

5G executive update

5G today

5G in use

5G mobile broadband

5G and URLLC

5G M2M networks

verizon^v

5G executive update

5G today

The beneficial outcomes and improvements your organization can gain now

5G in use

5G mobile broadband

5G and URLLC

5G M2M networks

5G is rolling out now. Don't wait to act.

We've all heard about and seen how 5G technologies and use cases might deliver amazing new outcomes for a business. Some may think that we are years away from implementation, but don't be distracted: The reality is that there already are numerous ways to improve business outcomes with various aspects of 5G technology. Organizations that wait risk falling behind leaders that are deploying and using 5G now and gaining experience that will be invaluable for next-generation 5G solutions. According to Deloitte, "Networking executives believe advanced wireless is a force multiplier that enables them to unlock the full potential of other emerging technologies."¹

Here are some of the benefits:

- More ubiquitous connectivity will improve employee productivity and support applications that are used remotely. With better coverage and network availability, employees and customers will have fewer interruptions to their work or interactions.
- 5G provides broader coverage based on a range of spectrum bands, which makes it possible to support a broad mix of services – including those that require such attributes as high throughput capacities, high availability, high device densities and more persistent connections.

"Networking executives believe advanced wireless is a force multiplier that enables them to unlock the full potential of other emerging technologies."

Near-term use cases

5G can be used in a wide number of ways. As it matures, 5G is likely to enable thousands of individual apps or services. The focus of this section, however, is the near term – what you can do now. Being an early adopter of 5G or, at a minimum, having a road map for adoption can deliver important outcomes. Jumping into 5G now will provide two important benefits: improved near-term outcomes for your business and early experience, which will translate to better and more effective plans for future 5G usage. And early adopters benefit from the creation of internal expertise and skill sets while also getting greater attention from key technology vendors before the market takes off.

Execs see 5G as transformative

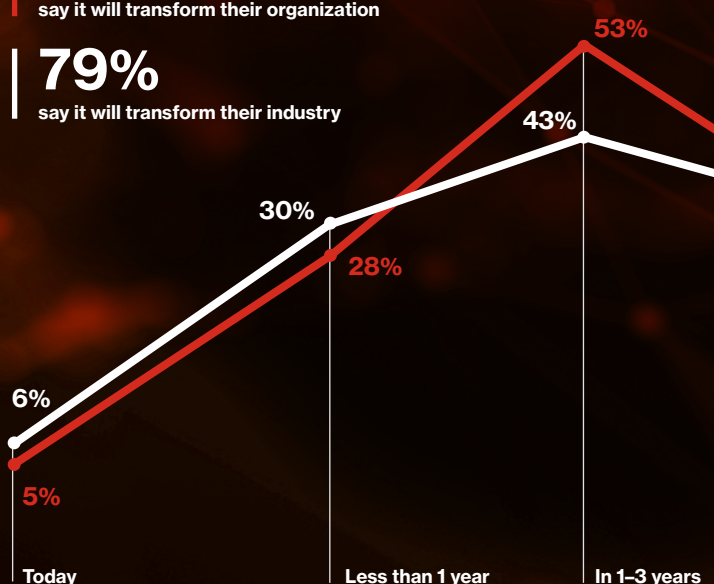
Source: Deloitte's Study of Advanced Wireless Adoption

86%

say it will transform their organization

79%

say it will transform their industry



Mobile office/kiosk

The pandemic put remote work at the forefront for most organizations, and there is unlikely to be any retreat from mobile work in the future. The arrival of 5G is well timed because it provides employees with a mobile office or kiosk that has a high-speed connection to the office and that can improve the security of remote work. Fixed Wireless Access (FWA) using 5G provides broadband-like connectivity without the infrastructure requirements of wired lines.

Customer experience

For e-tailers and retailers, the speed and bandwidth improvements gained from 5G make it possible to do more, such as supporting the first generation of augmented/virtual reality commerce applications. In addition, 5G is a better network than previous generations of cellular networks for the progressive web applications (PWAs) that will provide better customer experiences online.

