![Zebra - Capture Your Edge]

# 5G and WiFi 6/6E

Understanding the impact of the new generation of wireless technologies on your enterprise mobility strategy

# Executive Summary

## 5G

## Wi-Fi 6/6E

## How will next generation wireless technologies impact your business?

Today, mobility is a cornerstone technology in almost every business. Mobile devices help workers get more done in a day, as they are able to execute tasks faster and with greater accuracy. Retail associates can better assist shoppers. Nurses can provide patients with faster care. Manufacturers can take production volumes and product quality to the next level. Warehouse operators can make sure every customer receives the right items in the right order on time. And public safety officers and first responders can better protect and serve their communities.

At the heart of every one of those mobility solutions is a wireless network, the key enabler that carries the steady flow of information to and from the mobile devices that drive your business processes — and your success. But wireless networks are evolving, and the pace of evolution is increasing: 4G is evolving into 5G, Wi-Fi 6 and Wi-Fi 6E have arrived.

As an enterprise, you have probably started discussions about how this next generation of wireless networks can impact your current mobility solutions, your near-term mobility plans, and your overall mobility strategy. Do you need to start replacing infrastructure and devices now? How will your organization benefit from the new generation of wireless technologies? And when is the right time to build migration into your mobility plans? The following overview of these new wireless technologies and our initial recommendations can help you determine where and how these technologies fit best in your organization — and when you should begin deployment.

# 5G The fastest growing mobile technology in history

5G is here. It's everywhere you look — whether you're on the internet, watching TV, reading newspapers or driving past a billboard. The promise of 5G speeds is driving consumers to buy 5G phones by the droves, making 5G the fastest growing mobile technology in history. In just one year (Q3 2019 to Q3 2020), there were 225 million new 5G subscribers. By comparison, it took four years for 4G LTE to build that size of a subscriber base. The meteoric rise continues — there was a 66% increase in global 5G subscribers in just one quarter (between Q3 2020 and Q4 2020).[1] And in 2026, the number of worldwide 5G subscribers is predicted to hit 3.5 billion, representing an unbelievable 57% annual growth rate over 6 years.[2]

## So, what's driving the 5G frenzy?

5G benefits everyone — service providers and end users. Carriers and service providers benefit from increased device sales, more efficient infrastructure, and new business models, driving incremental revenues and reducing costs. Both enterprises and consumers will benefit from new use cases, higher speeds and more reliable lower latency performance. Consumers have embraced 5G as "the next big thing and are driving 5G adoption right now, just as they have driven the return on investment of the prior generations of cellular network technologies.

However, enterprise adoption of 5G will help speed up the development and availability of 5G-enabled devices — and the maturity of 5G enterprise solutions.

5G is here. It's everywhere you look. But is it time to migrate to 5G devices for your enterprise applications?

## The many benefits of 5G in the enterprise

While consumers will benefit from 5G's additional speed, the many benefits of 5G in the enterprise space will help improve existing applications and drive the deployment of new enterprise applications.

### Wired speeds — up to 10 Gbps

With up to 10 Gbps, 5G will deliver speeds equivalent to wired internet — 10 to 100 times faster than 4G LTE.

### Low latency

Discussions of 5G benefits almost always include its speed and low latency. What exactly is latency? Latency is the time it takes for information to travel from the mobile device to the server and back. To understand the impact of low latency, let's look at an example. If you're driving a car at 60 mph, it will take a human 250 milliseconds (ms) to react to a situation that requires braking. In that timeframe, the car will travel about 100 feet. If you were able to react in 1 ms, the car would only have moved forward a little more than an inch.

When it comes to latency, just how low can 5G go? The 5G specification calls for a maximum of 4 ms latency, and 1 ms for ultra-reliable low latency applications. While the evolution to those speeds will take some time, once they arrive, they will help pave the way for real-time applications, such as autonomous cars.

### 90% reduction in total energy requirements[3]

From an energy requirements perspective, 5G is a green technology that is actually good for the planet. While it will connect more higher speed devices, it will not require more energy to do so. Studies show that under certain conditions, the complete 5G ecosystem — including infrastructure, base stations and mobile devices — has the potential to reduce overall energy consumption per unit of traffic by up to 90%.[3] And low power 5G IoT modes enable the batteries in IoT devices to last up to 10 years,[4] paving the way for sensor applications that weren't feasible before due to the time and cost for frequent and regular battery changes.

### 1000x bandwidth per unit area[5]

5G's major increase in bandwidth provides support for 100 times the number of devices that 4G LTE could support. 5G supports one million devices for every square kilometer (.386 square miles) vs. 100,000 for 4G LTE, paving the way to a world where everything is always connected, all of the time.

