WHITE PAPER

# The Top 3 Considerations to Choosing an Industrial LTE Solution

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## Overview

LTE is reshaping the wireless landscape. Thanks to the proliferation of mobile devices and applications, LTE continues to be the preferred network in the consumer market. According to the latest report from Global Mobile Suppliers Association (GSA) in January 2015[1], 611 mobile network carriers are investing in LTE in 177 countries. Currently, 360 LTE networks are commercially deployed around the world. This is up from the 146 commercial launches just three years earlier. By the end of 2015, there will be approximately 450 commercial LTE networks in operation worldwide.

In this changing wireless landscape, several converging trends have encouraged industries to adopt LTE for M2M applications:  the gradual decommissioning of legacy networks, the cost-benefits of LTE technology, and the increased demand in rich media and real-time monitoring.

This paper discusses the key benefits of LTE and why network professionals should embrace and take advantage of LTE to transform M2M applications. The paper will also examine the top three considerations when selecting LTE solutions for industrial applications.

## Preparing for the 2G Sunset

Like every introduction of disruptive technology, the rise of LTE means the decline of 2G and 3G. Driven in part by the consumer market, major carriers have started to migrate away from legacy 2G and 3G networks. This migration allows carriers to repurpose the spectrum for more efficient LTE data transmission and to keep up with the increasing demand for cellular broadband data. In 2002, AT&T announced that they will stop providing 2G services as early as 2017[2]. Similarly, Verizon is already in the process of phasing out their 3G network to expand their LTE services[3].

Seeing the potential for better services and greater profits, many mobile network carriers have started to decommission legacy networks to make way for LTE and are expecting industries to gradually move M2M applications into LTE networks.

While some M2M applications can continue to rely on 2G and 3G technologies until the end of the decade, managers and network professionals must consider the 2G sunset in their long-term plans to ensure that their devices can operate in the field for many years to come.

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1. http://www.gsacom.com/news/gsa_fastfacts.php4
2. http://www.business.att.com/enterprise/Family/mobility-services/machine-to-machine/m2m-applications/cd2migration/page=addl-info/
3. http://money.cnn.com/2014/12/04/technology/mobile/verizon-killing-off-3g/

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Moxa is a leading manufacturer of industrial networking, computing, and automation solutions. With over 25 years of industry experience, Moxa has connected more than 30 million devices worldwide and has a distribution and service network that reaches customers in more than 70 countries. Moxa delivers lasting business value by empowering industry with reliable networks and sincere service for automation systems. Information about Moxa's solutions is available at www.moxa.com.

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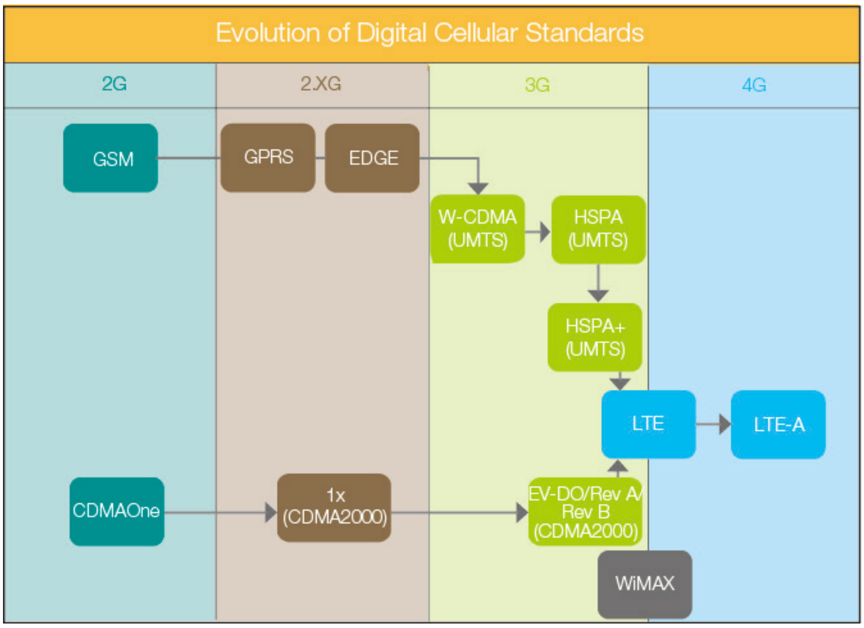
"With an estimated 90% of M2M communications still using 2G networks, that leaves a lot of devices looking for a new home."
– Canadian Business, September 2014.
http://www.canadianbusiness.com/insights/the-lte-revolution-has-only-just-begun-and-etworks-try-to-catch-up/

## LTE is the Future

Advocates have long considered LTE as the future-proof solution to the impending 2G sunset.

