5G in Enterprise—Now or Later?

Why it makes sense to prepare now and how to get started

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Executive Summary

In enterprise IT environments, the demands for cellular connections are soaring. It's no longer only about phones and tablets. From retail operations to complex manufacturing environments, connected devices, sensors and machines are everywhere. And connectivity requirements will only increase with the surge of the Internet of things (IoT) solutions. For IT managers, finding efficient, cost-effective solutions to support the diverse wireless needs of their enterprises has become an ongoing challenge. Not only are wireless solutions becoming more business-critical, but additional capacity and better latency is needed to address emerging use cases and solutions.

4G, which brought wireless to a lot of enterprise applications, was a good starting point for enterprise IT. For example, 4G enabled untethered payments systems and it gave road warriors constant connectivity to corporate networks and databases. Yet while 4G continues to evolve, we will need a revolutionary technology to efficiently connect billions, if not trillions, of IoT devices or support many types of virtual reality/augmented reality (VR/AR) or industrial use cases or highly reliable high-availability remote operations. For these things, we need a technology that provides next-level connectivity options for the enterprise. 5G, which operators began rolling out in early 2019, is that technology.

5G is more than the next generation in cellular connectivity; it's a huge leap forward in wireless capabilities that address the capacity, latency, efficiency and variability needs of the enterprises in addition to "future-proofing" their business solutions. With its unified yet flexible design, 5G can efficiently address the breadth of enterprise wireless requirements, including:

- **Fixed or mobile**
- **High speed or low latency or both**
- **Cost-efficient or industry grade reliability**
- **All available spectrum: Low/mid/high band, licensed unlicensed and shared**
- **Massive number of devices and dense deployments**

What's more, innovators will be able to combine the wireless capabilities in 5G with major technology advancements, such as artificial intelligence and VR/AR, in new ways. That means new applications, services, business models and use cases that don't exist today are just around the corner.

The combination of these factors has created unprecedented industry traction for 5G; leading providers are moving quickly to roll out the first networks and services. But what does all of this mean for enterprise IT managers… Is it a good idea to wait until 5G matures before seriously considering it for your environment, or are there advantages to early adoption? The short answer is that in most cases, the sooner the better. With respect to capacity, cost, flexibility and performance considerations, 5G is unbeatable. And thanks to carefully considered and orchestrated standards, and backward compatibility with 4G, there are few risks with early adoption. Moreover, first movers with 5G will be better positioned to adopt the cutting-edge solutions and approaches that are critical to building and maintaining market leadership. The key will be to work with technology leaders like Inseego in building a future-ready roadmap for 5G rollout.

The Unique Needs of Enterprise IT

Device and network selection for consumers is a mostly straightforward process based on a combination of coverage, cost and performance needs. Depending on the use case, however, IT managers usually have a lot more

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to think about. In addition to device lifecycle and cost of ownership considerations, you need to carefully consider network capacity, speeds, and latency, as well as deployment and manageability related factors. For example, devices like video monitors require high speed and high bandwidth connections while low bandwidth yet high-reliability connections are important for PoS terminals and IoT sensors.

From a device lifecycle perspective, part of the challenge has been future proofing. For instance, consumer smartphones typically have a two- to three-year lifespan, whereas enterprises often use devices for four to six years. That means that when choosing hardware, enterprises have struggled with questions around longevity and whether or not devices would be able to support new technologies, apps, and services that come along. Enterprises also need to weigh the cost and long-term benefits of deploying new devices now against the costs and challenges of continuing with existing devices and solutions.

With respect to device deployment and management, the overall complexity in enterprise IT environments has put simplicity and flexibility at a premium. Versatile devices that include support for technologies such as Wi-Fi and Bluetooth are needed to simplify IT environment complexity while increasing the flexibility of wireless deployments.

Finally, wireless plan options and pricing are important to bigger picture total cost of ownership (TCO) considerations. Currently, carriers generally only offer a few types of flatly priced plans that are designed around voice and streaming needs with substantial tradeoffs when it comes to data allotments and costs. But enterprise data and performance needs are much more varied than consumers. After all, the service level and plan needs for a factory with thousands of IoT devices may look very different than for a company employing virtual reality solutions. With existing and previous generations of cellular technology, however, the options for customizing plans based on specific enterprise needs have been limited. Moving forward, as enterprises adopt more and more wireless solutions they will need plan choices that allow them to keep costs in check for less-important applications and performance optimized for business-critical applications. .