Machine-to-machine

5G is the platform that should begin to make factories and devices intelligent and able to interact with each other. Existing 4G/4G LTE wireless networks are perfect for deploying the first-generation implementations.

Immersive collaboration

Current collaboration tools are little more than adequate and still leave much to be desired. 5G connectivity could someday provide truly immersive experiences, where engineers can “live” inside a design and collaboration tools make it feel as if the parties are all sitting in the same room.

Choose a 5G network partner. Look for one that is in the process of building out a 5G footprint that is as comprehensive as possible. Working with a partner that has 5G experience will help you avoid mistakes and complete projects faster. It can also help build your application “stack” for new business applications.

Investigate machine automation. Evaluate and plan for how your industrial automation or M2M strategy will begin and roll out with more functionality in the future. Experts agree that these types of solutions will be best delivered in a “crawl-walk-run” cadence, so start now on the first phase.

Solve mobile app performance problems. Some current mobile apps that are not performing at required levels or perhaps can't even be released because of capacity issues can be re-evaluated to see how they will perform with 5G.

Find immersive experiences. Identify which internal and external apps or tools will benefit from the more lifelike or immersive experiences that are going to be possible using 5G.

What to expect

The rollout of first-generation 5G is for real, and 5G's capabilities will continue to expand as both speed and bandwidth increase in the future. 5G has the potential to support new, innovative applications and use cases such as immersive entertainment, online gaming, and robotic control that will provide game-changing outcomes. Hundreds of technology companies are building 5G products, and more are being launched every day. It is worthwhile for every organization to evaluate the many new solutions that are available now.

Organizations must expect that this dynamism will continue and devote resources to identifying new solutions that have the most promise – all while ensuring that they have a high-performing and forward-looking/innovation-ready 5G network in place to support these new apps as soon as possible.

“More ubiquitous connectivity will improve employee productivity and support applications that are used remotely.”

5G executive update

5G today

5G in use

How businesses are benefiting from 5G right now

5G mobile broadband

5G and URLLC

5G M2M networks

5G at work today

Current 5G implementations are experiments that aim to lead the way to new and innovative applications and someday deliver better outcomes for organizations and customers. In addition, removing the “mobility penalty” by providing higher performance for remote, wirelessly connected workers could someday improve productivity and employee efficiency.

This section will focus on examples of how 5G is being tested today and the benefits it could deliver. Of course, many current use cases will be enhanced going forward as the technical capabilities of 5G grow, but there is still much that 5G can do right now.

Areas where 5G can help:

- Where greater throughput is needed: One of the performance benefits of current 5G networks is that upload speeds are faster than 4G/LTE or any previous generation of cellular network. For many business apps designed for collaboration, improved throughput and reduced latency are vitally important in preventing “lags” that impact the user experience.
- Where the focus is on the visual: The ability to deliver more immersive, interactive and engaging visual experiences is a key goal of many 5G deployments. Users have not been hesitant to turn to first-generation 5G for such deployments because, as higher-speed/-bandwidth 5G technology becomes available, it will be possible to improve the first-generation offerings, rather than discard them and start over.
- Where latency can't be tolerated: There are many apps or use cases where latency creates time sequencing or interactivity problems that render the app unusable. 5G's ultra-low latency raises the prospect of real-time mobile or remote use cases for both human- and machine-centric applications.