Designed to be the first global mobile communications standard, LTE is the natural upgrade path for carriers with detached cellular ecosystems. Coupled with the profit potential that LTE can offer to carriers, the pace of LTE network launches will continue to increase.




For industry, LTE presents four key benefits to set new trends for M2M applications and promises to bring a whole new world of possibilities for remote communications.

### 1. Higher throughput

As the future of industrial automation calls for converged networks that combine control data (SCADA), voice, and high-definition video streaming, bandwidth has become the key requirement to transmit high data volumes and enable seamless communications.

With an actual download speed of up to 100 Mbps and upload speed of 50 Mbps, LTE is an ideal solution for M2M applications that require big bandwidth. For example, it takes approximately 8 minutes to send a 5 MB file on 2G. With LTE, it may take less than 10 seconds. This increase in performance allows M2M applications to send richer and multi-stream data, more quickly.

### 2. Lower latency

LTE is optimized with shorter connection handover and setup time to deliver low-latency traffic. Compared with 2G and 3G, LTE provides 10 times lower latency. In M2M applications where latency is critical–for example, applications that control sensitive machinery, industrial alarms and controls, and traffic systems–the low latency that LTE offers enables real-time connection and control that would otherwise have been impossible before.

**3. IP-based system**

As more and more industrial applications migrate to IP networks, cellular communication with IP-based connectivity is essential for the future of automation networks. Unlike previous generations of cellular technologies, LTE has an all-IP core network infrastructure that uses fewer network nodes for data transmission. This makes it cheaper and simpler for carriers to deploy and operate LTE networks. For customers, they can enjoy faster and more reliable connections.

**4. Longevity**

With the relentless expansion of LTE networks and carriers' move to refarm the spectrum for more profitable LTE services, the lifespan of legacy networks is unpredictable. Additionally, the gradual tear-down of legacy networks is likely to affect the quality of 2G and 3G services. For companies operating large-scale M2M applications on 2G, migrating to LTE will ensure quality connection and seamless operation in the coming decades.

## The Top 3 Considerations for LTE Network Migration

Advancements in mobile connectivity lead to limitless applications for M2M communications. For instance, local governments have deployed large-scale video surveillance systems at intersections to ensure road safety. Industries have also adopted M2M communications for remote resource monitoring, whether to measure gas or energy, and for keeping track of field equipment like oil wells or unmanned power substations.

In the mining, transportation, and oil & gas industries, many large-scale wireless applications that are deployed in harsh environments require the use of industrial-grade devices. While the business benefits of LTE are obvious, companies choosing an LTE solution must also factor three key considerations into their migration plans: extreme temperature, power and radio isolation, and reliable cellular connectivity.

### Extreme Temperatures

Cellular devices deployed outdoors are exposed to extreme temperatures that vary with the seasons and daily temperature changes. At high temperatures, there is risk of device failure due to overheating, while at temperatures below -30°C, devices may fail to start.

For example, temperatures in a desert oil field can dip well below the freezing point at night and exceed 120° F (49° C) during the day. Similarly, devices inside traffic cabinets must tolerate temperatures above 140° F (60° C). Once in operation, heat generated internally puts an extra toll on the lifespan of these devices. Thus, an LTE solution that meets the extreme temperature requirements in harsh environments is critical to maintaining business operations.


Currently, most commercial LTE solutions offer a standard operating temperature range between -25 and 60° C. While that may be adequate for non-industrial applications, commercial solutions are not rugged enough to withstand the test of harsh environments. What industrial applications need is an LTE solution that features an **extended operating temperature range**, preferably between -30 to 70° C. Such a solution ensures reliable device operation and network connectivity for mission-critical applications.