Current Challenges of 4G Solutions

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Capacity

Considerations around capacity are one of the most important factors that have thus far limited a wide-scale embrace of wireless in the enterprise. The skyrocketing increase in smartphone and data demand from consumers and enterprises alike has overloaded today's cellular networks and limited the ways in which enterprises can efficiently and cost-effectively use wireless. For example, operators have set capacity that restricts their ability to offer unlimited data plans and makes fixed wireless services unviable. That means that to address internal demands, enterprises often have to juggle a mix of wired and wireless services from different providers.

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One of the reasons for 4G's limited capacity is related to limited spectrum availability. In practical terms that means consumer smartphone users and enterprises in a given area are all competing for the same frequencies, so when usage spikes networks can quickly reach capacity. And when that happens, operators rely on a variety of techniques, including aggregating bandwidth from different providers, to support user needs. The problem with these techniques is that they contribute to network performance issues that are not acceptable for business-critical applications.

A lack of spectrum harmonization also contributes to enterprise challenges. Specifically, it adds to the complexity of global solution deployments due to the need for unique hardware SKUs for every country or region.

Latency

In many enterprise environments, wireless is now considered a reliable wireline alternative. The latency of 4G, however, has become a stumbling block for many types of new applications and use cases that involve IoT or VR/AR technologies. For example, the remote-controlled machinery in modern factories typically calls for latency as low as 1 millisecond along with very high reliability. Today's 4G networks are unable to consistently deliver that level of performance. For example, 4G doesn't have a mechanism to ensure the reliability and performance of the connections for control automation and other critical applications even during peak traffic times.

Limited Service Level Options

Despite the advancements in 4G networks from previous generations, there are still technology considerations that have limited the ability of operators to package service offerings for different types of enterprise needs. Generally speaking, operators configure networks for best-case and worst-case scenarios and then subscribers have to live with however the network performs. And for enterprises, high-performance/high-reliability connections have come at a premium without the promises of a clear service level agreement (SLA). That means, for example, that a store running its POS transactions over a wireless connection faces the same network slowdowns as all other users in an area during traffic spikes. An outcome that is clearly bad for business during a sales rush. Conversely, options for transferring lower priority data, from say an IoT device, are also often prohibitively expensive. These outcomes are not surprising when you consider that 4G was primarily built for smartphones to browse the Internet, download files, watch videos and use other conventional media applications. But with the role of wireless drastically changing across consumer and enterprise domains, 4G is falling short and it's time for new generation of wireless technology.

Introduction to 5G

Starting around 1980 with the introduction of analog wireless standards, we've seen steady advancements in cellular standards and technology roughly every decade. On a very basic level, 2G digitized networks and introduced basic voice and short message services (SMS). From 3G to 4G we saw a sizable leap in user data transfer rates from roughly 100s of Kbps to up to 100 Mbps. With 5G, data transfer rates are expected to reach multiple gigabits. But that's only the beginning of what's exciting about 5G for enterprise applications.

What Makes 5G Special?

5G is a significant milestone for a number of reasons. First and foremost, unlike previous generations of wireless where the primary objective was to increase data speed, 5G offers a unified air interface that is flexible enough to

support an array of use case requirements, ranging from speed to capacity to latency to reliability to licensed or unlicensed spectrum. With 4G, different versions were required for different use cases, making it impractical for many types of applications.

Part of the reason that 5G is such a significant milestone in cellular network progress is that it opens up the mmWave spectrum bands, which were previously considered unfit for mobile applications, in addition to relying on sub-6GHz frequency ranges for ubiquitous coverage. The characteristics in each layer of coverage make them ideal for different types of use cases.

The mmWave spectrum brings 10 – 40X more capacity to cellular networks than 4G LTE, providing significantly more bandwidth along with the high broadband speeds and capacity that are needed for today's and tomorrow's more advanced use cases. For example, 5G will have the capacity to support high-density applications that also require high speed, including AR and VR. It will also be able to maintain peak performance during usage spikes and support seamless connections to the cloud, virtually eliminating the lag time that users experience today when using a cloud-based application from their devices. Previously, the millimeter wave spectrum, which is the band of spectrum between 30Ghz and 300 GHz, went unused because it presented an array of technical challenges related to coverage distance, penetration through hard and opaque objects, and heat generation. 5G incorporates technologies such as beamforming, beam tracking and beam steering to address these challenges.

The lower spectrum, or sub-6GHz, bands in 5G include the 600 MHz band, as well as mid-spectrum bands, such as the 3.5 GHz band. The behavior of the sub-6GHz bands is similar to that of today's 4G, but advanced features in 5G will enable higher efficiency in these bands than was possible with 4G.

