

## 5G for Business

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**Abstract:** 5G stands for fifth generation of cellular networking, surpassing 4G LTE. It is expected to change the way we live and work. 5G technology is developing rapidly to enable the next generation of wireless communications and paving the way for more than just super-fast data transfer. 5G wireless technology will usher in an era of gigabit speeds for everyone, reducing latency to customers and organizations. The advent of 5G technology will not only transform our devices but will also significantly change the way businesses operate, communicate, connect, and share data. 5G is expected to be a game-changer to the business world. This article deals with how 5G technology works and how it is applied in business.

**Keywords:** business, 5G wireless technology, 5G for business.

## INTRODUCTION

Businesses have grown more productive in the centuries since the first Industrial Revolution. Digital transformation is currently driving the Fourth Industrial Revolution. 5G networks constitute important elements in the journey toward digital transformation.

They are changing the way we do business. Expected benefits include increased speed, new bandwidth, reduced latency, and the ability to support more users, services, and devices.

5G is the newest generation in wireless networking, with greater capacity and higher speed. It will integrate with infrastructure, buildings, and appliances, creating an Internet of things (IoT). The key features of 5G include high throughput, improved spectrum efficiency, reduced latency, better mobility support, and high connection density. It supports interactive multimedia, voice, video, Internet, and other broadband services. To support increased throughput requirements of 5G, new spectrum has been assigned to 5G in mmWave bands. 5G will use Multiple Input Multiple Output (MIMO) to significantly increase network capacity [1,2].

## OVERVIEW ON 5G NETWORK

5G is the next-generation wireless cellular technology that will provide faster and more reliable communication with low latency. Evolution from 1G to 5G is depicted in Figure 1 [3]. As any other cellular network, 5G networks will consist of cells divided into sectors and send data through radio waves. Each cell is connected to a network backbone through a wired or wireless connection. 5G may transmit data over the unlicensed frequencies currently used for Wi-Fi. It promises a smarter, faster, and efficient network. The goal of 5G is to have far higher speeds available, at higher capacity per sector, and at far lower latency than 4G. In

order to increase network efficiency, the cell is subdivided into micro and pico cells [4]. 5G will be a new mobile revolution as it is expected to provide gigabit-per-second data rates anytime, anywhere.

In a 5G wireless network, every mobile phone will have an IPv6 address depending on the location and network being used. 5G utilizes user-centric network concept World Wide Wireless Web (WWW) instead of operator-centric as in 3G or service-centric as in 4G [5]. WWW will be capable of supporting applications and services and interconnected the whole world. 5G includes the latest technologies such cognitive radio, Internet of things, nanotechnology, and cloud computing.

5G technology has the following advanced features [6]:

- Architecture will be device-centric, distributed, programmable, and cloud-based
- High data rates
- One to 10 Gbps connections to end points
- One millisecond end-to-end round trip delay
- Low battery consumption
- Better connectivity irrespective of location
- Larger number of supporting devices
- Lower cost of infrastructure development

Some of these features are illustrated in Figure 2 [7]. The development of 5G will not be from scratch but will gradually build on 4G LTE. Major technologies enabling 5G include:

- *D2D Communication*: Direct connectivity is achieved through device-to-device (D2D) technology. 5G cellular network will implement D2D mm wave communication technology to provide high speed data rate, improve coverage, and offer peer-to-peer services. Much research effort has been invested of characterizing D2D connections as part of LTE [8].
- *M2M Communication*: While D3D communication targets mobile radios, machine-to-machine (M2M) expands the scope and facilitates ubiquitous connectivity among mobile devices. It is estimated that there will be over 100 billion connected devices using M2M communications in 5G backbone [9].
- *MIMO*: Multiple-input-multiple-output (MIMO) technology plays a crucial role in 4G and is expected to play an important function in 5G. Massive MIMO extracts the benefits of MIMO on a large scale by increasing the throughput and spectrum efficiency.

Other enabling technologies of 5G include mmWave communication, ultra-dense network (UDN), all-spectrum access (ASA), OFDM (orthogonal frequency division multiplexing), and Internet of things.

