PLANNING YOUR JOURNEY TO 5G

Introduction

5G networks are a key part of the worldwide digital transformation that stands to impact consumers, public sector organizations and enterprises across every vertical industry. New devices and applications are already emerging on the market to take advantage of 5G's dramatically reduced latency and much higher data speeds. And the 5G rollout has only just begun.

5G Deployment Today and Tomorrow

The 5G technology standard was set out in December 2018 by the 3rd Generation Partnership Project (3GPP), an organization that develops international protocols for mobile communications. A new G — or Generation — emerges approximately every decade. Wireless service providers and equipment manufacturers must then develop the new technology, and carriers must deploy the new networks, in a massive effort to meet the standard. The Ericsson Mobility Report[1] predicts that by 2025, 29% of mobile subscriptions will be 5G. Most experts predict that enough 5G infrastructure will be deployed for the majority of applications to benefit from 5G by 2025, especially those within urban areas.

Product Evolution: 2G to 3G to 4G LTE to 5G

The first 2G and 3G wireless networks date back to the 1990s. Carriers are currently in the process of phasing out 2G and 3G networks entirely in order to repurpose the spectrum with more efficient 4G LTE and 5G networks.

4G LTE (the "LTE" stands for Long Term Evolution) is the current generation of cellular network technology that is now widely deployed around the world.

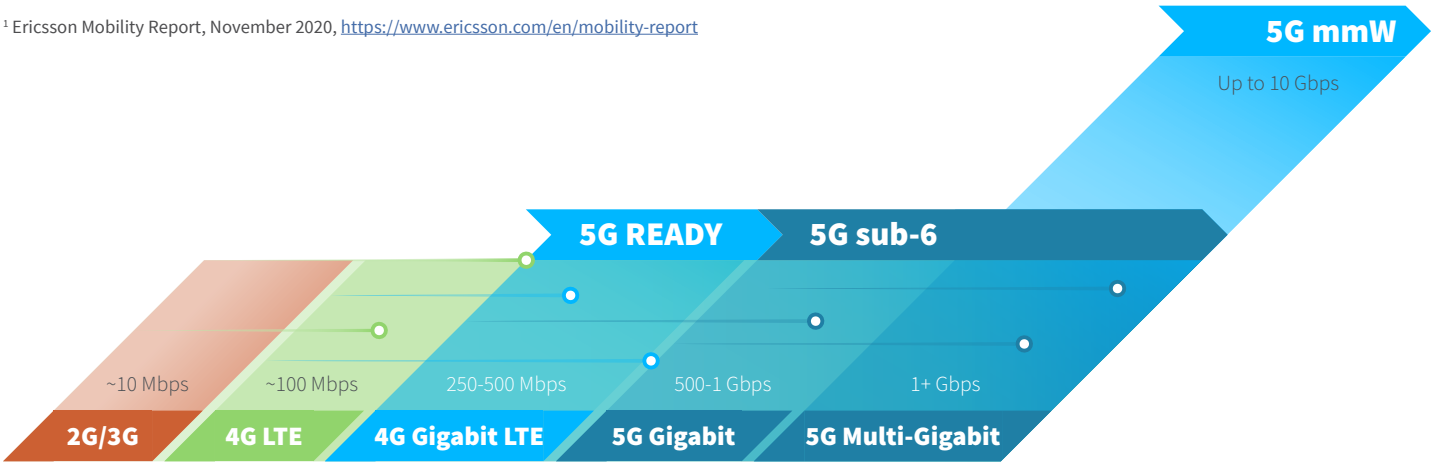
As the name implies, 4G LTE technology has evolved considerably — and is continuing to evolve — since it was launched over a decade ago. Thanks to a technology called Dynamic Spectrum Sharing (DSS), 4G and 5G devices are able to share the same band of spectrum, which means that 4G LTE networks have at least a 10-year lifecycle remaining. Even as the excitement grows around the capabilities of 5G, 4G LTE represents affordable and proven technology that is safe to invest in now, and will not need to be replaced for many years to come.

