

MOTOROLA SOLUTIONS

UTILITIES REQUIRE BROADBAND FOR MISSION CRITICAL OPERATIONS

Utility operations in 2020 and beyond will demand more reliable telecommunications infrastructure in order to meet the ever-increasing demands for reliable, secure service delivery, while providing the right data at the right time for process analytics. In one notable critical infrastructure use case example, Volt VAR Optimization (VVO) technology optimizes power factor control in combination with flattening the voltage profile of an electric distribution feeder by applying intelligent controls to capacitors and voltage regulators on the line.

This serves to minimize electrical losses, reduce line and transformer loading, and provide energy savings for both the utility and the customer by lowering the source voltage (Conservation Voltage Reduction – CVR) at the substation and subsequent line regulators, resulting in a lower voltage at the customer meter. This use case requires coordination via broadband communication for monitoring and control, to optimize the use of these devices to respond to system dynamics in near real-time. It is also anticipated with increasing Advanced Metering Infrastructure (AMI) deployments that smart meter data received will be incorporated into the VVO control scheme, providing even more accurate and granular voltage/var control as well as vital feedback for VVO performance. There are many additional use cases for utility operational efficiencies such as asset management, AMI and cybersecurity that are pushing utility telecom managers and CIOs to look beyond narrow band and public networks to consider private LTE networks. Near real-time, secure, control and management of the electric grid is critical to smart communities across the country.

The electric industry is being forced to change its business model by data-driven consumers and smarter technologies. The utility business model is fundamentally more complex today than it was even five years ago; Once primarily the supplier of centrally produced power, the utility is now the master orchestrator of a multitude of Distributed Energy Resources (DER). As more DERs come online with new energy storage assets and advanced inverter controls (i.e., smart inverters), the reactive power capabilities need to be integrated into the overall VVO control scheme to provide greater granularity of control. Such a scheme may also integrate the customer into greater market participation with potential payments available, likely driven by a Distribution Locational Marginal Pricing (DLMP) based Distribution System Platform (DSP).

As more technologies such as electric vehicles, roof-top solar panels, and smart meters, become more prevalent energy storage will play a critical role in balancing the load demands. Utility telecommunications networks must secure the energy grid, while maintaining grid resiliency, and reliability. New "Smart Communities" are requiring the modernized energy grid to have the appropriate communications platform for a solid foundation for new technologies, consumer applications, and secure communications.

WHAT'S WRONG WITH THE STATUS QUO?

According to the U.S. Energy Information Administration, through 2018, electric utilities have deployed about 86.8 million AMI meters. With a greater emphasis on the Internet of Things and connected homes, analysts expect the number of connected devices within the average utility to grow by an order of magnitude and the volume of data available from each connected device will also climb.

In 2015, Gartner estimated that there were only 3.8 billion connected devices like smart cars, thermostats, streetlights, smoke detectors, and smart TVs in the U.S. Now it is expected by the end of 2020, there will be upwards of 25 billion smart devices all transmitting over public communication networks, which will put more pressure on the unlicensed networks and cause more interference for any critical communication on the same network.

The growing aspiration for smart cities and connected communities may bring new benefits to utilities like more effective, data-driven decision-making, and enhanced engagement with residents, but it also opens this critical infrastructure up to vulnerabilities from previously unconnected systems, like smart HVAC or lighting. NERC CIP regulations are compliance-based and focused on generation and transmission-level power network assets, leaving room for serious vulnerabilities in the distribution grid. The National Infrastructure Advisory Council (NIAC) report on "SECURING CYBER ASSETS: Addressing Urgent Cyber Threats to Critical Infrastructure" recommends establishing separate, secure communications networks specifically designated for the most critical cyber networks. Surely the nation's electric utilities should be considered 'the most critical' for security measures.

Consumers have begun to expect more from their energy providers; For a few years now, they have asked the utilities about greener, renewable generation sources and demanded improvements in their customer service capabilities. But now these savvy consumers will expect real-time consumption data and proactive programs to help them reduce their energy use. Some forward-thinking utilities have a long history of working hand in hand with municipalities to improve the quality of life for citizens and businesses. Critical to the foundation of new consumer initiatives are smarter mobility, renewable energy, water conservation and better waste management, all of which are dependent on utilities' telecommunication infrastructure. Utilities have a tremendous opportunity to bring greater value to consumers when it comes to the development and maintenance of the digital transformation of cities. The key to unlocking this opportunity is telecommunications infrastructure.

