The Roadmap to LTE for IoT and M2M Connectivity Solutions

korewireless.com/lte

KORE®
The People Powering IoT

TABLE OF CONTENTS

INTRODUCTION

Since 2003, when machine-to-machine was but a nascent concept and "Internet-of-Things" had barely been coined a term, KORE has been advising customers to always use the network that best fits their unique needs. For many, even most of our customers, that has meant tapping into lower-cost 2G GSM or CDMA networks to achieve the best match between technology and economics. IoT was indeed synonymous with the small data packet.

Now IoT is but a subset of the expanding Internet of Things (IoT) market—a market that IDC projects will have 212 billion devices online by 2020[i]—and operators would be remiss to ignore the opportunity they have to transition into the LTE world of faster data speeds and a more efficient use of spectrum. More importantly, as we look towards the future, the use of LTE technologies quite simply provides the longest possible deployment lifetime for our customers, and in the long run can save them the most money.

Now is the time to change. Market events have forced almost every IoT stakeholder to reconsider their thinking – AT&T will decommission all 2G technologies (GPRS, EDGE) from its network by the end of 2016.

Beyond the obvious, there are other reasons to consider not only a migration to 3G technologies, but even a full upgrade to LTE modules in both new projects and existing IoT implementations, as AT&T has announced that they will allow no new 3G activations on their network after December 31st, 2018.

And yet, we understand that LTE may not be the best fit for all applications and priorities at the present moment. Some businesses may choose to ride out the 2G and 3G lifecycle for as long as they possibly can, for any number of reasons. We get it. But ultimately, our perspective is that all wireless applications, phone and non-phone, manned and unmanned, will need to make the leap to LTE.

There will emerge more "networks-with-in-a-network" in the LTE standard, both at a device level and at a network technology level.

What we do know for certain is that there is tremendous staying power in LTE technologies. Customers who adopt LTE modules in their applications will immediately recognize the longest possible life-cycle from all available options on the market today. In fact, we see the most extraordinary thing about LTE is that it carries a very broad structural set of standards. Today's iteration of LTE is merely the very first step in what the fully realized LTE network will eventually look like. In the first section of this guide, we will take the time to preview the multiple, and potentially confusing, emerging standards.

High-performance, high-bandwidth networks deployed today can already handle with aplomb the most data-intensive consumer devices available, whether they be iPhones, iPads, or Galaxy phones. But what we see deployed today is only the beginning for LTE networks. There will emerge more “networks-within-a-network” in the LTE standard, both at a device level and at a network technology level. They all utilize exactly the same radio access technologies, the same infrastructure, the same security and authentication services, and the same quality of service management. Yet, they’re designed to be able to scale upwards to much higher bandwidth, to fuel applications that go beyond what we can even imagine today.

Let us not get ahead of ourselves. Our customers have told us how they are going to deal with these transitions, and that their decisions are going to be varied, based on each use case and its specific requirements. In the words that follow, we have tried to distill these cases into digestible, actionable advice, which we present in the hope it offers the right insight to help you determine the best way for your business to move its IoT to LTE strategy forward.

Alex Brisbourne
CEO, KORE Wireless Group Inc.

1. READY, SET, TRANSITION: IOT'S MOVE LTE

2G cellular networks, for consumers, were a giant leap forward. Even the most optimistic analysts could not have envisioned the growth of data traffic on cellular networks back at the dawn of 2G in the early 1990s. Some numbers to help you grasp the exponential growth in mobile data traffic from smartphones and tablets: In 2014, mobile data traffic was 30 times the size of the entire Internet circa 2000, or 2.5 exabytes per month by the end of 2014. For the first time, video in 2014 comprised more than 50% of the total of mobile data traffic, and the average smartphone ate up 45% more bandwidth than it did the previous year.

The consumer IoT market also exploded; by the end of the 2014, 109 million wearable devices generated 15 petabytes of monthly traffic[ii].

COMMERCIAL IOT TO REPLACE 2G

For the commercial IoT communications market, things moved a bit more slowly. While consumers chased bandwidth-intensive applications requiring video and HD graphics on their LTE devices, most IoT applications didn't really need such wide bandwidth. Since IoT mostly meant exception-based reporting (alerts and alarms when something was amiss), the bulk of that work involved shifting small data packets over networks to the right people or machines at the right time, as opposed to streaming video on a smartphone or tablet.

