THE ERA OF 5G: WHAT IT HERALDS FOR ENTERPRISES AND CONSUMERS

Abstract

5G is the next generation of wireless technology that is poised to transform multiple areas – industrial operations, transportation, healthcare, consumer experience and more. 5G goes well beyond the higher bandwidth play and is being actively explored by enterprises and industries. This Point of View elucidates the key features of 5G and its inter-play with other key technology areas. It also explores leading industry use cases of 5G and looks at what consumers can expect.

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5G is the fifth generation of wireless networks, an organic evolution from 4G through 4G LTE. However, 5G goes far beyond just higher network capacity and faster downloads, and has transformational potential in multiple spaces for enterprises, communities and consumers alike. Globally, telecom companies, governments and industry segments have started investing in and actively exploring the technology by setting up 5G networks, conducting field trials and building out potential use cases. 5G is also reshaping the landscape of some of the leading technology trends such as virtual reality, cloud, autonomous systems and the IoT, creating new possibilities and newer opportunities.

The Promise of 5G

5G has been designed to achieve not only data speeds that are faster by a factor of ten than 4G, but also a dramatic decrease in latency, higher reliability, increased device efficiency and greater network efficiency. This, in turn, helps realize many industry or consumer scenarios, that were so far beyond the realm of reality, opening up exciting opportunities.

Speed and Network Capacity

5G is designed to use higher frequency bands from 30 to 300 GHz which provide higher capacity, greater scalability and better quality as interference is lesser. Data speed in 5G is expected to be about 10 Gbps, which has the potential to revolutionize mobile content and rich immersive user experience.

High Reliability

The high band spectrum that 5G is designed to operate in is also called the millimeter wave (mmwave) band, as the wavelengths are in millimeters. Since antenna size is inversely proportional to the spectrum frequency it is built for, far more antennas can be fit into the same device or base station. Using multiple antennas to break down and transmit a single stream of information intelligently, a technique known as Multiple Input Multiple Output (MIMO), has the effect of greatly increasing reliability and throughput. Due to the large number of antennas, this effect is compounded (Massive MIMO) with 5G and when combined with techniques such as beam forming, results in very high reliability.

Low Network Latency

Evolution in multiplexing technologies to minimize frame sizes and pack in more information in frames, enable significantly lower latencies and better usage of the available spectrum. The use of mobile edge computing for localized processing is also a key factor in enabling low latency.

High reliability and ultra-low latency capabilities enable mission critical applications, such as autonomous vehicles, remote healthcare, robotic systems, real time monitoring and control systems and intelligent transportation, to be brought much closer to reality.

Network Slicing

5G brings to life the concept of network slicing, where network resources are allocated in slices in accordance with specific network utilization requirements, enabled by Software Defined Networking (SDN) and Network Function Virtualization (NFV). This results in more efficient provisioning of network resources and better usage of network capacity. This benefits enterprise and retail customers who can now get customized services with better quality of service.

Increased Device Efficiency

The high reliability and low latency features of 5G will enable much of the processing to be moved from handset to the edge cloud. This extends battery life and device efficiency, and the device is no more a bottleneck in critical scenarios such as autonomous vehicles.

Higher frequencies of 5G network operation also means antennas can be significantly smaller; allowing for smaller, low-power devices with longer battery lives.

Massive IoT

By decreasing the signaling information for IoT devices and reducing interference, 5G enables scalability and greater IoT connection density. With simplification of the signal processing overhead, 5G pushes up energy efficiency of sensors, enabling longer life for sensors. The smaller antennas also enable smaller, lower cost devices. This hugely benefits scenarios that require large numbers of sensors such as smart farming, smart cities, industrial monitoring and maintenance, and smart wearables.

Impact on Emerging Technologies

While 5G ushers in new concepts such as network slicing and edge cloud, it also opens up newer possibilities for use of other technologies and emerging areas such as virtual reality, cloud, IoT, edge computing and mobility enabling greater realization of their potential.

Virtual/Augmented Reality & Immersive Experiences

High network capacity and low latency of 5G make streaming of data-intensive, rich experiences such as watching a match in virtual reality, whether live or through OTT streaming, a real possibility. It also opens up the potential for more immersive collaboration and learning experiences such as a virtual office meeting room or a virtual classroom, where remote participants gather in immersive environments to interact in real time. Enterprises will also be able to explore providing immersive, personalized interactions to their customers to substitute in-person meetings.

A challenge in VR environments today that restricts extensive usage is VR motion sickness. One factor that contributes to this is the delay in tracking the user's physical movements in the virtual world caused by lower bandwidth and latency issues. 5G can help improve the situation with high bandwidth and low latencies, reducing the reasons behind motion sickness in virtual reality environments. This also contributes to increasing acceptability of VR as a viewing medium.

