

5G IS A CORNERSTONE TECHNOLOGY OF THE FOURTH INDUSTRIAL REVOLUTION

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Last year, during the first year of 5G's rollout, I wrote that 5G was going to be a lot bigger [1] than you actually think. As a trade association representing the voice of LTE and 5G throughout the Americas, 5G Americas is of course biased toward thinking the technology is incredibly important, but there are some clear reasons to consider the historical significance of 5G. Let's take a look at why I think 5G is a cornerstone of the Fourth Industrial Revolution.

The fifth generation of wireless cellular, or "5G", is the epitome of the evolving state of technology in wireless telecom today. 1G was introduced in 1979 and was the first time that communications could occur over wireless telephony. 2G, introduced in 1991, was the first time the industry used digital signals. In 1998, 3G emerged and opened the door to data being transferred on mobile phones. 4G continued this high speed data communications trend in mobile devices and brought high quality video to the mobile Internet age beginning in 2008. At the end of 2018, the current era of 5G began, ushering in the capabilities of wireless cellular for the Fourth Industrial Revolution.

We are still in the early days of 5G's rollout. While there are 129 5G networks globally [2], as of the end of October 2020, consumers are really only beginning to take their first steps with a new handset or 5G device. Many of 5G's capabilities, such as "network slicing" or ultra-reliable low-latency communications, are still in various early stages of being implemented, as 5G standalone networks get deployed. As many of these new technological capabilities reach maturity, you will begin to see a convergence of technologies that will make up one of the fundamental shifts in the history of industry.

What do I mean by that?

Let's take a look at that term: "Fourth Industrial Revolution" — what does it refer to? The First Industrial Revolution included the development of water and steam to mechanize production. The Second Revolution included electric power to open the door to mass production. The third involved electronics and information technology. That is the revolution that we are currently undergoing, so it is sometimes difficult to fully see all of its impacts. In the Fourth Industrial Revolution [3], physical, digital and biological systems will converge, enabled by the power of technologies such as artificial intelligence and machine learning, cloud computing, edge computing, robotics, virtual and augmented reality, automated vehicles and drones, blockchain, IoT, "in silico" technologies merging biology and data science, and of course, 5G to connect the real world with the digital world.

When you think about the impacts of any one of these technologies, it is staggering. AI alone has ripple effects across virtually every facet of life. The combination of all these things together? Profound, and 5G is right at the center of it all.

For instance, manufacturing is a huge vertical industry for 5G applications. There is intense demand to manage real-time, automated factory operations that require precise orchestration. Imagine the future factory with automated drones, robots, and vehicles moving around and in-and-out of the facility, all sending and receiving data wirelessly. This type of automation requires not just ultra-reliable low latency capabilities, but also the ability to manage up to one million devices per square kilometer for some enterprise-size plants. It is something that 5G is designed to address. According to Research and Markets, manufacturing is the fastest growing 5G market [4] with a CAGR of 134.54 percent between 2020 and 2028. It is expected that the smart manufacturing market will hit \$40 billion in 2026 with over 75 billion installed IoT devices by 2025, creating up to \$2.7 trillion

in economic impact annually for factories.

Let's take a look at healthcare, which is an enormous market for 5G services that could cover wearable devices for remote monitoring and biometrics, robotic surgery, or even 5G-connected ambulances with access to patient files, video conference capabilities with the emergency room, or wireless augmented reality connections. In the United States alone, the revenue opportunity is \$76 billion in 2026 for healthcare transformation for 5G, according to Ericsson [5].

Of course, it is not all ponies and rainbows. To reach its full potential, 5G requires an immense amount of work from hundreds of thousands, if not millions, of people around the world. 5G, like the legacy wireless generations before it, faces challenges to ensure its success. In the face of the global COVID-19 pandemic, some work on international standards has been delayed due to the lack of face-to-face meetings. 3GPP Release 17 dates, in particular, may slide back the adoption of specific features late into 2021 or 2022.

One area of challenge is ensuring that enough licensed internationally harmonized spectrum is available. In particular, mid-band spectrum (between 2GHz and 6GHz) offers the most opportunities as it hits a sweet spot of offering coverage and capacity. The United States is a leader in 5G in terms of deployments, connections and allocation of high band mmWave spectrum. However, we have a challenge in the mid-band spectrum area. In the United States, the various federal agencies continue to work hard to make enough mid-band spectrum available to support a flourishing 5G wireless industry ecosystem of new services and applications. 5G Americas has advocated [6] for several years to raise awareness about the need for more mid-band spectrum and will continue to do so.

Another area is densification of the network. 5G offers the ability to access spectrum for wireless communications that have never before been used for mobile wireless communications. However, millimeter wave bands do not propagate as far over long distances and suffer more signal attenuation compared to lower band spectrum. Therefore, more small cells are required to ensure enough coverage. This densification of cell sites also requires densification of fiber or spectrum for backhaul, as well as power. Fortunately, the United States has moved on the regulatory front with the Small Cell Order and the 5G Wireless Infrastructure Fast Plan to move the industry forward. Many states in the U.S. have also provided legislative guidelines to streamline the processes for cell siting.

All told, we are still early in this ball game, as we outline in our 2020 white paper [7] about this 5G transformational technology. But as enterprises and nations continue their journey into the 5G era, it is important to factor this technology into the digital transformation of your organization. Just like people at the dawn of the age of electricity, nobody knew what could be accomplished by the adoption of such technology. It was not until the explosion of modern day electrical appliances were people made fully aware of its impacts. So too it is with 5G. Who knows what the future holds?

So as I said last year about 5G and its impacts on the way we live, work and play, I continue to believe that 5G will be bigger than you think!

REFERENCES

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BIOGRAPHIES

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