5G Delivers Higher Speed and Lower Latency

The lower the frequency of a radio wave, the farther the signal can travel. And the higher the frequency, the more data the signal can carry. 5G runs on radio frequencies ranging from below 1 GHz all the way up to very high "millimeter wave" (mmWave) frequencies. 5G speeds depend significantly on the type of 5G connection (Sub-6 or mmWave) and the bandwidth the carrier has allocated to 5G. Some 5G Sub-6 speed tests show speeds similar to 4G LTE, or lower. But 5G is theoretically capable of peak data rates of up to 20 Gbps.

5G can deliver much lower latency than 4G LTE for the nearly immediate response that is essential for autonomous vehicle and traffic management applications. It also provides an overall more uniform user experience so the data rates can remain consistently high, even when users are moving around. Moreover, the new 5G NR (New Radio) mobile network will be backed up by Gigabit LTE coverage, which will provide ubiquitous Gigabit-class connectivity.

[1] Ericsson Mobility Report, November 2020, https://www.ericsson.com/en/mobility-report



- Here are the three frequency bands that form the foundation of 5G networks:
- **5G high-band**, also called mmWave, can provide ultra high-speed. The mmWave frequencies range from 24 GHz up to 100 GHz. 5G mmWave coverage is limited, because these high frequencies can't readily move through walls, windows, or even through trees and other foliage. Therefore, they are short range and require significantly more infrastructure to provide coverage for a given geographical area.
- **5G mid-band** is new spectrum in the 2–6 GHz range that was recently opened up for 5G communication. Mid-band provides a layer of **capacity** well suited to urban and suburban areas, with peak rates in the 100's of Mbps.
- **5G low-band** is existing spectrum below 2 GHz that is used today for 4G LTE. It provides a very wide **coverage** layer. Multiple carriers have announced the availability of low-band 5G networks. Since the spectrum is already being used for 4G LTE and the amount of available spectrum is limited, the performance of 5G low-band will be similar to 4G LTE and initially it may actually be lower. However, it does offer an opportunity for early adopters to try out 5G devices.

The combination of these frequencies provides broad coverage, massive capacity and multi-Gigabit peak data rates, along with ultra-low latency. Initially, 5G will be more expensive than current technology, but costs are expected to decline steadily as 5G coverage and adoption expand.

Who Needs 5G and When

Customers who are planning to deploy 5G applications in the near term fall into three general groups.

1. **Early adopters:** These are organizations that may not have identified a current or definite future use case for 5G, but have a keen interest in the technology as the next great thing. This is fueled by both the excitement and media attention around 5G and a desire to get onboard with future technologies.
2. **Defined requirements:** These organizations have identified an application can benefit from 5G as soon as it can be fully supported — such as the high speeds and reduced latency.
3. **Future proofing:** These are organizations that want to "future proof" their investments in wireless technology to ensure a long service life for products and gain the benefit of 5G as soon as the need and the opportunities arise.

Digi can support your decisions around 5G — enabling you to fully evaluate the right approach, balancing the need for innovation and forward-thinking evaluation of 5G against the cost of early adoption. For many organizations, 4G LTE and Gigabit LTE capabilities are fully adequate to meet their needs. For others the time for 5G is now, especially with technology leaders like Digi actively releasing 5G and 5G-ready solutions.

See our Digi 5G Products article for additional information, or Contact Us for an individual consultation