The improved support for more immersive entertainment will also spur demand for media companies and content creators to create more virtual content and in turn, the demand for more and better XR devices.
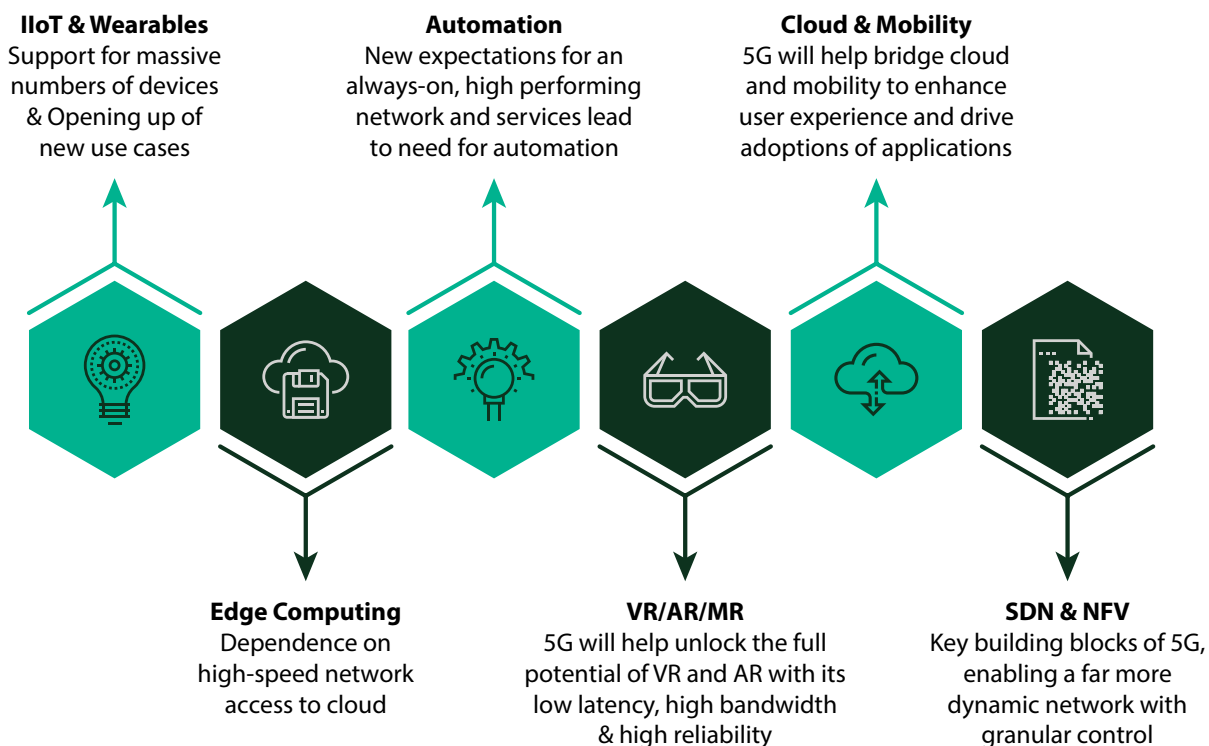
Cloud, Edge & Mobility

5G and Cloud technologies enjoy a symbiotic relationship feeding off each other to create a host of expanded possibilities and solutions. 5G architecture helps bring mobile edge computing or multi-access computing closer to reality. This enables the central cloud to give way to a network of distributed edge clouds that bring computing to the network edge, closer to the consumer and other applications. The edge cloud in turn helps 5G edge closer to its ultra-low latency promise.

Computing-intensive processes such as dynamic video analytics for surveillance, or algorithms running on time-critical data to control a self-driving car, can all be run on the edge cloud.

5G can also help mobile devices offload a bulk of their processing to the mobile edge cloud. This will serve to increase battery life of devices and potentially lead to smaller devices that are more affordable and easier to carry.

IIoT & Wearables
Support for massive numbers of devices & Opening up of new use cases

Automation
New expectations for an always-on, high performing network and services lead to need for automation

Cloud & Mobility
5G will help bridge cloud and mobility to enhance user experience and drive adoptions of applications

Edge Computing
Dependence on high-speed network access to cloud

VR/AR/MR
5G will help unlock the full potential of VR and AR with its low latency, high bandwidth & high reliability

SDN & NFV
Key building blocks of 5G, enabling a far more dynamic network with granular control

IoT & Digital Twins

5G lays out the ground work to unleash the potential of IoT, enabling the infrastructure to accommodate a hundred times more number of devices than what is currently possible. Gartner predicts that there will be over 20 billion connected devices in the world by 2020, and this number will only keep growing.