As consumers abandoned 2G networks that didn't work with their touchscreen devices, commercial IoT users welcomed the newfound bandwidth it opened. In fact, in 2014 only 1% of the 3.2 billion IoT connections globally went over LTE networks vs. 23% on 2G [iii].

But the market is rapidly expanding, even as 2G networks go dark. Cisco projects 103% annual growth in the number of IoT connections through the end of 2019.

IoT users are beginning to need more bandwidth as well, particularly as they increasingly see the value of incorporating video. In the security and fleet monitoring/management markets as well as digital signage, businesses see growing returns in dropping higher resolution technologies that require faster, bigger data pipes into their workflows.

When it finally is sunsetted for data traffic, 2G will have been with us since around 1999, having been in service for 20-plus years. That's an extremely long lifecycle in high-tech. Today's 3G networks are effectively transient; they really only came of age around 2010 with the dawn of EVDO CDMA and 3G HSPA networks. In 2010 and 2011, they really got traction.

In 2014 there were 3.2 billion IoT connections globally. Cisco projects 103% annual growth in that number through the end of 2019.

LTE TAKES CENTER STAGE AS NEW STANDARDS EMERGE

Two misperceptions have been holding LTE back for IoT applications: Its reputation for expensive modules and limited network coverage compared to 2G and 3G. Because carriers have nearly completed the LTE infrastructure and device manufacturers are offering competitive pricing on LTE-connected devices, those trends – while they might have had some grounding in 2014– have already become myths.

LTE has reached nearly full saturation in the U.S., and the cost of modules has dipped into the mid-$30 range (or, exactly what 3G modules cost in late 2014) and is trending downward[iv]. Taken together, these trends make 3G appealing to a much smaller group of IoT users.

LTE promises to have a lasting impact, and not only because it features the fastest throughput and deepest saturation of cellular networks. It will host a number of emerging standards, including User Equipment (UE) Category 4, Category 5, and Category 6 that will create even faster throughput using the same LTE infrastructure. Category 6-enabled devices promise download speeds of 300Mbps, or twice as much as Category 4 standards. Specs exist for even faster Category 7 and Category 8 LTE devices, as well, but those won't see widespread development adoption for a number of years.

LTE has reached nearly full saturation in the U.S., and the cost of modules has dipped into the mid-$30 range (or, exactly what 3G modules cost in late 2014) and is trending downward.

Even more promising for business that rely on IoT are Category 0 and LTE-M devices, which could be powering IoT devices by the end of this year. These low-power devices will support short bursts of data transmissions. Chipsets for these devices exist today, although it's very early on the implementation curve. [v]

In the following sections, we will explore the future of LTE for IoT, who will be using it and for what business applications. We also will examine which businesses will benefit from switching sooner, and which ones might hold on to 2G or 3G to their bitter ends.

Two misperceptions about LTE that need to be dispelled: one, that modules are too expensive and two, that the network offers limited coverage.

KEY ABBREVIATIONS AND TERMS:

2G (second generation)	Second generation (2G) cellular telecom networks were commercially launched on the GSM standard in Finland by Radiolinja (now part of Elisa Oyj) in 1991.
3G	The third-generation (3G) mobile communications standard allowed larger data files to be transmitted via cellular networks, enabling more sophisticated messaging and web content to flow to smartphones, the use of which became widespread thanks to these networks.
4G/LTE	LTE, commonly marketed as 4G LTE, is the current standard for wireless communication of high-speed data for mobile phones and data terminals.
CDMA (Code Division Multiple Access)	A digital communication technology used by some carriers to provide PCS service. Also known as IS-95A or cdmaOne. Other technologies used are TDMA and GSM.
GSM (Global Standard for Mobile)	A digital communication technology used by some carriers to provide PCS service. Other technologies used are CDMA and TDMA.
Category-0	Emerging LTE standard to support IoT. Devices use low current, and transmit short bursts of data.
Category-4	LTE standard supporting 300Mbps download/75Mbps upload.
Category-5	LTE standard supporting 150Mbps download/50Mbps upload.
Category-6	LTE standard supporting 300Mbps download/50Mbps upload.
IoT (Internet of Things)	See IoT.
LTE (Long Term Evolution)	See 4G.
IoT (Machine to Machine)	While the Internet of Things (IoT) typically refers to consumer devices, IoT casts a broader net covering IoT uses as well as commercial applications of wireless sensors such as defense, industrial automation, security and many others. While IoT automated communications can be wireless or wired, the scope of this e-book covers cellular wireless networks.