Unlicensed spectrum options exist and may have intrigued utilities but for the nation's critical infrastructure operations, utilities must continue stringent standards on security, reliability, and resilience and demand a deployment model not offered by public commercial networks. The need for priority access for critical operations dictates that utilities will be best served with a private network model where spectrum, technology and operations are under the management of the utility. The exponential growth and challenges that lie ahead for electric utilities cannot be addressed adequately with public, unlicensed or legacy networks; The risk of interference and increased security threats related to these will grow with the increase in number of devices connected to these networks. Relying on leased public networks does not provide the utility the reliability and resiliency to effectively deploy these advanced systems. Response time to network outages can be days compared to private LTE solutions, which are hours. Installing a private network allows the utility to make capital investments on their own infrastructure and reduce the heavy operational expenses of the leased services. Electric utilities must demand more robust, interoperable, secure and pervasive telecom networking capabilities that they can control and command.

WHY SHOULD ELECTRIC UTILITIES CONSIDER PRIVATE LTE?

Utility-grade broadband for electric utilities is available today using private LTE systems over licensed 900 MHz and other bands. While there are many critical drivers behind utilities' need for licensed, standardized broadband spectrum in the U.S., a secure, reliable modern grid will also provide immense benefits to consumers and communities of all sizes and structures.

How can states like California, Nevada, Hawaii and New Mexico hope to achieve 100% renewable energy without private utility broadband? California's strict renewable portfolio standards (RPS) for power generation require that 33% of retail sales of electricity in California come from eligible renewable resources by 2020 and 50% by 2050. Likewise, in 2019, Nevada's governor signed a bill requiring 100% of the state's power from carbon-free sources by 2050 and requires 50 percent of its supply to come from renewables by 2030. Utilities know that renewables require flexibility of the infrastructure but also greater control and monitoring 24x7. The issue of transmission flexibility is complicated. Landmark studies from the DOE's National Renewable Energy Laboratory (NREL) on integrating renewables into the U.S. identified flexibility characteristics: increased balancing area; increased sub-hourly scheduling; increased transmission use; dispatch of generation over wider regions; state-of-the-art wind and solar forecasting; increased dispatchable generation; more operating reserves; new transmission to renewable sources; demand and response programs; all of which require reliable, fast, secure telecommunications. Modernizing the grid continues to require a substantial investment in new technologies including a return on those investments so that utilities can meet their obligations to consumers. This is exactly the kind of investment that regulators and consumers want utilities to make.

PRIVATE LTE IS THE TECHNOLOGY OF CHOICE

A multitude of connectivity choices are available to utilities today, but only one standard can meet all the needs of utilities wishing to deploy a holistic, interoperable, broadband network across their territory for a multitude of applications: Private LTE.

The immediate need for private LTE networks is accelerating by increasing natural disasters such as wildfires, hurricanes, superstorms, and intense blizzards, that are growing in intensity and frequency, escalating the threat posed to the critical utility infrastructure. In the case of recent wildfires in California, the November 2018 Camp Fire consumed approximately 150,000 acres, destroyed 14,000 homes, and caused at least 85 deaths. That same year Pacific Gas and Electric Company (PG&E) filed for bankruptcy after calculating its liability at $30 billion. Disasters like wildfires put a utility and their customers at a tremendous risk financially and more importantly threatens safety and security. Wireless telecom infrastructure to monitor and control systems in near real time is now the minimum requirement for disaster and storm restoration. The secure wireless networks must enable connectivity of fire monitoring cameras, weather sensors and other load control devices that can shut off power to a falling power line and reroute the power to other areas. The NIAC report reminds us that the data systems must be capable of supporting massive restoration efforts involving multiple utilities following a devastating attack or disaster. This suggests that the networks must be broadband and interoperable among utilities in broad regions. With very few exceptions, utilities simply do not have such networks now.

In May 2020, the Federal Communications Commission (FCC) voted to realign the 900 MHz band to make available six of the band's ten megahertz for the deployment of broadband services and technologies to meet the ever-increasing spectrum capacity demands of a wide range of industries, including utilities. This broadband spectrum is the ideal workhorse of the invisible infrastructure underlying utility applications of all types, not only for protection of critical infrastructure, but also for Smart Grid systems and other Smart Community applications. Motorola Solutions are ready for the move to private LTE on the re-banded 900 MHz, which will be allowed to transmit LTE signals from devices utilizing three watts of power. This will give utilities an advantage for priority messages, as it is 15 times greater than the 0.200 watts power used by a typical commercial public LTE. Having this higher power limit is expected to be especially useful to utilities' fixed architecture applications like distribution automation, FLISR and Volt/Var optimization.

Utility use cases like the ones mentioned above require greater telecom capacity to support latency, data rates, bandwidth and message priority requirements and, at the same time, present a means to evolve technologically and provide utilities with a future-proof, secure, and interoperable platform on which to add new use cases not yet thought of. Ubiquitous, integrated and seamless connectivity will play a fundamental role as the U.S. power industry transforms. To survive, electric utilities will depend upon a vast network of connected devices throughout the grid and at customer premises across their operating territories.