### Improves signal quality and strength

Massive MIMO (Multiple Input-Multiple Output) in the Sub-6GHz range enables more simultaneous connections, which is ideal in densely populated areas. Using massive MIMO, multiple users can communicate simultaneously at the same time and using the same frequency, reducing latency and increasing system capacity.

## 5G enterprise applications

5G's increased uptime, lower latency and greater bandwidth will help to improve all the mobility applications in use today by improving application performance. But those same attributes also pave the way for a new family of applications across industries, including:

### Transportation and Logistics

With ubiquitous, reliable, 5G coverage, expansive facilities such as airports, seaports and rail yards, can more effectively deploy mobile solutions that streamline and error-proof processes.

For example, sensors on baggage can help ensure luggage reaches the right plane on time, and a rugged mobile device can verify the identity of incoming shipping containers to ensure they are processed promptly and properly. Autonomous cars, trucks and drones could be utilized for delivery operations. Sensors can be placed on refrigeration units in delivery trucks to ensure correct temperatures are maintained throughout shipping for sensitive pharmaceuticals, frozen foods and more.

### Manufacturing

Real-time data collection and analysis from sensors on the production line can help manufacturers improve efficiency, impacting production speed and workforce productivity. Augmented, virtual and cross reality technologies can help technicians reduce production line downtime by ensuring repairs are executed perfectly. They can also help technicians uncover and address emerging issues during routine maintenance, before they impact machine performance. Sensors on tools can enable automatic tracking of tool usage to ensure that any required maintenance is always performed on time — such as calibration. And 5G can provide the constant connection robots require, without the limitations of wires, enabling the creation of the factory of the future. Plus, sensors on doors, gates and areas where sensitive information or goods are stored can help improve safety without adding manpower.

### Mining

5G can enable mining operations to deploy autonomous vehicles that help improve efficiency and worker safety — workers no longer need to be in the vehicles.

### Healthcare

5G speeds and low latency can improve the delivery of healthcare. For example, first responders can stream real-time patient diagnostic data from the field and ambulance to the emergency room so hospital care teams are best prepared to care for incoming patients the moment they arrive. The quality of telehealth appointments should also greatly improve, providing patients with a more natural experience akin to an in-person meeting.

With 5G, very large 1 GB files generated by scans can be sent to a patient's physician in minutes instead of hours — without impacting network performance or availability. Rather than waiting until the evening when there is less network traffic, facilities can send scans as soon as they are available, eliminating delays in the transfer of crucial information, the patient diagnosis, delivery of the results to the patient, treatment, and the scheduling of second opinions —and ultimately improving the quality and speed of care. And 5G speeds and low latency can make the tactile internet and haptic communication a reality, providing surgeons on one side of the world with the sense of touch required to successfully complete a robotic surgery on the other side of the world via a 5G network. The result? World class healthcare, even in remote areas — patients can utilize any surgeon, regardless of location, without traveling.

### Utilities/Field Service

Since 5G coverage will be consistent throughout a coverage area, utility companies' field service personnel can depend on the availability of apps like augmented reality, virtual reality and cross reality to ensure maintenance and repairs are performed properly. And any dangerous activities could be conducted with robots and augmented reality to help keep workers safe — for example, during the cleanup of hazardous materials or removal of explosive devices.

### Retail

Operating with very high capacity and small cells, 5G mmWave can enable futuristic retail use cases which will revolutionize the in-store personal experience. For example, it can be used to deliver personalized digital signage to customers through an interactive "magic mirror" in a dressing room.

### Hospitality

Guests could utilize their cell phones to open the door to their rooms, adjust lights and more, all with the press of a button or two on the 5G device that is always on hand. If all merchandise in a quick service restaurant has an RFID sensor, store managers can enable "smart shelves" that alert workers when a shelf needs replenishing, allowing associates to spend more time helping guests instead of checking inventory.

### Public Safety

5G can enable first responders to tap into a wealth of information in the systems in a smart home. Police and firefighters could use a 5G-enabled handheld mobile computer or tablet to access the real-time feed from security cameras in a home to obtain a new level of situational intelligence. This could help firefighters identify hotspots before they enter a burning home. A 911 caller could send live video to a first responder or 911 operator enabling a faster and better response to the situation. And 5G's network slicing can enable the dynamic creation of a virtual network to prioritize crucial data during a response, such as tracking the location of first responders and first responder equipment.

# Summary

While 5G is here, it is far from ubiquitous, which heavily impacts its ability to deliver value in enterprise applications. Today, coverage is primarily centered in highly populated areas, with coverage in rural areas expected to lag significantly. In areas where 5G is not available, connectivity will fall back to 4G, reducing the ROI for 5G devices. And, if enterprise applications are designed to leverage the high bandwidth and low latency of 5G where the required 5G speeds aren't yet available, application performance could suffer, impacting workforce productivity, at the least, and possibly worker safety.