2. THE FUTURE IS NOW: IOT'S NEED FOR SPEED

IoT communications and alerting is a broad concept, not confined to wireless cellular networks. In fact, one of the earliest IoT telecommunication devices, a caller-ID box patented in 1971, was fully wired. Today's IoT communications commonly happen over wired networks, over Wi-Fi, Bluetooth, and cellular frequencies.

New standards promise to expand IoT usage in general, including over LTE, and they work by collecting short-range signals and porting them to a Wi-Fi or cellular hub for transmission to a computer for processing and further routing.

Talking about standards may be interesting to engineers, but the rest of us are more concerned with the real-world implications of IoT technologies that need LTE some, if not all, of the time. Here are ten examples, some of them in early-adoption phases and some more mature; some need LTE simply because their sensors live outdoors or in otherwise tough spots where Wi-Fi isn't available or too unreliable for the critical nature of the device.

HEALTHCARE

Many IoT applications are emerging in healthcare and more will come in the next few years. Why? Many of them are driven by three trends: One, personal fitness and wellness monitoring wearable devices for consumers; two, "aging in place" – keeping elders at home and out of nursing homes for as long as possible, with help from people and assistive technology, some of them powered by "always-on" devices over LTE networks that deliver the low latency they require; and three, "accountable care," which rewards providers for solving patients' health problems before hospitalization is necessary. The latter two involve keeping tabs on everything from heart failure to patients' vital signs to tracking dementia patients' locations to confirming that behavioral therapy patients take their medications in the right dose at the right time. For frailer elders, always-on devices trip alerts to a monitoring company if they fall in their home. Sensors pipe data into monitoring systems and electronic medical records; when something deviates from the expected pattern, physicians and/or nurses receive alerts. Furthermore, mobile devices carried by visiting nurses and home healthcare workers will feed information directly back to central data repositories via cellular networks.

ASSET MANAGEMENT

Knowing where your company's vehicles are – or receiving data about cargo getting delivered – can yield positive results such as loss prevention for rental car companies, bottom-line improvements of just-in-time supply chains for manufacturing companies, and pinpoint delivery information to enable better customer-relations for retailers. It can also increase driver efficiency and safety by monitoring traffic conditions and strategically re-routing vehicles around trouble spots. Dashcams mounted in public-service vehicles and heavy goods transportation is another form of asset monitoring utilizing streaming video.

IoT communication is not confined to wireless cellular networks. Today's IoT communication also happens over wired networks and Wi-Fi and Bluetooth frequencies.



DIGITAL SIGNAGE

Why portray your product on a massive billboard, a small bus-station panel screen or anywhere in-between with a static image when you can have dynamic audio and high-resolution video content to make it come alive? We've all seen the transformation in signage over the last decade. But all of these connected screens cannot function on their own. That's where IoT over LTE networks comes in. Wires are awfully cumbersome and limiting for those hard-to-reach, often elevated locations, especially outdoors.

SUBPRIME AUTO DEALERS

A distant cousin of fleet management, dealers who finance vehicles with subprime auto loans have a problem: Sometimes they need to repossess the vehicle. IoT setups involve inexpensive (~$50) GPS sensors, keeping the car in the dealer's sights until the loan is paid off, at which time it's deactivated. How big is this market? In the 2nd and 3rd quarter of 2015 alone, more than $110 billion in auto loans were made to borrowers with credit scores below 660, the cutoff for a "good" rating.[vi]

USAGE-BASED INSURANCE (UBI) FOR AUTO CARRIERS

Auto-insurance carriers have begun tracking customers' habits as a way to reward safe driving. The idea now has turned into a way to monitor down to the number of miles driven for more forward-thinking companies. It's a way to level a playing field in which two-thirds of drivers pay higher premiums than they should, effectively subsidizing high-mileage road warriors. One such carrier – and KORE customer – saves each of its customers an average of $500 per year, basing insurance rates on mileage readings with sensors customers plug into the diagnostic port in their cars, which in turn relays data to a smartphone app.

UTILITIES

With the emergence of LPWA modules in IoT – Cisco predicts 933 million modules operational by 2019 -- electric, water and gas utilities will use these standards to connect meters. With expected 10-year lifespans for these modules, utility companies will want to standardize on LTE from the start, because 2G and 3G will be gone by the time the modules need replacement.