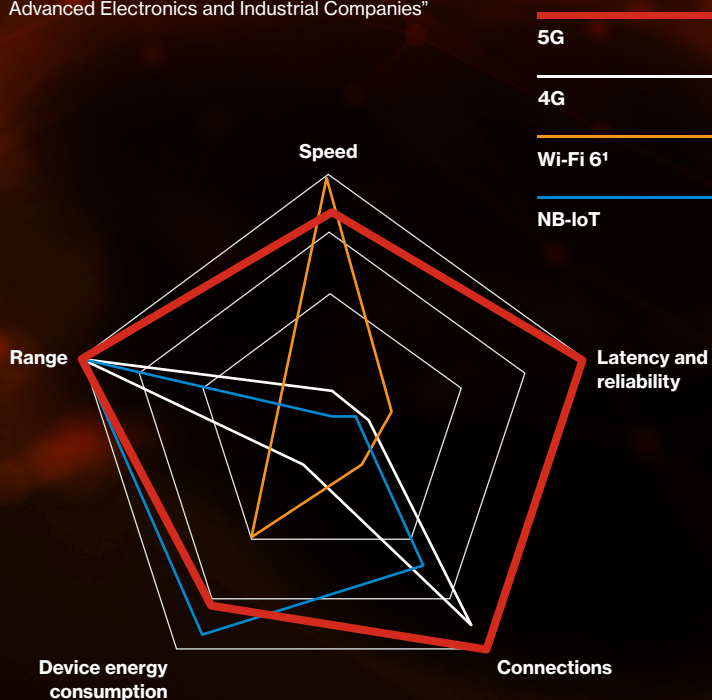
“Removing the ‘mobility penalty’ by providing higher performance for remote, wirelessly connected workers could improve productivity and employee efficiency.”

Real-world use of 5G today

Two case studies of very different enterprises, the *New York Times* and the National Football League (NFL), illustrate how organizations are exploring 5G today.

The 5G advantage

Source: McKinsey – “The 5G Era: New Horizons for Advanced Electronics and Industrial Companies”



New York Times

The *Times* is exploring the future of journalism in the 5G era. The newspaper believes that the current capabilities and future potential of 5G will enable an entirely new style of storytelling. The *Times* is currently experimenting with using 5G to better support its remote journalists, who work in over 160 countries. The *Times* wants to speed delivery of content from these journalists, including video and high-res images, using higher-speed connections. This is where 5G could provide improvements over 4G networks. There are also explorations taking place today of using 5G to stream photos and visual content from photographers/videographers directly to the media servers that support the newsroom.²

The *Times* is also experimenting with using 5G to deliver an improved audience experience. The goal is to deliver more dynamic storytelling formats that support more immersive experiences. The 2018 piece about David Bowie's stage costumes,³ for example, might get an upgrade to show them in new environments captured in 3D.²

NFL

Attending an NFL game has always been a memorable experience, but Verizon and the NFL are teaming up to pilot an improved experience by testing mobile apps that allow fans to create personalized highlights, complete with replays, varied viewing angles and statistics available instantly.⁴

Teams also hope to use 5G to support improved stadium operations such as contextual social media interactions. Fans might be able to find the nearest concession stand with a short line, an available parking space and more. The goal of many of these new fan services is to simplify game attendance while increasing the in-stadium revenue opportunities for the team.⁴

Take action.

Get infrastructure ready. Updating infrastructure with the most modern functionality is essential. This includes virtualizing networks, defining a modern and effective set of security protocols, and integrating existing systems to provide a single point of management.

Choose a 5G network partner. Leveraging the expertise, experience and services that a strong 5G network partner brings to the table is critical to getting early 5G projects into use more quickly. It is not time-effective for internal teams to learn as they go.

Watch the pioneers. As organizations progress along their 5G strategic journey, much can be learned by analyzing how they change or upgrade what they are doing. This information can help your own plans better succeed.

Evaluate potential for enhanced video. The reduced latency and increased throughput of 5G positions it as a great option for supporting a new range of remote video applications that demand more fidelity. Evaluating how your organization is currently using video and identifying new use cases is an important step to take right now.

Identify remote use cases/apps. Many organizations have several functions that require working remotely or traveling constantly, and the number is increasing because of the pandemic. Look for apps or services that are now constrained by network performance problems that could be solved by 5G.

“One of the performance benefits of current 5G networks is that upload speeds are faster than 4G/LTE or any previous generation of wireless network.”

5G executive update

5G today

5G in use

5G mobile broadband

How 5G mobile broadband (MBB) delivers positive business outcomes now

5G and URLLC

5G M2M networks

What is 5G mobile broadband?