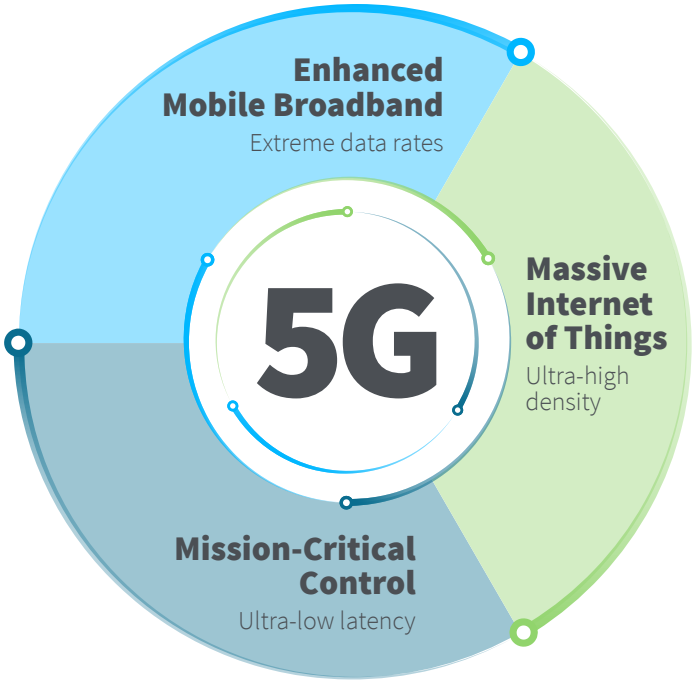
Identifying Use Cases for 5G Technology

Not every application requires the performance of 5G. Gigabit-class LTE and 4G LTE can meet many application requirements today. The use cases for 5G range from applications requiring high volume of data throughput to those needing high speed, beyond what current LTE networks are capable of offering. The right solution for any specific application depends upon the business case.

Key considerations include:

- The application's network speed and throughput requirements
- 5G availability in the proposed deployment area
- Costs, based on the deployment scope and scalability requirements

As an example, if the application in question will be deployed outside of a 5G-enabled area, 5G may not be feasible at this time, but evaluation should continue as 5G rollout progresses.



5G use cases can be broadly categorized into three main types of connected services:

1. **Enhanced Mobile Broadband:** These applications include anything where a faster connection is necessary to support the desired performance. Highly interactive applications cover a range of use cases, from streaming and high definition video, 360-degree video and other data-intensive and image-intensive use cases. For example, these include consumer gaming apps, professional flight simulation and training as well as precision medical applications.

   5G will provide enhanced mobile broadband services to support the needs of users in public transit, as well as new immersive experiences, such as virtual reality (VR) and augmented reality (AR) applications.

2. **High availability, Ultra Reliable Low Latency Communication (uRLLC) applications:** These include applications that require near instantaneous communications, such as autonomous (self-driving) vehicles, as well as connected vehicles, capable of automatically applying brakes on cars to prevent accidents and injuries. In addition, 5G will be used in industrial automation use cases, in which emerging technologies such as artificial intelligence and machine learning will be utilized for electronic object recognition and decision making.

3. **Massive Internet of Things (IoT) use cases:** 5G will have the ability to seamlessly connect massive numbers of embedded sensors placed virtually anywhere. These include applications that can rely on small data packets, which include smart wearables, connected fitness bands and home automation use cases. These are applications you can see today, enabled by network technologies such as NB-IoT and LTE-M — the forerunners of 5G for mMTC — which will be enhanced with the development of 5G over time.

Are You Ready for 5G?

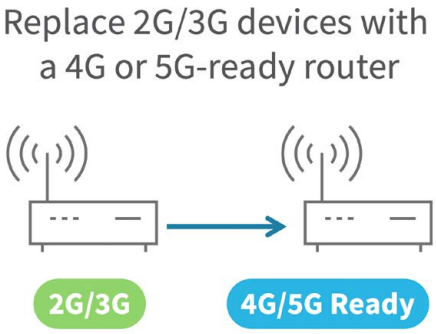
Like 4G LTE, 5G is an evolving technology. A defining capability of 5G is the design for forward compatibility — the ability to flexibly support future services that are unknown today. Network infrastructure will evolve from a Non-Stand-alone (NSA) that works in concert with existing 4G LTE, to Stand-alone (SA) infrastructure, which operates independently.

Devices will evolve as well to support the new high-speed capabilities of the evolving network. In some cases, evolution to 5G will require just a software update. In other cases, there will be a need to augment or replace the hardware. In the commercial, industrial and government spaces, the full rollout will be a lengthier process than in the consumer space.

For those who are ready, Digi 5G is here today. However, for applications operating well on LTE networks, it may be another 5–10 years before it makes sense to upgrade. In any case, it is prudent to start planning for 5G now.