Another important aspect of 5G is its support for shared spectrum. In 4G this support was an afterthought, for example, LAA (Licensed Assisted Access) standardized utilization of 5GHz unlicensed spectrum, and CBRS (Citizens Band Radio service) brought the option to use shared licensing to cellular networks for the first time. 5G, on the other hand, includes native support for these types of spectrum, which means that operators don't have to wait for the next iteration of standards to use them. In other words, in the near future enterprises will be able to utilize their 5G devices for both licensed and shared spectrum on the same network. This will not only further increase the amount of spectrum available to 5G but also enable seamless user experience when moving between different types of spectrum. For example, today, users experience a lot of connectivity issues when handing off from cellular to Wi-Fi and vice versa.

Overall, 5G will provide a unified air interface for all kinds of applications, services, and deployments, including support for the deployment of billions of IoT devices.

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Case Study: C-Thru firefighting system

C-Thru, an AR- and 5G-based system that provides firefighters visibility in smoke-filled "zero-visibility" situations, is an excellent example for illustrating the potential of 5G. When a firefighter wearing 5G-enabled AR glasses enters a smoke-filled room, the glasses render what's in front of the firefighter based on the orientation of his or her head and eyes in real time. The system also transmits views from firefighter headsets back to the central command center using 5G.

In this type of use case, data delays (latency) or system failure are a matter of life and death, so the C-Thru system must rely on a wireless network with significant and uninhibited bandwidth, ultra-low latency, and extreme reliability. All the things only 5G can provide. Inseego worked with Verizon and various other partners to develop the C-Thru system. It was successfully demonstrated at Mobile World Congress 2019.

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Why 5G?

5G isn't just fast, it enables ultra-low latency and very high-reliability communications while bringing significantly more capacity and flexibility to wireless connections than previous generations of wireless technology. Operators will be able to customize their service offerings for specific business needs, and businesses will be able to cost-effectively and reliably connect millions of users and billions of IoT devices in what Qualcomm has called a "unified connectivity fabric" for people and things. In other words, in many ways, 5G is more of a revolutionary new approach than it is a simple iteration of existing standards and technology.

Solves network congestion challenges

5G networks provide a way to balance the needs of surging network traffic in downtowns and other urban areas, venues, shopping malls, large offices, airports and places where peak traffic has always meant reduced network speeds for all users. The availability of more capacity allows users to experience faster speeds and excellent user experience even during peak traffic times. It also means you can efficiently support a larger number of users without degradation in network performance and the overall user experience.

Enables additional service offerings

With 5G there will finally be enough bandwidth available for cellular operators to offer both fixed and mobile services without compromising either. Large-scale fixed wireless access (FWA) services are expected to provide better Internet access options for enterprises and consumers alike. The advanced capabilities of 5G will enable new applications, such as industrial automation, remote operations, enterprise use cases with VR/AR and more.

Supports SLAs for specific use cases

While 5G brings an array of important and differentiating capabilities to wireless, including extremely high speeds

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and capacity, and ultra-low latency, enterprises will rarely need to rely on all of the advanced capabilities at the same time (and doing so would be very expensive). For example, for massive IoT you need slower speeds along with the ability to connect billions of devices. For video applications, high speeds and capacity are important. And for emergency and critical industrial applications latency is often more important than speeds. One of the important breakthroughs in 5G networks will be the ability of operators to easily "slice networks" or tailor virtual networks according to enterprise business needs (similar to a VPN). Optimizing network slices for applications and services also enables operators and enterprises to establish SLAs and keep costs in check.

Reduces cost-per-bit in support of differentiated pricing and new business models

Lower per-bit pricing on 5G networks will enable cellular operators to more cost-efficiently support network traffic. That means they will be able to consider new business models, such as bulk capacity selling. They could even include the connectivity cost as part of a device cost for IoT devices, for example. These types of business models were not possible with 4G.

Provides future-ready technology

Over time, all of the major operators will upgrade their networks to 5G. Although the features and enhancements from 5G networks won't be immediately available, the new technologies that OEMs are introducing will be backward compatible. That means that if your enterprise is planning to invest in new devices and systems in the near future, buying 5G-ready solutions will be key to avoiding the need for another upgrade or replacement in the next few years.

Why now not later?

If you remember back to the launch of 4G, you may be thinking that there's no need to start thinking about 5G until networks and technologies mature in several years. After all, Verizon was the only operator in the U.S. to launch a 4G network in 2010 and then it was another year or two before other operators were ready. With 5G, however, many operators are already working on their 5G plans and are committed to launching 5G services in 2019. OEMs are also set to start rolling out products starting in 2019.

Given the flexibility and efficiencies that 5G networks will bring to enterprises, waiting to deploy 5G solutions until the market is mature could leave you unready to adopt cutting edge solutions and leave you at a competitive disadvantage. Here are three reasons why it's worth starting on your 5G plan sooner rather than later.

