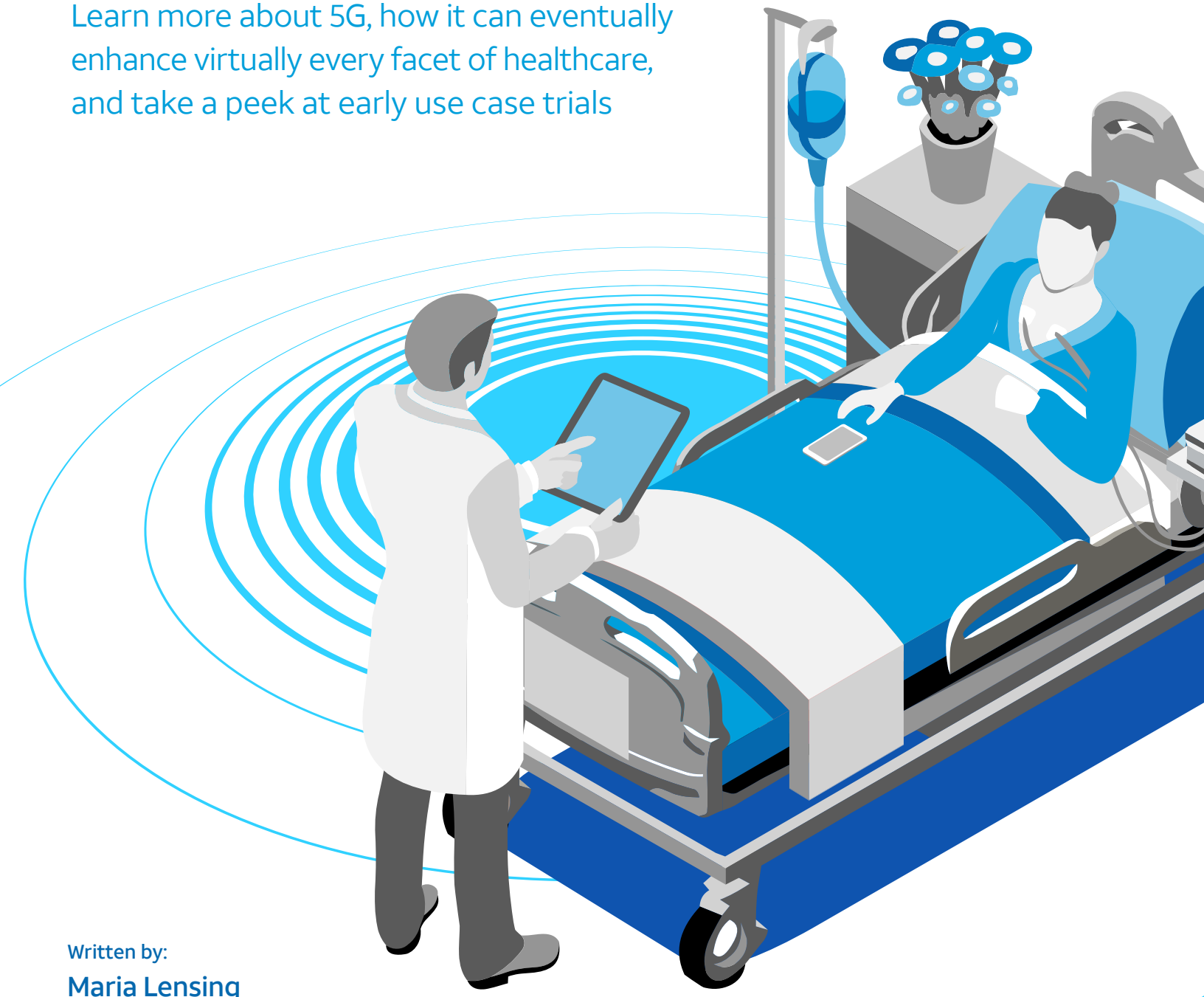
Revolutionizing healthcare with 5G

AT&T Business

Learn more about 5G, how it can eventually enhance virtually every facet of healthcare, and take a peek at early use case trials



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We've all heard about the First Industrial Revolution, the period from 1760 to around 1820. Steam power triggered innovation and efficiency in manufacturing that rapidly modernized Europe and the United States. It meant a huge shift from hand-production methods to machines. Then we got the Second Industrial Revolution right around the time the Civil War started. Electricity was the catalyst, ushering in industrial productivity on scales never before seen.