STREETLIGHTS

It might sound boring to the average consumer, but the IoT potential for saving more than 50% of lighting costs is extremely interesting to city managers, who see streetlights accounting for up to 40% of total municipal budgets. IoT can help with powering lights on at the right times, dimming them when appropriate to save energy, and alerting crews when a lamp burns out. IoT can also help enhance safety: For example, increasing light in areas where emergency crews are at work. [vii]

VIDEO SECURITY

For both commercial and consumer applications, video security via IoT is growing in popularity, thanks to LTE's capabilities to support the streams (which are also decreasing in size, down to 10kbps). This is not your father's do-it-yourself rig, either. Small and large enterprises can track assets and goings-on at their properties with video controllers from a centralized location, which not only enhance visuals during playback but also remotely control pan-tilt-zoom camera settings.

ROLLING CONNECTIVITY

Many new cars now are equipped to be rolling wi-fi hotspots, enabled by LTE networks. Standalone LTE boxes can enable mobile commerce in vehicles too, such as food trucks, with payment terminals.

FOOD SAFETY

Stopping – or even preventing – a mass outbreak of food poisoning requires constant monitoring of a traceable food supply. Today, investigators follow contaminated food after the fact, tracing it to its source. IoT can make the process much closer to real-time, as food production and storage environments are monitored with sensors and sent alarms when conditions deviate from spec. After an outbreak, IoT-enabled food supplies can be documented and traced back to the source of contamination much more quickly. Regulators are looking to food producers to shore up food protections as the FDA rolls out new rules as directed by Congress in the Food Safety Modernization Act (FSMA).

It might sound boring to the average consumer, but the IoT potential for saving more than 50% of lighting costs is extremely interesting to city managers, who see street-lights accounting for up to 40% of total municipal budgets.

These are just 10 examples of what's here, and what's to come in the rapidly expanding market for IoT over LTE networks. There are many more in use today, and that will emerge as technology advances and creative enterprises adapt new standards and utilize the speed and reliability of LTE signals to improve efficiencies, security and ultimately the bottom line for both commercial clients and consumer end-users.

3. 3G NOW OR STRAIGHT TO LTE: THAT IS THE QUESTION

With all these exciting new technologies comes a cost, which precipitates the business question for IoT needs: At what point does the price-performance ratio tilt the scales toward LTE, which will have the longest lifespan of any cellular network technology?

Clearly, any business installing new sensors would best be served starting out on LTE to future-proof their investments. Take the example of pipeline or utility-line alert sensors, many of which are in wilderness or underwater settings. In those cases – or anywhere an organization is expending capital to place sensors in tough-to-reach places and hoping they will function for the next 10 years, continuously – LTE just makes sense.

Another clear case for LTE now is new instances of bandwidth-intensive applications, such as digital displays and streaming video in signage or security. As devices and content evolve, LTE offers the scalability to grow with the sophistication of these technologies. Any business whose IoT needs include a low tolerance for network latency and high needs for throughput should consider switching to LTE, too, sooner than later.

... any business installing new sensors would best be served starting out on LTE to future-proof their investments.

OTHER CONSIDERATIONS FOR SWITCHING TO LTE

According to research firm ABI, [viii] several other factors make LTE appealing for organizations utilizing IoT communications for applications other than video (the obvious application):

- Indoor penetration. One of the biggest advantages of LTE is that it solves this problem vexing other network implementations, opening new applications and expanding existing ones that have been limited by coverage problems. Owners of smart vending machine distributors, for example, will likely welcome LTE connections as fixed lines become less available.
- Infrastructure and coverage. In the past, limited LTE network coverage was an issue. Now, in developed and undeveloped countries, LTE covers 80% of the population centers and has even expanded into rural and sparsely populated areas.
- Security. Cryptographic keys in LTE use 128- and 256-bit encryption keys that provide a higher level of security.

BUSINESS CASES FOR HOLDING ON TO 2G/3G

That being said, who doesn't need LTE? First off, IoT users who have had 3G devices installed in the past five years, and need them to function only for the next five. Those products are mature, and many of them probably have a few more years' worth of usage left before they will need replacement – at which time it will make sense to retrofit for LTE.