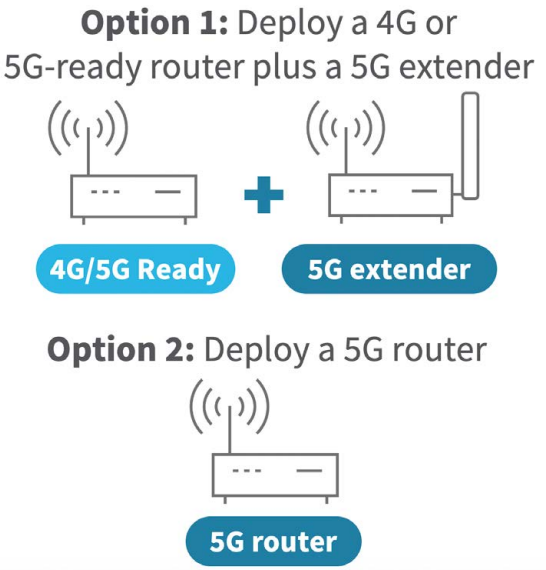
Digi recommends that customers plan for a migration to 5G following a three-phase approach described on the next page.

Phase 1: Prepare for 5G



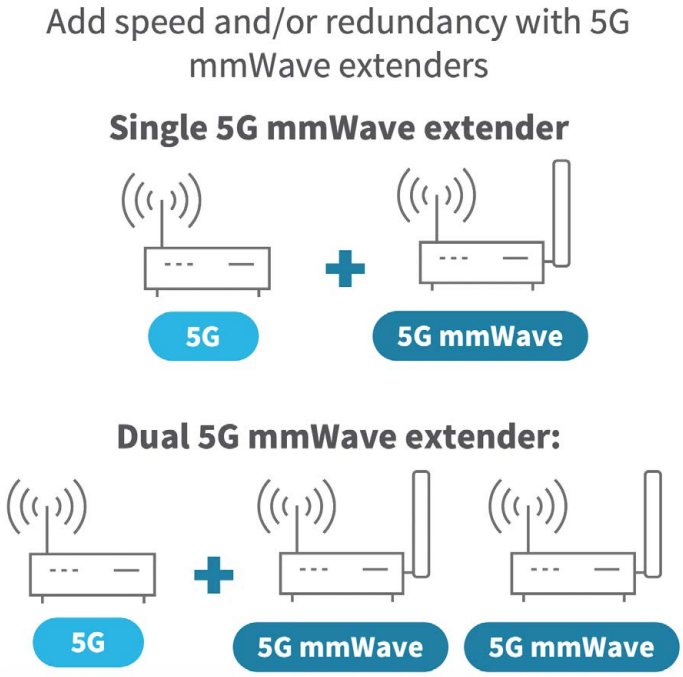
- **Replace:** Legacy 2G and 3G networks are currently being sunsetted by all major carriers. Older 2G/3G equipment should be replaced with 4G LTE or 5G-ready routers as soon as possible.
- **Upgrade:** If your 4G LTE routers are more than two or three years old, consider replacing them as well to benefit from future 5G speeds. For example, Digi EX15 5G-ready routers are equipped with Gigabit Ethernet port(s) and enough processing power to take advantage of 5G speeds.
- **Plan:** Make sure that your 5G network architecture and data capacity are aligned with the requirements of the planned use cases and the business justification for the project.

Phase 2: Deploy 5G



- **Option 1:** Add a 5G Sub-6 cellular extender, such as the 5G-ready Digi EX15 to 5G-enable an existing Digi or third-party router using a Gigabit Ethernet port. Existing 4G LTE service can remain available for redundancy or can be transferred to the 5G extender.
- **Option 2:** Replace your older 4G LTE router with a Digi 5G router, for example the Digi EX50 5G for indoor applications and the Digi TX64 5G for mobile applications.