Similarly, I believe that 5G technology is our modern day catalyst to usher us into a new Digital Revolution—especially in healthcare.

We currently enjoy the fruits of a robust wireline and cellular infrastructure that has spurred the growth of many different technologies and applications. We have seen the rise of an ecosystem of services and products aimed to change the customer experience. You can think of this as our steam-powered era; 5G will be our electricity. It will spark digital transformation at new scales.

Dramatically altering the patient experience

Some hear "5G" and just think it means faster connection speeds. However, it goes well beyond that. As it matures, 5G is expected to alter the very DNA of our user experience in dramatic, exciting ways.

For example, in a 4G experience you get to the door, look at your weather app, and decide whether or not to grab your umbrella. In a future 5G world, you get to the door and the umbrella—which is connected via the Internet of Things (IoT)—will ping you to let you know that even though it's not raining now, you should bring it since you've got an appointment across town at 1:00 p.m., and it's likely to be raining in the area at that time.

In healthcare, we have already started our own digital revolution with the move to electronic records. As we push care beyond hospital walls, we are looking to help develop the new use cases that will take advantage of bringing healthcare solutions to the customers and patients, wherever they may be. Technology, particularly wireless connectivity, can help address the needs in the healthcare market as well as close the gaps between caregivers and patients.

Accelerating the genesis of a 5G world

There are several factors pushing us toward a full 5G world:

1. The need for network technologies to work in harmony

With the tides of data continuing to rise, businesses must transform through virtualization and automation to enhance the cost and scale of the experiences they want to create. Businesses must also manage mobile devices, apps, and a variety of voice and collaboration tools so their teams can connect across geography, platforms, and devices.

All these separate networks, solutions, and connections create potential chaos and gaps. They often lack interoperability—or at best have spotty, hard-to-set-up interoperability. It's a bit like the frayed end of a rope, with individual fibers unbound and sprouting in different directions. That end of the rope is weaker. Developing the technology that has the capability to allow the convergence of wireline and wireless networking is like taking the frayed end of the rope and weaving it back into a unified whole.

From the core of their network all the way to the far reaches of their digital technologies, healthcare organizations want an entire tech ecosystem that integrates all these services, solutions, and products seamlessly, so they work in concert. And they want more control, visibility, and personalization.

2. The cybersecurity arms race between businesses and digital criminals

Edge clouds and Internet of Things (IoT) devices have multiplied at an exponential rate. While they represent new capabilities and services, they also represent a mind-boggling number of new endpoints and threat planes. These can be doors into the network for hackers to your data and assets.

As 5G technologies merge and codify, we have indications that 5G will have some cool and effective features, like common authentication between different access networks, new security key concepts, edge proxies, and more.

3. Unleashing the full potential of emerging experiences

The following technologies are already in various stages of commercialization: augmented reality and virtual reality (AR/VR), artificial intelligence and machine learning (AI/ML), autonomous vehicles, and drones. However, being able to use these tools in a distributed, highly dynamic, and mobile way has its challenges. There are some things not yet possible with our current network bandwidth, latency, and compute power.

For example, let's look at VR. The goal of the medium is true immersion—creating an illusion so real that it tricks the human brain completely. For users to get the best experience from their VR headsets and apps they need an extremely low motion-to-photon ratio—that's the time it takes for the data to respond to your movements and reconfigure the VR image.

When you move your head, the VR display should instantaneously reflect it in your virtual world. The greater the delay between your movement and what you see, the more "off" your virtual world appears. If it gets too jittery, it can make you feel seasick since your brain sees one type of motion, but your inner ear feels another reality. The dissonance between the two is annoying at best and sickness-inducing at worst.

To give you sense of scale, the typical refresh speeds for a computer screen are approximately 80ms. However, for AR/VR, the industry is driving the conversation toward the Vestibulo-Ocular Reflex (VOR)—the neurological process by which the brain coordinates eye and head movements to stabilize images on the retina. This is critical to synchronizing virtual and real objects to create a coherent view. The entire VOR process takes the brain 7ms, a more than 10x reduction over screen-to-brain propagation.[1]

Today's VR systems recommend a latency of <20ms for standard performance, and very low latency (<7ms) is even better. For this reason, developers and inventors want even lower latency to realize what they envision for the next iterations of VR.