In short, just as it took many years for the buildout of the 4G network, it will take years for the full buildout of the 5G network as well. So, when it comes to the need for 5G devices in the enterprise, you have plenty of time to migrate. There is no risk of carriers abandoning their 4G networks anytime in the near future — the 5G networks are built on top of 4G networks. In fact, some carriers are continuing to improve their 4G networks, in turn improving the quality of the service your workers experience. And even as 5G becomes available to your workers, there will be no impact or degradation of their 4G voice or data communications.

As a result, your workforce can continue to use their 4G devices until your enterprise has a use case that requires the speeds of 5G — and 5G higher speeds are actually available throughout your coverage area. When your 4G devices are ready to be replaced, you can assess whether your applications have a need for 5G speed, and if so, begin migration at that time.

# Wi-Fi 6/6E

## The importance of Wi-Fi 6 and Wi-Fi 6E in the enterprise

At the start of the mobile revolution, enterprises provided workers with mobile devices that could access information in key business applications. But, as mobility has matured, enterprises want more. With the convergence of voice and data, enterprises want to give workers one device that does it all, simplifying life for the workforce and eliminating the need to purchase and manage separate devices. To enable the most collaborative workforce possible, enterprises want to put a mobile device in the hands of every worker. IoT devices are now common, improving operations by providing instant visibility into new levels of information — from the temperature in a cold storage warehouse to visibility into areas in a retail store that are overloaded with shoppers. And next-generation technologies such as augmented reality are finding their way into the enterprise, where they can help streamline and error-proof everyday processes.

As enterprises deploy more mobile solutions to more workers, the Wi-Fi network becomes more congested. The Wi-Fi network needs to be able to accommodate more devices, more connections and more traffic. And with next-generation Wi-Fi 6, it will.

Also known as 802.11ax, Wi-Fi 6 is the first generation to adopt the new numeric naming convention. Wi-Fi 6 addresses everything from the need for speed to the need to accommodate more devices and improved security. Compared to Wi-Fi 5, Wi-Fi 6 quadruples bandwidth and capacity, reducing congestion and interference. And with substantially reduced latency (75% lower, according to Intel), a substantial increase in devices and traffic won't impact application performance.[6]

Wi-Fi 6 and Wi-Fi 6E are here. Should you migrate your Wi-Fi network infrastructure and devices to Wi-Fi 6? Or wait for Wi-Fi 6E?

Wi-Fi 6 paves the way for enterprises to put a mobile device with voice and data capabilities in the hands of every worker, blanket the enterprise with IoT devices to provide a new level of business intelligence, and deploy emerging technologies such as augmented reality to enable workers to get more done, more perfectly.

And if you need more speed, more bandwidth and more capacity, Wi-Fi 6E delivers. Wi-Fi 6E utilizes an additional Wi-Fi frequency band — 6 GHz. The 6 GHz band offers an additional 1200 MHz of Wi-Fi spectrum, compared to the maximum 560 MHz for prior Wi-Fi generations, boosting the total available spectrum to 1600 MHz — quadrupling the available space. With this added spectrum, customers can allocate additional wideband 160 MHz channels. The result is a Wi-Fi network that offers the highest possible reliability and capacity, plus the lowest possible latency, capable of supporting sensitive applications such as autonomous vehicles, and offering enterprises maximum relief for Wi-Fi network congestion.

## Wi-Fi 6/6E: key features and benefits

Wi-Fi 6 delivers what everyone wants — enterprises and users alike — more of everything. More speed. More capacity. More responsive applications. More battery cycle time. And more security.

### It's triple the speed
Wi-Fi 6 offers much faster data rates. Where Wi-Fi 5 (802.11ac) maxes out at 3.5 Gbps, Wi-Fi 6 offers a maximum possible data rate of 9.6 Gbps, potentially tripling the speed of its predecessor, Wi-Fi 5,[6] and providing support for more bandwidth-intensive applications.

### It can handle up to four times the devices
Wi-Fi 6 adds a third band (6 GHz) to the Wi-Fi 5 dual band (2.4 GHz and 5 GHz) solution. MU-MIMO, short for Multi-User Multi-Input/Multi-

Output, enables multiple devices to communicate simultaneously with the access point. The result? Up to four times the network capacity[6] — so you can give more workers more devices, without risking congestion.

### Lightning-fast application performance
Less latency means more responsive applications, which helps to improve the workforce experience and productivity.

### Longer battery cycle times
A new feature, Target Wake Time (TWT), enables access points to determine when devices can access the network, substantially reducing the time that antennas are powered on to transmit and search for signals. Battery power consumption is reduced, extending battery cycle times. While all devices can benefit from TWT, this feature is particularly beneficial to smaller, lower-power IoT devices, such as sensors. Sensor batteries last longer, and since IoT devices don't need to be "always connected," network traffic is reduced.