Phase 3: Optimize 5G



- **Single 5G mmWave extender:** In the future, you can use a 5G mmWave extender to add 5G mmWave for extra speed. An existing 5G Sub-6 service can remain available for redundancy or be transferred to a 5G mmWave extender.
- **Dual 5G mmWave extender:** Also in the future, you can add dual 5G mmWave extenders to provide redundant 5G mmWave connectivity to multiple carriers.

Our Solution

Meet our growing line-up of 5G-native and 5G-ready solutions.

Digi Remote Manager®: The command center for your IoT network, enabling you to efficiently configure, deploy and manage your devices, including automated security monitoring, mass firmware updates, and out-of-band management.

Digi 5G-Native Solutions

Digi TX64 5G is a high-performance 5G cellular router made for mission critical applications to reduce latency, improve uplink speeds, and future proof for full 5G rollout. It offers dual cellular industry-leading radios, 5G sub-6 and LTE Cat 20, and is FirstNet Ready™ for emergency response and extend primary applications.

Digi EX50 is an all-in-one 5G cellular router for organizations that require fast, reliable and secure primary or backup connectivity. With 5G cellular and Wi-Fi 6, the Digi EX50 offers a future-proof, cost-effective and fast-to-deploy alternative to wireline and multi-box solutions.

Digi 5G-Ready Solutions

Digi TX54 is a rugged and secure cellular router platform for mission critical industrial, transportation and traffic management applications with dual Cat 12 LTE-Advanced modems (including Band 14 for FirstNet®). Digi TX54 is FirstNet Ready™ for emergency response and extended primary applications.

Digi EX15 with Digi CORE® Cat 18 is a cellular extender with Gigabit Ethernet and Wi-Fi connectivity for retailers and other organizations that can't tolerate network downtime and the negative impact on revenue streams and brand reputation.

Supporting Solutions

Digi TrustFence®: Digi's sophisticated device security framework, which is integrated into every Digi cellular device, providing multi-layer security including protected hardware ports, authentication, secure boot and ongoing monitoring.

Digi Professional Services: A team of experienced engineers and deployment specialists to help you move rapidly from planning to project implementation and successful deployment with any guidance and support you may need, including team training.

Digi Can Help You Migrate to 5G

Digi International supports enterprises, government agencies and industrial organizations today with 5G solutions, as well as Gigabit-class 4G LTE for applications that do not require the fast speeds and throughput of 5G. We can discuss your needs and ensure that you find the right 5G or 4G networking solution at the right price, to ensure an optimal return on investment and the service life you expect from your deployment.

Contact Us for a consultation to learn more about 5G planning and 5G technology selection

Why Digi?

Digi is a complete IoT solutions provider, supporting every aspect of your project, from mission-critical communications equipment to professional services to get your application designed, installed, tested and functioning securely, reliably and at peak performance.

Digi builds its products for high reliability, high performance, and versatility so customers can expect extended service life, quickly adapt to evolving system requirements and adopt future technologies as they emerge. Digi cellular routers, servers, adapters and gateways support the latest applications in traffic, transit, energy and smart cities.

Our solutions enable connectivity to standards-based and proprietary equipment, devices and sensors, and ensure reliable communications over virtually every form of wireless or wired systems. An integrated remote management platform helps accelerate deployment and provide optimal security using highly efficient network operations for mission critical functions such as mass configuration and firmware updates, including system-wide monitoring with dashboards, alarms and performance metrics.

Company Background

1. Digi is publicly traded on the NASDAQ stock exchange, symbol DGII
2. Founded in 1985, Digi has 35+ years of experience connecting the “things” in the “Internet of Things” — devices, vehicles, equipment and assets
3. Headquartered in the Twin Cities of Minnesota, Digi employs more than 600 people worldwide
4. The business has been profitable for 16 consecutive years
5. Digi’s annual revenue is around $279 million
6. The company has 285 patents issued and pending
7. We have connected more than 100 million devices worldwide

As a communications equipment manufacturer, Digi puts proven technology to work for our customers so they can light up networks and launch new products. Machine connectivity that’s relentlessly reliable, secure, scalable, managed — and always comes through when you need it most. That’s Digi.

Contact a Digi expert and get started today

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