5G mobile broadband (MBB) is an extension of services first enabled by 4G LTE networks that allow for high-speed data transfer across a wide coverage area. MBB will provide the greater capacity necessary to support peak data rates both for large crowds and for end users who are on the move.

Why it's important:

- 5G MBB will roll out using low-band spectrum, but as mid- and high-band spectrums are used, MBB speeds should increase dramatically. With a wide variety of use cases, organizations are starting to deploy Phase 1 5G MBB, allowing them to move quickly as soon as higher speeds become available.
- 5G MBB use cases encompass many of the ways wireless is currently used, supporting many users. For this reason, moving to 5G to gain greater performance will have outsized benefit by improving productivity for many employees and customers.
- 5G MBB will provide the ability to quickly and easily add data-hungry functionality to existing wireless apps such as video and simulation. It will also provide the ability to use larger data files and higher-quality content streaming.

“5G MBB will provide the ability to quickly and easily add data-hungry functionality to existing wireless apps such as video and simulation.”

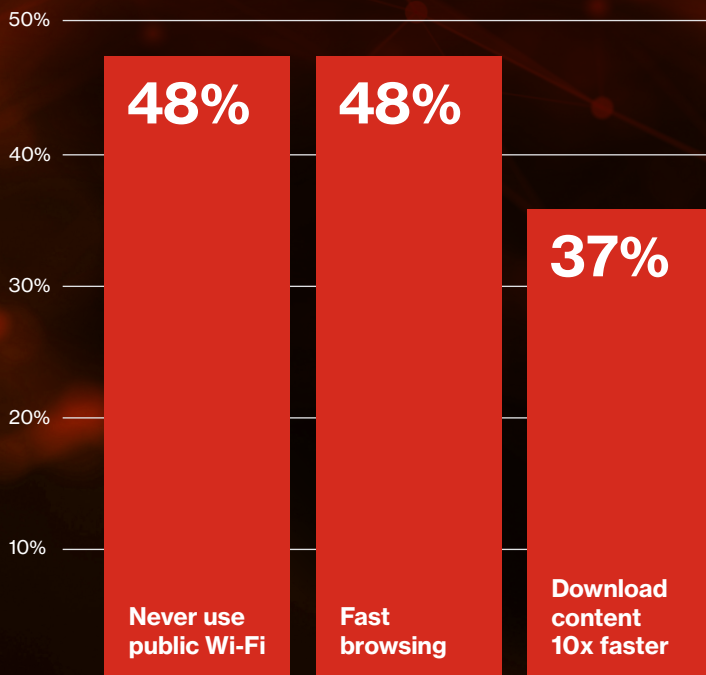
Near-term use cases

5G MBB encompasses several well-known and innovative new use cases. In many ways, MBB will eventually provide capability that is comparable to wired broadband. The result is inclusion of both brand-new use cases and some where MBB could be a better alternative to traditional hard-wired options. There are several potential use cases, and this breadth reinforces the need to evaluate where and how 5G MBB can help your organization. The examples below are only a small sample of what could be possible.

Top 3 MBB use cases

Source: Statista

60%
Share of respondents



Video-augmented apps

With better speed and bandwidth, previously static customer experiences or employee training activities could be substantially upgraded with video or immersive experiences.

Wireless streaming

Streaming data at higher speeds makes it possible to provide better infotainment experiences, deploy real-time applications such as video monitoring or collect data as it occurs. Look for use cases where enhanced data flow would make a difference.

Analytics and BI

As analytics becomes a part of every employee's job, it is essential that being mobile doesn't create a data access roadblock that makes analytics work difficult or impossible. Analytics requires large data sets, and making them available both quickly and safely to remote users is essential to drive broad usage.

Enhanced collaboration

Collaboration today is simply a voice and video combination. With the ability to support more immersive experiences, collaboration could move to the next level. With the data rates supported by 5G, virtual collaboration might soon approach the same experience as in-person activities.

Identify areas where going wireless for broadband internet access might be a better alternative to current hard-wired deployments. This includes simplifying use, lowering costs or increasing flexibility.