### Better security
Wi-Fi 6 gets a security upgrade, thanks to WPA3. Compared to WPA2, WPA3 uses the latest security protocols, enabling stronger authentication and increased cryptographic strength — ideal for markets with sensitive data, such as healthcare and retail. Improvements include requiring a username and password to access the Wi-Fi network instead of just a password. Encryption keys are longer, increasing from 128-bit to 192-bit, which are harder to break. Another new feature called Simultaneous Authentication of Equals (SAE) adds a new layer of security during ongoing communications. And Opportunistic Wireless Encryption (OWE) improves security by preventing eavesdropping when connected to public Wi-Fi hotspots.

## Use cases: do you need Wi-Fi 6 or Wi-Fi 6E right now?

**Just a few examples of applications that Wi-Fi 6 can enable includes:**

### Complete workforce collaboration

Give your entire workforce the simplicity of a single device that provides data access as well as all the functionality of a 2-way radio for push-to-talk instant communications, plus a mobile PBX handset. By enabling workers to take and place calls through the PBX, enterprises only need to give workers one device — instead of three.

### On-demand Training

Enable any number of users to watch real-time, on-demand training videos and enable video calls within your facility to provide live assistance — for example to support new technicians repairing equipment on the manufacturing production line.

### Telehealth visits

Enable remote healthcare consultations and appointments, allowing physicians in a clinic or hospital to conduct visits with patients in their homes.

### A new generation of IoT devices

Throughout the supply chain, manufacturers, distribution centers and warehouses can deploy any number of IoT devices to track critical metrics without compromising the quality of service in other applications, including temperature sensors to monitor cold storage.

### Improve the retail customer experience

Provide shoppers with virtual or augmented reality applications to guide shoppers through the store — no more searching for items. Deploy self-service kiosks to enable customers to place orders, check stock and more. And empower shoppers to start interacting with your store applications out in the parking lot.

### The new world of warehousing

Give all workers on the warehouse floor augmented and virtual reality applications to visually direct them via the fastest path to the right location to pick items for an order or put away incoming inventory — and verify that the correct items were picked or placed on the shelf for storage. Wi-Fi 6/6E will also make it easier to track and trace all inventory — from incoming raw materials to outgoing finished goods.

### Wi-Fi 6E supports applications that require the fastest throughput and highest capacity, including:

### Maximum users

Wi-Fi 6E can support the densest user environments, for example, a stadium full of fans or trade show with over 100,000 attendees.

### Cloud computing solutions

With nearly non-existent latency, any enterprise can enable superior performance for mobile solutions that depend on cloud applications.

### Manufacturing, mining and warehousing: autonomous vehicles and robots

Wi-Fi 6E enables a new generation of industrial automation solutions, from autonomous vehicles in mining operations and shipyards that help improve worker safety and throughput to robots picking products in a warehouse.

## Summary

Ultimately, you will need to upgrade your Wi-Fi network to either Wi-Fi 6 or Wi-Fi 6E. But when and how should you migrate? And should you upgrade to Wi-Fi 6 or Wi-Fi 6E?

To answer these questions, you need to take a good look at current application needs as well as anticipated new application needs. You'll also need to consider whether Wi-Fi 6E is available in your geography. If Wi-Fi 6E is not currently available in your area, you'll need to consider when certification is expected, how much of the spectrum will be available, and whether there are any usage restrictions.

The answers will help guide your planning. You may need Wi-Fi 6 now and Wi-Fi 6E to meet future plans. You might need to layer Wi-Fi 6 or Wi-Fi 6E network together to achieve the coverage you need. Or you may never need Wi-Fi 6E. Understanding your application roadmap and availability in your geography will help you determine if, how and when to start down the upgrade path.

# Conclusion

## There is no single best-practices roadmap to help enterprises determine how and when to transition to the next generation of wireless technologies.

Start with a thorough examination of all of the applications you use today and the applications you have planned over the next three to five years. Then you can assess each application's requirements individually and determine which of the wireless protocols is best suited for each application. It comes down to speed, bandwidth, reliability and latency needs. Rather than a one-size-fits-all approach, chances are you'll need to layer these new wireless technologies to meet all of your needs.

While the emergence of next generation wireless technologies makes the creation of your wireless network roadmaps more complex, it also gives you freedom of choice — the flexibility to define the best wireless network strategy to support your application requirements.

Zebra can help you analyze the current state of your applications and your application strategy to help you create a migration plan for one or all of these technologies to ensure you have a solution tailored for your business.

**Contact your Zebra representative or visit www.zebra.com to find a partner.**

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