At the same time, 5G is expected to drastically reduce network power usage leading to longer battery life for low power devices. Asset tracking, cold chain monitoring, smart farming, smart buildings, connected vehicles, all move closer to reality with 5G.

Digital Twin technology, a rising concept particularly in Industrial IoT, also gets a big fillip with 5G's support for IoT. Support for more devices with low latency and high reliability helps create much richer digital twins, and potential for much better monitoring and control of remote assets and devices.

Autonomous Systems

5G can also give a big boost to autonomous systems, self-driving vehicles and connected transport systems. With the massive IoT support and ultra- low latency of 5G, vehicles can transmit more telemetry information faster to the edge cloud for processing. They can also access the decisions made by dynamically learning models and respond to instructions much faster. The ubiquitous, low latency connectivity will also help in better V2X or vehicle-to-everything interconnectivity where vehicles communicate with other vehicles, traffic infrastructure, devices and so on to enable a smoother and safer transport experience.

Similarly, autonomous agents and systems on the manufacturing floor can communicate and coordinate with each other faster and better to make dynamic decisions in real time that improves safety, efficiency and productivity.
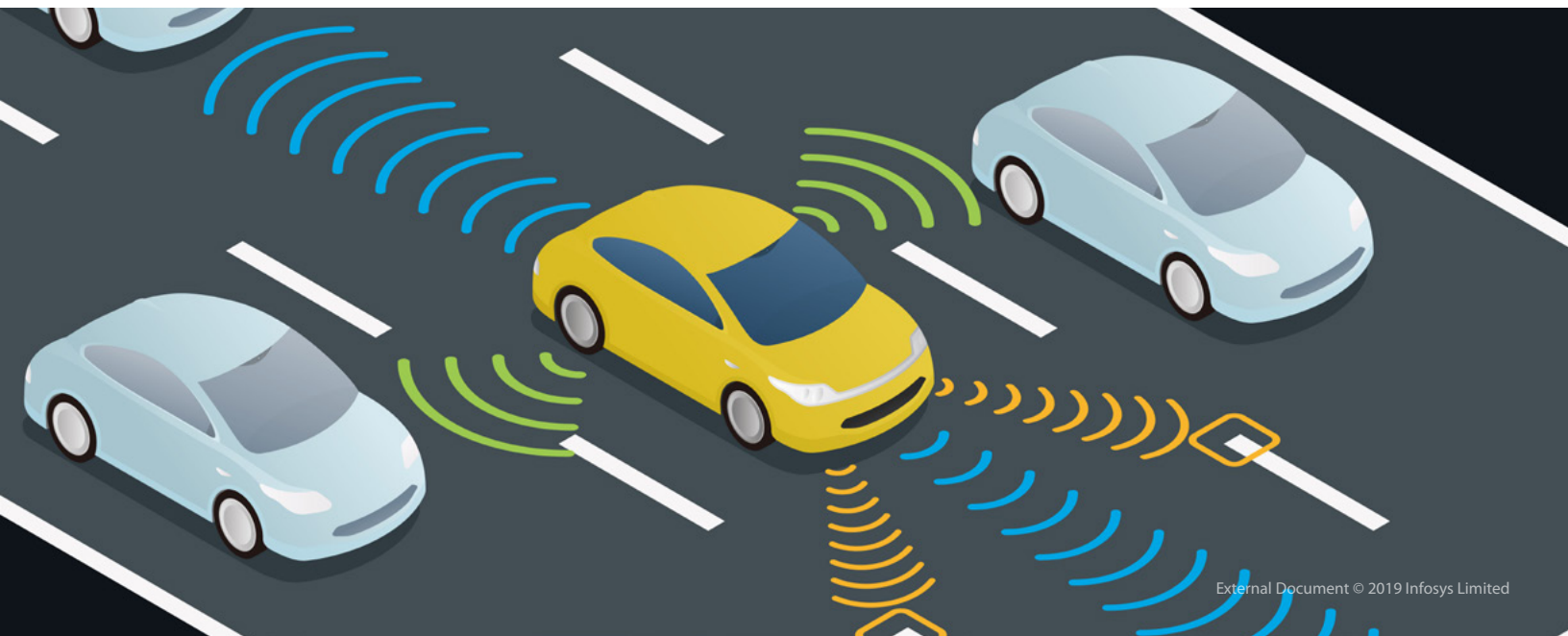
Leading Industry Use Cases

5G favorably impacts many industry spaces and helps realize greater potential.

Industry 4.0: Industrial IoT & Robotics

5G enables the next generation of industry in multiple ways.