**Electromagnetic Interference (EMI)**

Cellular devices deployed in industrial applications are susceptible to electromagnetic interference that can come from static discharge, ungrounded mobile devices, power spikes, or surges and dips in power supplies. Just because interference is invisible doesn't mean it is harmless. The effects of EMI can include signal degradation, data loss, and device damage, resulting in disrupted network communication and industrial operation.


Electromagnetic Interference

How could EMI affect a cellular device? In general, the system ground in a cellular device is designed to be the same as the earth ground. When there is a sudden change in voltage difference, harmful electrical interference can gain entry into the cellular device through the antenna or the power port, thus, degrading antenna sensitivity and damaging internal electronic components. For example, in applications on mobile vehicles, a cellular device is often deployed without earth ground. Excessive EMI from the surroundings can interfere with wireless transmissions and may even render a cellular device inoperable.

An unprotected cellular device installed on a rooftop or outdoors is prone to sudden overvoltage indirectly from lightning strikes. Even with a lightning rod taking the brunt of the transient overvoltage, residual charge can still reach as high as 500V. Such electric energy can cause unrepairable damage to a cellular device and possibly to any connected devices.

**Case Analysis**

Location: Argentina

A regional bus operator in Argentina implemented its first onboard communications network and installed wireless devices on the rooftops at all bus terminals. However, after two years of operation, most of the 50-plus RF modules in the devices were damaged and had to be replaced. This came as a surprise since lightning rods are already installed nearby. An investigation revealed that residual charge from lighting strikes gained entry into the wireless devices through the antenna ports and caused the wireless devices to malfunction.

To minimize damage from residual charge or other EMI sources, the bus operator should consider deploying wireless devices with effective power and antenna isolation.

A common approach to safeguard cellular devices is to install a DC block on the antenna port and a DC/DC power isolator on the power port. However, this approach is not cost effective for large-scale industrial applications. First, you need to purchase additional components–a DC block, a DC/DC power isolator, and a new power adaptor for the power isolator–and manually install them on each cellular device in the field. For cellular devices located in enclosures, space can be an issue. Another concern is the possibility of damage due to improper installation–if a DC block or power isolator is not installed properly, EMI can still affect a cellular device and cripple network communications.

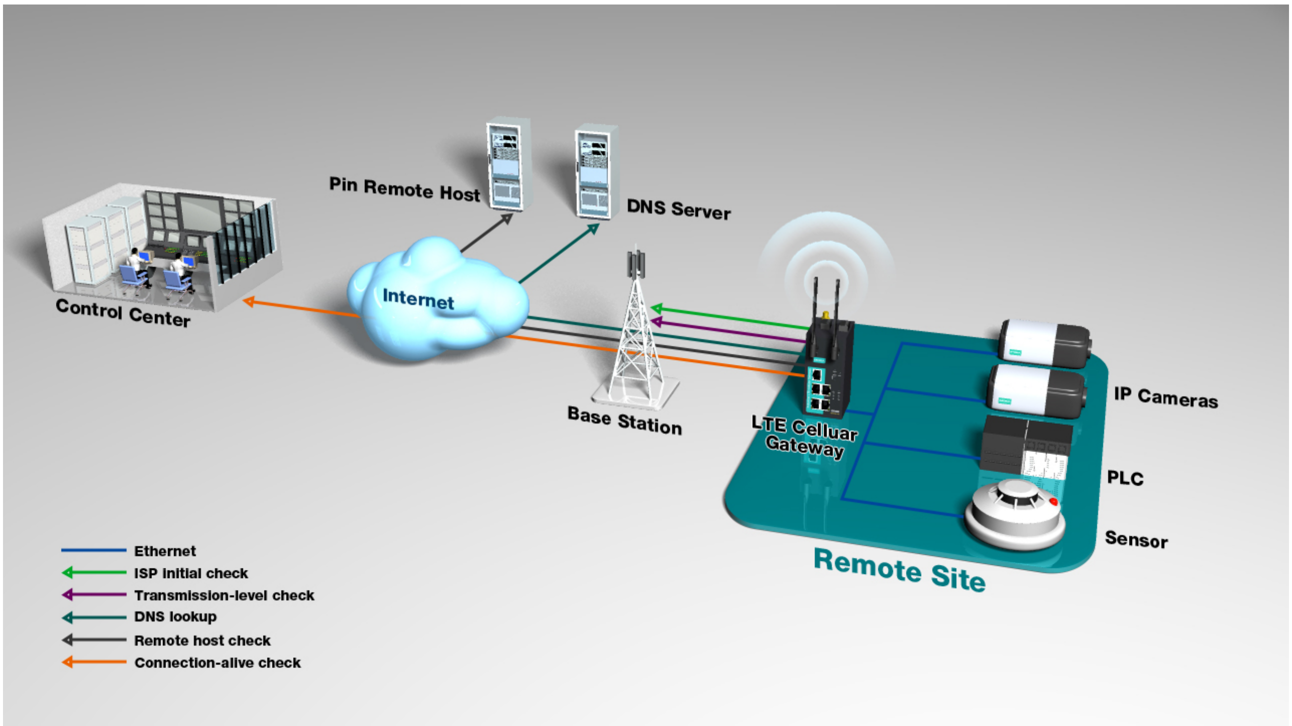
The more cost-effective approach is to choose a cellular device with **built-in power and antenna isolation**. This all-in-one solution eliminates the need for installing additional components and is effective in fending off unwanted interference.