High-capacity broadband is a fundamental part of a smart city. While utilities are developing new private networks and advanced technologies to meet the demands of more distributed energy resources, utilities position themselves for smart city opportunities. The modernized electric utility and smart cities of tomorrow cannot be fully realized without secure, reliable wireless broadband connectivity. LTE offers the data speeds, technical flexibility, signal prioritization, and security necessary for the multitude of endpoints and smarter utility applications. The enormous utility data generated today and, in the future, makes LTE the most economical network to offer flexibility, scalability and resiliency. Private LTE is the most robust wireless solution with security built in and it is available today for mission critical infrastructure.

AT MOTOROLA SOLUTIONS, WE EMPOWER UTILITIES ALL THE WAY TO THE EDGE!

LTE networks are increasingly more complex and utility leaders are challenged to find the right skill sets within their employee base to not only set strategies but to deploy and manage the systems. Having proven technology providers as strategic partners through this journey is critical to the success of the deployment and lifetime optimization of the network.

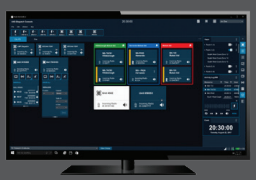
Motorola Solutions has continued to evolve as an organization delivering integrated communication networks. Over the past several years, we have made significant investments in critical application integration and delivery. These investments are best of breed, edge solutions delivering intelligence to organizations across the globe. Whether utility workers are conducting routine steady-state maintenance or emergency crews are restoring power after a storm, utilities need reliable, secure, high-quality communication with field teams. Land mobile radios and telephony have historically served as a mainstay for utility communications, however today more options are available to those considering investing in a private LTE network. Motorola Solutions offers a complete end-to-end solution for utility private LTE networks.

MSI brings a wealth of experience with utility end point applications including Avigilon Control Center Video Management for security, Critical Connect and MC-PTT for interoperability of voice and data. This deep utility history provides the MSI teams with an understanding of the overarching ecosystem of utility infrastructure and end point requirements. Motorola Solutions is committed to providing an end-to-end broadband solution that exceeds utility grid modernization requirements. MSI has developed a future-proof solution that can evolve as LTE-based products continue to be developed. Vital communication between LTE-capable devices and applications allows access to key information used throughout the utility operations.

Incorporation of Broadband services into the 900MHz allocation creates unique issues that must be successfully dealt with to avoid interference to incumbents, allowing coexistence within the allocation between narrowband and broadband systems. Deployment of broadband services within the 900MHz allocation is different from all other broadband reallocation efforts to date in that no guard-band has been proposed, or will exist, between narrowband and broadband services. It is impossible to produce a rectangular transmission mask filter sufficient to protect service in the immediate boundary of the broadband services. Since no guard-band will exist, smart allocation of adjacent narrowband services requires consideration of multiple factors:

1. Stringent control of broadband emissions within the band, ACLR
2. Potential co-location of narrowband services closely located in frequency near the broadband allocation; thus reserving the more distant channels for non-co-located deployments
3. Control of Power on Ground (POG) / Power Flux Density (PFD) permitted levels.

RADIO



Mission critical radio voice and data communications

BROADBAND

Unified broadband multimedia communications

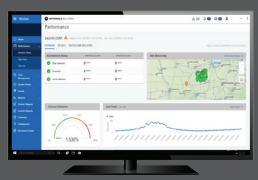
SOFTWARE

Complete, end-to-end mission critical applications suite

VIDEO

Video security solutions, evidence management, advanced analytics

SERVICES



Managed service, cloud delivery, cyber-defence

900 MHZ SOLUTION	BENEFITS TO THE CUSTOMER
High-Power RAN/UE	Reduces site count for utility, which lowers the Total Cost of Ownership (TCO) and OPEX cost.
Minimize RF Interference to 900MHz LMR Channels	"minimize" harm to incumbent LMR services
Flexible LTE Core	LTE Cores: 1. On-Prem, 2. Hosted provides lower operating costs, flexibility in design, and scalability, and 3. Hybrid core.
Kodiak MCPTT Platform	Provides integrated voice, video, and IoT data.
Edge Computing in UE	Running fewer processes in the cloud allows for faster operations.
Analytics Platform in UE	A unified and proper solution designed to address data-driven operations.
Critical Connect	Provides interoperability between LMR and LTE.
Security Services	24x7x365 protection for utility and consumer confidential information.

A private LTE network provides utilities with a dedicated broadband network offering better control and priority than commercial carriers.