Start identifying and creating 1.0 versions of new applications or digital processes that will benefit from improved connectivity with larger and a broader range of data sets that will either provide better results or a better experience.

Create more open and wide-ranging innovation plans. 5G offers more potential use cases than might be first realized. Focus on ideas and outcomes first, then consider which specific 5G options can be used to deliver them.

Look for a 5G partner that can deliver a cohesive set of products, services and support to assist you in creating an actionable plan. The innovative new use cases that MBB enables will have significant planning/design cycles, and a partner that helps you move quickly is important.

Look beyond just the network. To fully use and optimize 5G, it will be important to have complete infrastructure that includes edge support, network virtualization to support operations and integrations. Start planning/designing now.

What to expect

In the future, there are two important ways to consider what MBB can deliver. The first is to look at existing processes where adding better access, or the ability to use dramatically larger amounts of data, would enhance the process. The second is to consider brand-new use cases that make data collection and transfer possible regardless of location and without the need for a wire.

Organizations should expect that data fluidity, aggregation and ubiquity will become the norm. Tremendous innovation driven by data empowerment will become common. Firms that delay taking this step could be at substantial competitive disadvantage.

“5G MBB encompasses several well-known and innovative new use cases. In many ways, MBB will eventually provide capability that is comparable to wired broadband.”

5G executive update

5G today

5G in use

5G mobile broadband

5G and URLLC

5G and ultra-reliable low-latency
communications (URLLC)

5G M2M networks

What is 5G ultra-reliable low-latency communications?

URLLC is a 5G service that is optimized for mission-critical applications that need low latency and extremely reliable communications. Low latency is a metric concerning near-real-time responsiveness in communications between a user with their client device consuming an application resident on a physically separated server supporting the application. Use cases often involve the industrial internet, smart grids, remote surgery or intelligent transportation systems. Constant and reliable communications are central to making devices intelligent and interactive.

Why it's important:

- 5G URLLC using mmWave spectrum is expected to provide the speed and real-time communications necessary to power Industry 4.0 or other applications that demand real-time interaction between devices or between humans and devices.
- With 5G URLLC it should be possible to connect devices such as moving cars and other transportation that cannot be easily or effectively connected via hard-wired networks.
- 5G URLLC is expected to form the foundation for a huge range of entirely new and innovative applications or use cases. Many of these deployments are likely to begin with slower speed and less bandwidth than 5G eventually will deliver, adding more functionality in the future.
- 5G URLLC supports the interactivity and two-way communication that is the foundation for adding intelligence to an array of devices, systems and apps.

“URLLC is a 5G service that is optimized for mission-critical applications that need low latency and extremely reliable communications.”

Near-term use cases

Companies that decide to wait for mid- and high-band deployments before exploring what 5G can do for them could miss out on opportunities to implement near-term use cases that are not only compelling but also provide critical firsthand experience with 5G ahead of the pack. What those organizations learn now will help them optimize URLLC network use cases. A recent Deloitte study found that more than 90% of networking executives regard advanced wireless technology as “critical” or “very important” to business success.¹

Industry 4.0

Adding intelligence to manufacturing operations has been discussed for some time, but implementation was a problem without reliable connections. URLLC, with its planned enhancements of reliability and lowering of latency, is anticipated to be helpful in providing dependable connectivity.

Visual apps

Older wireless networks offer limited video support, but they cannot support the consistent video feeds and higher resolution necessary for next-generation solutions. The combination of resiliency and resolution makes it possible to use video in new and more compelling ways, such as real-time video interactions and more immersive or lifelike virtual interactions.