### Reliable Connectivity

In a public cellular network infrastructure, carriers may implement different timeouts at the application level and allow a base station to service users with varying traffic load. Thus, maintaining a reliable cellular network connection is a constant challenge for industrial M2M applications, especially for mission-critical applications such as real-time remote monitoring in the oil fields, along pipelines, and in traffic safety control centers.

There are hardware and software solutions for maintaining a reliable connection.

On the hardware level, **dual-SIM support** enables a cellular device to automatically switch to another carrier network when a base station fails to respond or when the quality of the existing connection deteriorates to below an acceptable level. Although this method ensures cellular connection to a base station, it does not guarantee connection beyond the base station.




At the software level, a cellular device can use one of two functions to test the connection to a base station:

- **ISP initial check:** A cellular device first sends a test packet to the base station and waits for a response before establishing a cellular connection. In situations where the cellular module in the cellular device becomes unresponsive, the cellular device will continue to send test packets at regular intervals, and in the process inadvertently rack up airtime cost.
- **Transmission-level check:** To eliminate the possibility of an unresponsive cellular module, a cellular device using the transmission-level check function resets its cellular module before negotiating a connection to the base station. Because no test packets are sent, the transmission-level check function effectively minimizes connection check time and airtime cost.

To maintain a reliable connection beyond the base station, most cellular devices utilize these common software features:

- **DNS lookup:** A cellular device sends a DNS lookup request to obtain the IP address of the intended receiver.
- **Remote host check:** A cellular device pings a known remote host to ensure connection to the Internet. At regular intervals, a cellular device sends a packet to a remote host to maintain connection.

A cellular device may include both software features to ensure cellular connectivity. However, every connection check incurs airtime cost. Since each of these software features performs two-way checking, the result is increased airtime cost just for maintaining cellular connectivity before transmitting data. For mission-critical applications that require a reliable connection, companies can either bear the added cost with LTE solutions that use these common software features, or look for a more cost-effective alternative.

To avoid racking up airtime cost, budget-conscious network professionals should consider LTE solutions that use **connection-alive check** to maintain connectivity beyond the base station. Unlike the other common software approaches, with connection-alive check, the system automatically re-registers to the base station to establish a new cellular connection after a period of inactivity–no additional airtime is required to check connectivity, thus reducing airtime cost while keeping the connection alive.

## Conclusion

Forward-looking companies need to acknowledge the fact that 2G and 3G network sunsets will affect current M2M applications and that LTE will continue to be an important technology as it takes center stage. To capitalize on the performance and longevity that LTE offers, network professionals must consider various factors–extreme temperature, electromagnetic interference, and reliable connectivity. With careful selection, companies with the right LTE solution will be in a better position to fully benefit from the greater speed and performance that LTE provides.

For information on how your mission-critical applications can benefit from Moxa's all-in-one LTE solution, download the OnCell G3470A-LTE cellular gateway datasheet or visit the **Reliable Video over LTE** microsite.