Stable 5G standards and spectrum harmonization

Unlike 4G LTE and previous generations of cellular service, the spectrum for 5G is harmonized across the globe.

The mobile broadband standards organization, 3GPP, has been hard at work on universal 5G standards, and in July of 2018, 3GPP Release 15 established a stable foundation for 5G commercial services. That means that the initial 5G devices you acquire will be compatible and work seamlessly with all of the 5G networks throughout the world. This will help eliminate the need for different SKUs for multiple operators or for enterprise implementations in different geographies, helping to eliminate risks associated with early product investments while supporting economies of scale in solution rollout.

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Strong traction for 5G among operators, vendors, and regulators

All of the major operators around the world, including in the United States, Japan, Korea, China, and Europe, are already working on their 5G plans. What's more, all of the major smartphone vendors except Apple have announced their plans for products, some of which will be rolled out in early 2019. And many vendors, including Inseego, are hard at work on other types of 5G products. Inseego is working with leading operators and chipset providers and is among the first vendors to offer 5G-based solutions. In 2019, for example, Inseego powered Verizon's launch of a 5G home service in select markets by providing gateway devices.

Full backward compatibility with 4G LTE

As with other wireless technology rollouts, 5G will be deployed in areas with the largest demands first, starting with major cities and urban areas. As enterprises wait for 5G to reach all of the areas in which they operate, they need to provide seamless or at least similar experiences for all of their users on different types of networks. The beauty of new 5G devices is that they will not only be backward compatible with 4G LTE networks, but they will also support new capabilities being added to 4G networks.

A chance to influence the development of standards and solutions

With past generations of wireless technology, telecom companies led the development of standards and solutions. Enterprises would wait until solutions were available, and then figure out how they wanted to use it. With 5G, however, this dynamic is shifting. Especially in the IoT space. Today, instead of waiting for telecoms to provide solutions, enterprises are asking their providers for the solutions they know they will need. In other words, early involvement with 5G could help you influence the development of standards and that are better suited to your specific challenges, setting you up for a competitive advantage moving forward.

Recommendations for enterprises

Given the traction of 5G combined with stable standards and full backward compatibility of 5G products with 4G LTE, now is the time to start charting your 5G strategy. Especially if some or all of your locations are projected to be in a 5G coverage area within 3 – 5 years. Starting now will enable you to future proof your networks and allow you to tap into the advantages of 5G as soon as it comes online, positioning you to quickly adopt emerging cutting-edge solutions and approaches. Some of the keys to success will be:

- **Consulting with your vendors to start evaluating product portfolios and roadmaps**

- **Working with the vendors who are at the leading-edge of 5G commercialization to have early access**

- **Claiming technology leadership and competitive advantage based on your early mover status**

In addition, enterprise have to make sure that they overhaul and upgrade their back-end system so that they can handle the significantly increased speeds and capacity of 5G. This ensures that hefty investments being done in 5G are improving the performance throughout the system.

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Why Inseego?

The mission of Inseego is to provide solutions that solve enterprise complexity challenges. Over the years, we have led the industry in developing efficient and cost-effective high-availability enterprise solutions, including products that support 3G, 4G, Wi-Fi, and Bluetooth technologies. With 5G, Inseego remains at the forefront of innovation, supporting a range of technology breakthroughs. Not only is Inseego among the first vendors to develop and offer 5G-based products, but we are part of Verizon's initial 5G launch and are working closely with Qualcomm and major infrastructure vendors and instrument providers to develop the solutions that will underpin 5G-powered enterprise environments. In the 5G space, Inseego will offer a portfolio of products tailor-made for industry verticals, in addition to full device-to-cloud connectivity and management. That means we carefully consider how our products fit in a global enterprise system so you can manage them more easily and efficiently. It's all about enabling your enterprise to do more with wireless with fewer headaches.

The Inseego advantage

- Solutions that solve complexity

- Increased efficiency and cost optimization

- Device-to-cloud services with business intelligence

From a broader perspective, Inseego enables high-performance mobile applications for large enterprise verticals, service providers and small-medium businesses around the globe. Our product portfolio consists of Enterprise SaaS Solutions and IoT & Mobile Solutions, which together form the backbone of compelling, intelligent, reliable and secure IoT services with deep business intelligence. Inseego powers mission-critical applications, such as asset tracking, fleet management, industrial IoT, SD WAN failover management and mobile broadband services, with industry-leading uptime. Our solutions are powered by our key innovations in IoT, purpose-built SaaS cloud platforms and mobile technologies, including the emerging 5G technology.

Learn more

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"Our 5G vision is closer to reality than ever," OnQ Blog, Qualcomm, February 14, 2018.
 Release 15, 3GPP, July 16, 2018.

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