Other organizations that continue to utilize IoT for low-bandwidth alert/alarm systems and await the promise of their OEMs developing LTE Category-0 or LTE-M modules for their specific applications. These will run on bands dedicated to IoT/IoT connections globally; their developers promise lower power use and will likely cost less than 3G and 4G devices. As of now, many of these are still in development, which means rollouts could happen closer to the 2G sunset dates – or even after. [ix]

This will put those OEMs' customers in a dilemma: Upgrade now to LTE, or wait? This tricky decision will come down to numbers, as each organization will have to weigh the costs of two potential upgrades, either to current 3G or LTE modules now and then the cheaper Category-0/LTE-M modules later. The total cost of ownership of a dual upgrade approach also includes other factors, such as the $400-$1,000 per truck roll.

While jumping from 2G to LTE might incur more up-front costs, it will be partially offset because the superior speed of LTE networks for these applications will incur less airtime than 2G and 3G. In this case, going straight to LTE would offset at least some of those costs of skipping 3G-connected devices.

CONCLUSION: ALL ROADS LEAD TO LTE

If you're not yet thinking of LTE, you're not alone. Many organizations utilizing 2G and 3G networks for IoT are only in the exploratory phase of developing their upgrade paths. But the time is now - with AT&T's 2G sunset behind us coupled with their announcement that there will be no new 3G activations after 2018 - other major carriers are scheduled to follow suit in the coming years.

It is important to keep in mind that there's a reason the carriers are sunsetting their 2G and eventually 3G networks: Over the past three to four years, applications as a whole have been getting richer. Human nature drives us to richer content. 2G, when it goes dark, will have been in service for 20-plus years. That's a long lifecycle in technology. 3G networks, in contrast, will likely have had the shortest life-term of any technology in our industry, when all is said and done. LTE is the one fundamental network that combines coverage, IP end-to-end, and in-building with subterranean accessibility. While LTE might have started out as a cost-prohibitive option for IoT, its standardization and adoption by more than 650 carriers around the world has driven costs down rapidly. The LTE networks as we know them today have become the networks that go the distance for the customer.

COST PARITY
LTE may have started out as a cost-prohibitive option for IoT, but now its standardization and adoption by more than 650 carriers around the world has driven costs down rapidly.

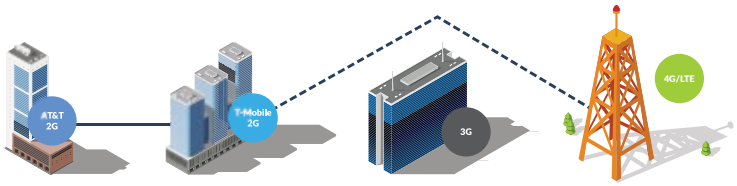
Data-rich applications need LTE now. For less-rich applications, businesses have choices. Our stance is this: If you intend to be running a business five years from now, you had better get on the LTE bandwagon. You could defer the time at which you commence that development, but you're going to have to do it.

THE LTE DECISION-TREE

When you think about your IoT strategy there are several migration choices that can move your operations from 2G to LTE, based on your timing and bottom-line needs:

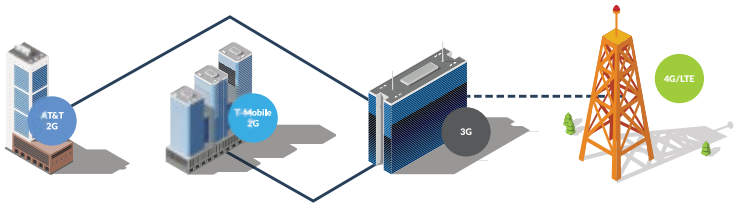
AT&T 2G TO T-MOBILE 2G TO LTE

AT&T's 2G sunset happened December 31, 2016, but T-Mobile has committed to support their 2G network for IoT applications to 2020. Although the future is LTE, migrating right now may be too disruptive for your business. You just need more time. If this sounds like your situation, this may be the best strategy for your business.



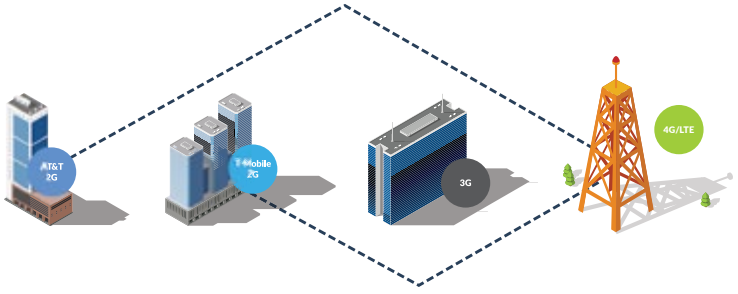
2G to 3G to LTE

When AT&T announced they would be sunsetting their 2G network, you may have suddenly found your business threatened, especially if you have thousands of 2G devices out in the field. If you aren't quite ready to make the leap to LTE because of concerns about the availability and cost of modules, then making the move to 3G might be the right choice.