While some level of AR/VR is here today, in most cases it's localized content, and to do a distributed and dynamic push of content based on analytics, it's imperative that latency is as low as possible.

How will 5G help with these key trends and use cases?

Let's start by discussing what 5G really is.

There are 4 key characteristics about 5G that will change the DNA of the user experience. To explain it, let's use an example. Let's say that you live in the suburbs and that you are 20 miles away from your office. Ten years ago, the commute wasn't so bad, but now it's congested and slow. How do you improve your commuting experience?

Capacity. You can make the interstate wider, adding more lanes from one end of the commute to the other, so you can accommodate more traffic.

Speed. You can raise the speed limit and get faster cars on the routes.

Proximity. You can move closer to the office, so essentially you live on the edge of your office's property. Because while speed is important, if you only live 3 blocks away and ride a scooter, you'll get there in less time than if you bought a Ferrari and zoomed down an uncongested interstate at 190 mph for 20 miles. But one downside is the cost of real estate: You may not be able to afford as many square feet of living space near the office as opposed to the suburbs, but your commute experience is better.

Traffic management. You could create HOV (high occupancy vehicle) lanes on the interstate and put programmable lanes on the surface streets around the interstate. HOV lanes create priority lanes with less traffic for certain types of vehicles. And programmable lanes, often seen around sports stadiums, route traffic based on current congestion information. You improve how the road treats you—not how you treat the road.

Now let's translate the analogy.

Capacity is bandwidth. 5G will ultimately not only support a better experience per device, but also for more attached devices, such as AR goggles, machines, sensors, and drones. 5G will and its architecture will theoretically be like adding many more lanes to a 4-lane interstate.

Speed is how fast the data can travel. As 5G evolves, a 5G network will be like giving each car an engine with incredible top speeds and then raising the speed limit to allow for ultra-rapid transit time.

Proximity is the power of the edge. The 5G network (core and RAN) is designed from the get-go to be flexible and better suited for edge deployment. It brings compute resources and services closer to your work and home. Services that currently reside in a central cloud outside the mobile network can be pushed to the edge so they're closer to the doorstep of the devices. It will improve overall experience, end-to-end latency—not just network latency.

Traffic management is, as the name implies, how you manage data traffic across hyper-busy networks so it travels with reliability. Network slicing lets network operators open dedicated virtual networks over a common network infrastructure to provide functionality specific to the service or customer. It's like opening HOV lanes on the wireless network. Today we have a better Class of Service (CoS) app that can re-route traffic around jams or accidents on your route, but tomorrow virtual networks can be created on the mobile network that could essentially help the mobile network be MPLS-like.

5G is more than just speed. It is a conglomeration of technologies that will elevate and enrich the user experience from end to end.

The 5G revolution will ultimately bring:

How do we bridge the gap between today and the future of a 5G world?

You can think of this as happening in 3 steps:

1. Lay the foundation for 5G

The more you can virtualize your network through software-defined networking (SDN) and network function virtualization (NFV) the readier you will be to add the features and upgrades made possible by 5G. When the network has more variables, you will be able to adjust quickly and efficiently on the fly thanks to software.

2. Build cloud competence

Be clear of where your organization is when it comes to colocation, cloud networking, content delivery, cloud disaster recovery, and virtual data centers.

3. Invest in cybersecurity

Does your security plan and its capabilities cover your network from one edge to the other? Can you manage threats through strong threat intelligence? Do you have in place security for data and apps, the network and the cloud, mobile endpoints and devices, and IoT?

What does this mean for healthcare?

5G is only going to accelerate the transformation we're already seeing in the healthcare space. Healthcare providers will be building an entire ecosystem that creates highly responsive, effective, patient-centric experiences. Pretty transformative, right? To truly understand the potential impact, we wanted to make sure we were developing and testing use cases in real healthcare settings, so let's talk about our real-life healthcare trials and what we are learning from them.