Autonomous devices

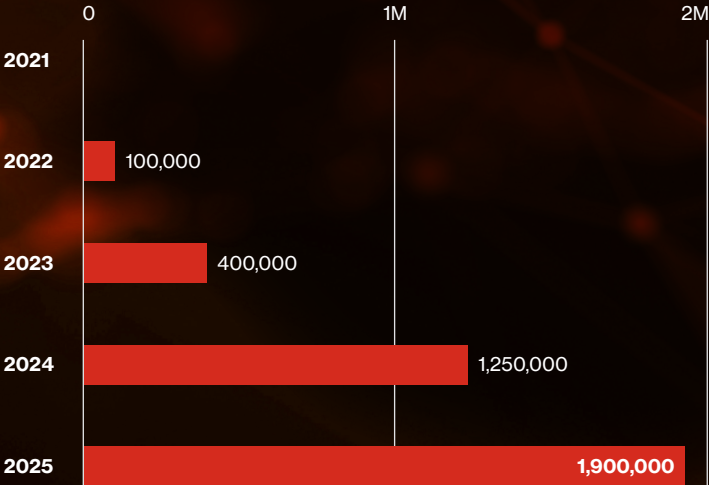
We are quickly approaching a new digital world where many devices are expected to become truly autonomous. Using 5G URLLC to provide two-way communication that connects devices to the environment is essential to autonomous activity. While full intelligence and autonomy are the goals, first-generation deployments will focus on creating pilot projects that will become more capable as 5G advances.

First-gen telemedicine

The demands on a limited number of specialists or specialized procedures had already made telemedicine an increasingly viable solution, but the pandemic has made its use commonplace. Further, connecting humans with medical devices could give healthcare systems the ability to provide better remote care. Another potential use case may be ambulance to ER (Amb2ER) communications.

URLLC device shipments

Source: Mobile Experts URLLC 2019



Planning for the connection of previously standalone equipment or devices should be one of the fastest ways to derive value from URLLC. Look for processes in the company that are not part of your digital infrastructure.

Look for partners that can help lead the way. Using 5G URLLC involves more than just connecting to the network; it will require edge infrastructure and integration services to bring ideas to life. Finding partners that can fill the holes in your internal skill sets is essential to progress.

Identify where enhanced or more effective video capabilities can drive innovation. With resilience and bandwidth, URLLC should enable a wide range of innovative use cases for enhanced and intelligent video, including collaboration, monitoring and more.

Determine where wireless will benefit your factory. With URLLC, it should be possible to connect factory resources with the consistency necessary to continuously enhance operations. Identify where connectivity brings the greatest returns.

Increase your ability to track processes. With 5G URLLC, it should be possible to implement more comprehensive and useful tracking of assets, parts or other aspects of the business. The ability to transmit accurate and up-to-date tracking information should enable improved business outcomes.

What to expect

As organizations move forward, the ability to use wireless networks with the same dependability and low latency that used to be possible only with wired networks should bring innovation to mobile devices/objects. It should also enable services that could not be easily tethered to a wired network or where a wired network was not a great option.

The starting point for many firms will be to look at unconnected devices, “things” or services that can now become interactive. A common approach is a phased implementation, where new functionality will be added in steps. However, starting now is very important, because the 1.0 versions of these innovative new capabilities will teach users much about 5G and make them more prepared to adopt the more advanced 5G capabilities when they become available.

“As organizations move forward, the ability to use wireless networks with the same dependability and low latency that used to be possible only with wired networks should bring innovation to mobile devices/objects.”

5G executive update

5G today

5G in use

5G mobile broadband

5G and URLLC

5G M2M networks

5G and massive machine-to-machine (M2M) communications

What is 5G massive M2M communications?

Machine-to-machine communication is direct communication between devices using 5G wireless networks. M2M communication can include industrial instrumentation, enabling a sensor or meter to communicate information, and output/status data from devices/sensors, allowing it to be routed to application software that can use it. M2M communication should dramatically improve the capabilities of the overall industrial ecosystem.

Why it's important:

- 5G can support the need for fast, low-latency and high-bandwidth communications between machines, sensors and devices.
- 5G should initially support a basic level of interaction and communication, but as it advances, it should support real-time interactions with large data flows.
- 5G can enable fully digital ecosystems for machines and devices, helping to bring new and innovative ideas to life, giving organizations the chance to deliver outcomes that will substantially change how some industries operate.
- The ability of wireless to interact effectively with mobile machines/devices or those in remote locations could be the foundation for an entirely new set of digital systems and processes.