IT'S AN IOT WORLD

The electric utility industry is no stranger to the Internet of Things (IoT). Essentially smart grids, and now smart cities, are applications of IoT technology including smart sensors, devices, two-way communications, and data analytics software. IoT-enabled asset monitoring solutions offer centrally consolidated tracking, monitoring, and analytics for the asset-intensive utility industry. These solutions include the management of utility meters, predictive asset maintenance, and operational control. Today, utility 4.0 is all about digitalization – delivering connected devices, data analytics, and artificial intelligence to further automate utility command and control processes. End-to-end visibility, and the ability to model, manage, analyze, and control new grid-edge resources, will be key to the advanced distribution management required by electric utilities today and in the future.

IoT is a critical link connecting end-to-end utility IT/OT technology platforms both to the consumer and to the edge of the grid. The use of IoT in grid technology is accelerating the integration of renewable energy resources, such as solar, wind, and hydroelectricity into the electrical grid. Over time, a utility company has amassed numerous complex communication systems. As the utility business grew, they built disparate, dedicated networks for each specific application, all of which work independently from one another. Each of these networks has a cost associated with running it. The solution is to replace all these networks with a single resilient geo-redundant system allowing seamless management and optimized operational efficiency.

SAFE & SECURE, RELIABLE & REDUNDANT BUILT IOT READY FOR CRITICAL INFRASTRUCTURE

The utility industry's number one priority is to deliver reliable services safely and securely to their consumers. Keeping the command and control network working at optimal performance is vital and an ongoing challenge to this priority. Utility telecom managers look to strategies for centralized network configuration, subscriber provisioning, network performance management and fault monitoring as well as channel and message priority management to ensure that higher priority mission-critical traffic takes precedence over lower priority traffic.

Motorola Solutions' LXN 7900 is a fixed LTE broadband infrastructure solution for utility IoT applications. Using a distributed, regionalized architecture, it provides the high security, high resiliency and low latency required to quickly and securely process information to enable effective mission-critical operations. It was designed from the ground up to offer resiliency in challenging environments. Its locally redundant architecture allows continued operation of any single component and supports geographic redundancy: if the local system is damaged or destroyed, a backup system in a remote location continues to operate the network. It uses hardened Commercially-available Off-The-Shelf (COTS) servers to reduce vulnerabilities and the U.S. Department of Defense Security Technical Implementation Guide's (STIG's) methodology for standardizing security protocols to enhance security for the software and hardware components of the solution. With centralized syslog message collection within the LXN 7900 and from remote sources including eNodeB, utilities can record events and proactively protect and maintain the system. Critical connections are protected from "man-in-the-middle" attacks and eavesdropping with a secure IPSec connection between the base station and the core. Furthermore, the LXN 7900 is 3GPP and NIST 800-187 compliant for over-the-air connection security.

The LXN 7900 allows agile deployment of NB-IoT and/or LTE-Cat-M core networks as a private network. Critical infrastructure industries like smart cities and utilities can now take advantage of dedicated IoT solutions using a distributed/regionalized architecture rather than incur the time delay, cost, and complexity of monolithic centralized solutions. Secure and resilient, the end-to-end solution offers utilities fast, reliable broadband connectivity with real-time access to voice, video, data, and chat.

VERSATILE, FLEXIBLE, AND COMPATIBLE

IoT investment focuses on regulatory compliance, operational efficiency, and sustainability, but reliable connectivity is critical in the development of utility IoT applications. The IoT use cases can help utilities increase operational efficiency, improve customer engagement, add renewable energy resources, and provide their customers with reliable and sustainable energy services. Connectivity's mission-critical role in utility operations has led many to ensure they have full control over this service. As a result, they have developed their own private communications networks for their assets, infrastructure, and people using a variety of available networking technologies. Utilities are now considering private LTE networks as a solution for many of their connectivity needs.

As utilities envision the future, they are confronted with a variety of technologies, which will demand more robust telecom infrastructure. Utility applications such as fire mitigation, distributed energy resources (DERs) integration and volt/var control require utility leaders to conscientiously plan for the communications infrastructure capabilities needed to deliver the data and real-time control these use cases require. Private LTE uses widely adopted 3GPP standards and provides utilities with both the flexibility and control they need to meet their current and future requirements. The versatile LXN 7900 can be hosted as a CAPEX solution within the utility's data center or as a managed service at a Motorola Solutions' data center. Motorola brings a flexible solution that utilizes standards-based technology for interoperability with equipment from multiple vendors. Private LTE meets the demands of critical infrastructure and Motorola is your partner for mission critical communications.

1. National Infrastructure Advisory Council's Securing Cyber Assets: Addressing Urgent Cyber Threats to Critical Infrastructure Final Report and the transmittal letter released September 2017 https://www.cisa.gov/ sites/default/files/publications/niac-securing-cyber-assets-final-report-508.pdf

For more info and technical specs see the LXN 7900 LTE Infrastructure Whitepaper.

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Motorola Solutions, Inc. 500 West Monroe Street, Chicago, IL 60661 U.S.A. **motorolasolutions.com**

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