The ability to support a larger number of sensors in a smaller area, and use low power sensors with improved battery life makes capturing more, finer level of information about the system possible. Combined with low latency, this data helps make Digital Twins of the system or assets richer and more real-time, enabling finer levels of monitoring and control. Throw in real time analytics and AI on the edge cloud, you have the ability to better support industrial robots and autonomous agents on the assembly floor. These can orchestrate greater efficiency & productivity while actively preventing failures and incidents in real time.

Another important way that 5G contributes is by enabling AR/VR for activities like real time monitoring and control of remote or hazardous assets, experiential learning and remote maintenance or remote assistance.

For example, 5G will be of great use in the operation and maintenance of remote mines through AR/VR.

Healthcare

5G's support for massive IoT, low latency and high reliability will greatly benefit the healthcare space, resulting in a proliferation of IoT enabled devices, sensors and wearables, enabling better patient monitoring and preventive care. This also enables greater reach and quality of remote healthcare through virtual patient-doctor interactions, and makes remote surgeries and procedures a distinct possibility.

5G also makes possible the use of small, low-power implantable devices. Researchers at the University of Madison in Wisconsin have developed stretchable circuitry, almost a "skin" of integrated circuits, that allows remote patient monitoring with ease and comfort.

Media and Entertainment

With rising expectations from consumers and stiff competition from OTT providers, media industry is on the threshold of a transformation, and 5G could change

the game. With high bandwidth and low latency, 5G can provide a much better user experience for streaming 4K or even 8K content on TVs and smart phones. But the real change will come from the ability to support rich immersive media such as AR/VR and online gaming. 5G will make possible live streaming of matches or event in VR with 360-degree content, enjoy immersive vacations to exotic places or experience amazing adventures in the comfort of one's home.

Automotive

5G helps accelerate capabilities in connected cars with a larger network of sensors and monitoring devices. It helps enable safety features like automatic collision avoidance and emergency braking, and dynamic routing and navigation based on real time traffic information. Dynamic monitoring of vehicle condition with real time analytics helps with quick identification of potential issues leading to a safer, trouble free riding experience. In-transit experience can also be enhanced with the delivery of personalized services & content.

What Can Consumers Expect

The biggest benefit of 5G that consumers are eagerly waiting for is quite obviously the enablement of higher bandwidth on the go. While this is certain to happen, it will be a few years till 5G becomes truly ubiquitous and most smartphones become truly 5G enabled. Readiness will also depend on the extent of local government support in putting in place key aspects such as regulation, support for infrastructure and spectrum allocation that are necessary before 5G can be made commercially available. Till then, 5G can be experienced in identified pockets or zones where it is set up for live testing by telecom companies or governments.

However, consumers will start to see some shifts in their end-user experience as enterprises move to embrace 5G.

Wearables

- Wearables are likely to get a new lease of life as 5G supports a large number of low-power sensors and devices.

- There will be a spurt in wearables related to healthcare as they become smaller and easier to integrate into common accessories. Apps to track & monitor the data and provide real-time recommendations and actions from healthcare professionals will become much more common.

Immersive VR Experiences

- As competition intensifies in the media industry and 5G provides a new playing field, consumers will see more immersive experience content becoming available for live streaming.

- This will spur demand for better viewing devices and accelerate developments in VR headsets and the immersive devices space resulting in more comfortable and affordable VR kits.

- On the other hand, telecom providers are already working with large sports leagues to provide fans immersive live-viewing experience of matches along with other immersive experiences such as learning or playing the game in VR

Gaming

- Big players such as Google are looking to revolutionize gaming with cloud gaming platforms, and 5G will be a key enabler in realizing this. This will make anywhere anytime gaming with high fidelity and low latency possible.

- 5G will help in analyzing trends in real time, with continuous learning and AI to bring in dynamic changes that will keep the freshness and relevance of games and avoid monotony.

Battery Life

- As 5G comes into use, its low power features will improve device battery life while reducing the heating up of the device even during intensive use such as gaming or streaming of high-resolution content.

- This can also result in better utilization of lower end devices, or new devices that are more compact and affordable.

In summary, 5G is much more than just higher bandwidth. With features like low latency, ultra-high reliability, low power and massive IoT support, it has a role to play, and the potential to accelerate change, in multiple industries, transforming consumer experience on many fronts. How quickly these unfold, remains to be seen.

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About the Author

Ananthalakshmi V Vallapuzha is a Principal Product Architect with the Center for Emerging Technology Solutions at Infosys, Bangalore. Technologist, thought leader and evangelist, she has been driving solution development, client offerings, partnerships and ecosystem building in emerging tech areas including 5G, blockchain, AR/VR and Digital twins. She has several years of experience architecting software applications & solutions for large global clients across industry domains such as retail, transportation, logistics and process outsourcing.

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