“Machine-to-machine communication is direct communication between devices using 5G wireless networks. M2M communication can include industrial instrumentation, enabling a sensor or meter to communicate information.”

Near-term use cases

For many organizations, the gains from connecting machines and devices, even at lower speeds, are too great to be ignored.

Device telemetry

When data can be gathered from remote devices that are not hard-wired, businesses can build a more comprehensive view of operations. Data from device telemetry could be leveraged in many ways that are specific to the use case and to provide the foundation for operational analytics.

Health monitoring

The introduction of wearable devices ushered in the first generation of health monitoring, albeit in a basic fashion. It should now become possible to connect a much wider range of sensors that measure many different bodily functions with more depth and completeness. This increases the number of conditions that can be monitored and studied to help inform medical research and care protocols.

Smart spaces

Interconnection of sensors, cameras and other devices makes it possible to more completely understand what is going on in a physical environment and to react to incoming information to change the attributes of that environment. This could include lighting, temperature, changes to access or other aspects of the space. Analytics from this data could impact how physical spaces are designed in the future.

Industrial automation

This is one of the most well-known potential use cases for 5G M2M/massive IoT solutions. It should bring connectivity and data sharing to the factory floor. There may also be more activity focused on connectivity between the network and edge infrastructure close to the machines or devices. The concept of a fully digitally connected factory that can be viewed as a comprehensive ecosystem (Industry 4.0) may become a reality more quickly with 5G technology.

5G IoT endpoints

Source: McKinsey – “The 5G Era: New Horizons for Advanced Electronics and Industrial Companies”

Endpoint shipments by industry in millions

- Manufacturing, 2.3
- Supply chain, 1.0
- Construction, 0.8
- Agriculture, 0.3



Take action.

Identify where machines or sensors should be sharing status or activity information beyond their current use. Look for new 5G-enabled devices that may replace or be added onto existing equipment.

Develop plans for integration of machines and sensors into a cohesive digital ecosystem that can be used as the blueprint for linking them together using 5G M2M or massive IoT offerings.

Match the speed and capabilities of different 5G spectrum options to different internal use cases to create a prioritization schedule for which implementations should be started first and which will wait for the delivery of higher speed 5G functionality.

Identify where sensors or monitoring the activities of customers allows the organization to better serve them. This is not digital eavesdropping; rather, it is a focus on gathering more information that increases customer loyalty and simplifies interactions.

Analyze physical spaces, offices and facilities to determine whether they are candidates for upgrade to a smart space and how that might be implemented. The focus should be on what information would drive an improved human experience in that space.

What to expect

The ability to collect data, transmit it and integrate that information into a cohesive whole could fundamentally change how we interact with the physical world. There are multiple aspects that need to be evaluated. The first is the move to connecting machines and devices in real time so that they operate at human speed. The second is the need to design machine or sensor “arrays” that deliver a complete perspective. And the last is how to optimally connect all this data in a manner that provides an accurate and useful picture.

Acting on this data will likely require the use of AI or machine learning to process it as quickly as it is collected. The processing speed of many M2M or massive IoT deployments moves too quickly to allow time for human intervention.

“5G can enable fully digital ecosystems for machines and devices, helping to bring new and innovative ideas to life.”

1 “Enterprises building their future with 5G and Wi-Fi 6: Deloitte’s Study of Advanced Wireless Adoption,” Deloitte Insights, June 1, 2020. 2 “Exploring the Future of 5G and Journalism,” NYT Open, April 11, 2019. 3 “Augmented Reality: David Bowie in Three Dimensions,” *The New York Times*, March 2018. 4 “Verizon 5G Ultra Wideband Service Live in 13 NFL Stadiums,” NFL Communications, September 5, 2019, and “Verizon’s Super Bowl LIV Demo Made Me a 5G Believer,” Digital Trends, February 1, 2020.