Rush University System for Health

We signed a trial agreement with this major healthcare system in Chicago to bring the first standards-based, 5G-enabled hospital to the U.S. The vision was to create the Hospital of the Future—and the work is already underway. 5G using millimeter wave spectrum ("5G+") is being utilized in parts of the hospital during the testing of various use cases to determine how its ultra-fast speeds and lower latency can bring to life the smart hospital. These initial use cases are:

Quickly transmitting large imaging files – MRIs downloaded within seconds

Imagine if transferring large files could be in near-real time to the appropriate clinicians to enhance patient outcomes? Adding high-speed 5G+ to existing network architectures can help quickly and reliably transport huge data files of medical imagery, which can improve both access to care and the quality of care.

Expanding telemedicine – virtual visits with top doctors

Telemedicine requires a network that can support near-real-time, high-quality video, which often means wired networks. With 5G, healthcare systems can eventually enable mobile networks to handle high-quality telemedicine appointments, which can greatly increase the reach of the program. In addition, wearables or other connected devices that are sending key healthcare information—like biometrics—to the physician's medical platform can benefit from 5G and enhance the patient experience.

VITAS Healthcare

AT&T is collaborating with VITAS® Healthcare to study the effects of eventual 5G-enabled spatial computing on patient engagement. The goal is to help reduce pain and anxiety for terminally ill patients in hospice by providing calming, distracting content via 5G-enabled AR and VR.

Improving AR/VR and spatial computing

Among 5G's many ultimate potential applications, some of the most exciting involve its role in simulating complex medical scenarios and enabling alternative treatments for the critically ill. The potential use cases range from medical training to remote surgeries to pain management. In the use case at VITAS, AT&T will provide necessary wireless services, video content, and Magic Leap 1 Lightwear headsets for the duration of the trial. The trial study will include field study to determine how the network behaves in a real-world environment at patient sites. The average file size for a 1-min VR video is about 1 gigabyte. Results have been promising so far.

And there are many more use cases we are starting to trial:

Highly reliable, near-real-time remote monitoring and wearables

By using IoT devices, healthcare providers can monitor patients and gather data that can be used to improve personalized and preventive care. With the lower latency and fast speeds of 5G, healthcare systems can offer remote monitoring for more patients. Providers can then be more confident that they will receive the data they need in near-real time and can provide the care their patients need and expect.

Assisted robotics surgery

Imagine a robot platform that could allow doctors to perform many types of complex procedures with more precision, flexibility, and control than is possible with conventional techniques. Robotic surgery is usually associated with minimally invasive surgery, procedures performed through tiny incisions. This is different because there are fewer complications, less pain and blood loss, quicker recovery, and less noticeable scars.

What makes this 5G? To be effective, robots need to be able to learn and adapt on the fly. Robots will be enabled by the cloud. Pushing AI, edge computing, object recognition, and other intelligence to mobile clouds coupled with the lower latency, increased reliability, and fast speeds of 5G is key to creating the optimal experience and lowering robotic costs. For example, the Mayo Clinic is currently running a randomized controlled trial (RCT) from 2018–2022 comparing robotically assisted vs. manually executed total knee arthroplasties.[2]

AI

Healthcare functions are using AI to determine potential diagnoses and decide on the best treatment plan for a specific patient. Additionally, AI can help predict which patients are more likely to have post-operative complications, allowing healthcare systems to provide early interventions when necessary. The large amounts of data needed for near-real-time, rapid learning require ultra-reliable, high-bandwidth networks. Additionally, providers often need to access data from their mobile devices. By enabling all these technologies through 5G+ networks, healthcare systems can help improve the quality of care and patient experience, reduce the cost of care, and more.

Conclusion

Healthcare, and businesses in general, are undergoing a major digital transformation that is being fueled by technology innovations. We like to think of 5G as the fuel to help accelerate this digital transformation. It truly is a network built with the business user in mind. It's not just hype; it eventually will be a real game changer in the scale in which we can transform lives. In healthcare, this is particularly important. Working together, we need to continue developing use cases to understand and learn what 5G can do to help them improve patient outcomes, and to help them plan and prepare for the changes that are bound to come with this latest transformation.

About the author

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Maria is passionate about women in STEM, female technology leaders and Hispanic business leadership. She has received many awards including Top 12 Latina Corporate Executive of the year in 2018 by Latina Style, Inc. She was honored with the 2015 Diversity and Inclusion Champion award from AT&T. Maria has been published by the *Huffington Post.*

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