2G to LTE

Do you need to update your company's 2G devices that are at risk to go dark? Organizations using 2G modules are in the best position to move to LTE, because they will enjoy the greatest network speed bumps, airtime savings offsets and avoid the double-jump from 2G to 3G to LTE compatible modules.



Carrier	2G Network	3G Network
AT&T	Shutdown 12/31/2016	Committed until at least 12/31/2021, however no new 3G activations allowed after 12/31/2018
Verizon	Shutting down end of 2019 for 1xRTT	Shutting down end of 2019 for EVDO
T-Mobile	Committed through 2020	No formal announcement
Sprint	Committed through 2022 for 1xRTT	No formal announcement
Rogers	Committed through 2018	Shutting down end of 2025

DEFER THE LTE DECISION

2G GSM on AT&T to 2G GSM on T-Mobile: Some organizations may want to remain on 2G for any number of reasons. T-Mobile has extended its 2G network for IoT/IoT applications until 2020, so if an organization is in an area T-Mobile covers, this can be a reasonable option.

2G to 3G: Let's say your IoT operation involves modules that have easy access for switching, and 3G modules for your application are far less expensive than their LTE counterparts. Or, you're not quite certain the IoT application you're supporting will last beyond a few years. In this scenario, and others where financial barriers are holding back an LTE migration, a 2G-to-3G migration might be your best move.

IN THE END, IT'S ALL UP TO YOU

Take some time to consider your IoT usage. Only your organization can determine when the jump to LTE will be optimal. Just know that it must happen sooner or later. Planning properly for the transition can save capital investment as well as airtime costs – and potentially keep the 2G-to-3G-to-LTE double upgrade off your financial ledger.

KORE sees it this way: LTE brings infinite possibilities to the world of IoT & IoT, beginning now.

To consult a KORE expert for guidance on an upgrade plan tailored to your IoT needs, call 877-710-5673 (KORE) or email sales@koretelematics.com.

SOURCES

i. “Internet of things: $8.9 trillion market in 2020, 212 billion connected things,” ZDNet.com, Oct. 3., 2013. http://www.zdnet.com/article/internet-of-things-8-9-trillion-market-in-2020-212-billion-connected-things/#!

ii. p.2 Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2014–2019. February 2015. http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-indexvni/white_paper_c11-520862.pdf

iii. p.14 Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2014–2019. February 2015. http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-indexvni/white_paper_c11-520862.pdf

iv. “LTE – bringing a new spectrum of opportunities for IoT and IoT.” KORE blog post, July 22, 2015. http://www.koretelematics.com/blog/lte-%E2%80%93-bringing-a-new-spectrum-of-opportunities-for-IoT-andiot

v. “LTE Category-0 & LTE-M low power IoT device roadmaps.” IoTdevzone, May 18, 2015. http://iotdevzone.com/blog/2015/05/18/lte-category-0-lte-m-low-power-IoT-device-roadmaps/

vi. “Surge in Subprime Auto Lending Draws Attention.” Wall Street Journal, Nov. 19, 2015. http://www.wsj.com/articles/total-u-s-household-debt-rises-to-12-1-trillion-in-third-quarter-1447948826

vii. “Smart Streetlights are the drivers of the Smart City.” IoTnow.biz, March 16, 2015. http://www.IoTnow.biz/2015/03/16/31124-smart-streetlights-are-the-drivers-of-the-smart-city/

viii. ABI Research paper, Future of 4G in IoT/IoT: applications, verticals, and LTE CAT1, CAT0, CAT-M. 2015.

ix. “LTE Category-0 & LTE-M low power IoT device roadmaps.” IoTdevzone, May 18, 2015. http://iotdevzone.com/blog/2015/05/18/lte-category-0-lte-m-low-power-IoT-device-roadmaps/

Want to find out how KORE can help your business?

Contact one of our connectivity experts today.

KORE
The People Powering IoT

www.koretelematics.com

North America: 877-710-5673 (KORE)
Europe: +44 (0) 1895 454 660
APAC: +61 3 9908 2190

sales@korewireless.com