## APPLICATIONS

5G is regarded as a game changer for Internet of things (IoT) applications in industrial and commercial operations, enabling many new use cases. The 5G mobile networks and associated technologies are expected to provide multi-service wireless applications with diverse specifications intended to address the needs of various vertical industry markets (such as healthcare, education, energy, mining, agriculture, manufacturing, etc.) [10]. As shown in Figure 3, industries that will benefit from 5G technology are many [3]. They include [11,12]:

- *Manufacturing:* 5G makes it possible to monitor more performance parameters along the assembly line. 5G networks will enable constant refinement, improving quality and productivity and lowering costs. With 5G, factories will accommodate an influx of robots on assembly lines and drones for last-mile deliveries.
- *Healthcare:* Connecting to the Internet is fundamental to the success of any telehealth solution. The benefits of telemedicine on a 5G network include privacy, security, employee accountability, device tracking, and operational efficiency. With 5G, hospital doctors can work with field paramedics to diagnose the patient before and during transport using ambulance. With 5G, telehealth services can be expanded into rural areas. Connectivity at 5G levels enables caregivers in rural and remote areas to receive real-time instruction from surgeons around the world at anytime, anywhere. Some benefits of 5G technology in healthcare are portrayed in Figure 4 [13].
- *Smart Cities:* 5G is used for smart city applications, such as the Alba Iulia Smart City in Romani. Alba Iulia is a relatively small city, but it is an excellent example of the potential of WiFi and IoT connectivity powered by 5G to transform how citizens interact with the government. This smart city has traffic monitors, parking sensors, and waste management systems. Cities with 5G stand to attract residents and businesses that will leverage this increased connectivity.
- *Autonomous Vehicles:* The automotive industry will experience significant changes in the future with driverless cars on 5G networks. German automakers BMW, Volkswagen, and Lufthansa are currently piloting private 5G networks in their manufacturing facilities. Typical autonomous vehicles are shown in Figure 5 [14].
- *Traffic management:* 5G traffic technologies can benefit the public in terms of safety and convenience. As electric vehicles (EVs) are equipped with 5G-based technology, traffic accidents and fatalities will be reduced. Cars will become fully automated and they will communicate with one another to avoid accidents.
- *Immersive Experiences:* T-Mobile's new 5G network is ushering in a new era of mobile computing. One can create augmented reality (AR), virtual reality (VR), mixed reality (MR), or other immersive experiences that transform smartphones into powerful pocket computers.
- *Retail:* The 5G's high-speed makes it possible to offer more personalized services to retail customers. 5G technology can enable new services that will attract customers, such as the ability to "try on" clothes using VR and AR. Some experts in the industry see 5G connectivity as a critical component in the mass adoption of AR and VR technology. With 5G-powered mobile edge computing, inventories could update in near-real time.
- *Remote Areas:* New technologies and innovations usually reach urban regions first. Many challenges remain to bring broadband connectivity to the rural and remote regions. 5G will allow people residing in remote locations to access Internet more easily. This will fuel business opportunities in rural areas, in terms of retail, agriculture, and online services.

## BENEFITS

The benefits of 5G for businesses are many. 5G will enable more efficient energy grids that can run with minimal human intervention. It has the potential to make cable and DSL obsolete. Faster Internet speeds, increased traffic, and seamless tech integration are just a few business benefits of 5G. Other benefits of 5G for businesses include:

- Replaces expensive wired cable with highly reliable cellular connections
- Faster transmission speed means more business actions can be carried out in less time
- Connectivity is increasing and countries are multiplying their average download speeds with 5G
- Nearly every chip manufacturer sees 5G as its “goldmine” and has positioned to take advantage of the potential opportunity
- Immersive experiences will rise to new heights
- Increase device capacity
- Lower latency and high reliability enable business improvements
- Increased productivity
- Smart working
- Safer transportation
- Enhanced communication

In order to reap these benefits, business leaders will have to create a 5G strategy, consider IT systems and security, and educate people.

## CHALLENGES

Although 5G technology will be at the forefront of bringing innovations to the businesses, there are still issues like security and privacy to be concerned about. Privacy issues like identity, personal data, and geo-location tracking must be considered while designing security protocols. Major telecommunications companies are struggling to expand 5G networks due to lengthy cell site installations and delays caused by the COVID-19 pandemic. Other challenges include [15]:

- 5G architecture was built for capacity, not security
- Like 3G and 4G, the 5G network could be exposed to some form of data hacking
- 5G connectivity brings more complexity
- The small cells can cause long-term health problems
- 5G will require regular updates and upgrades to the network system to maintain functionality and security
- Loss of competition and choice

## CONCLUSION

5G is the fifth generation of wireless technology. It is estimated that, in the next few years, a quarter mobile connections would be on a 5G network. China is leading the race for 5G with 29% of mobile connection; North America follows with 13% adoption; and Europe is behind with 4% adoption [16]. As technology evolves toward 5G, industry leaders must understand how to deliver on the 5G vision while meeting consumer demand for higher communication speeds. As businesses start to gear up to take advantage of 5G, not everyone is prepared for it. 5G has arrived. It is coming to a city near you very soon. More information about 5G for business can be found in the books in [17-19].

## REFERENCES

1. “5G,” *Wikipedia*, the free encyclopedia

<https://en.wikipedia.org/wiki/5G>

2. M. N. O. Sadiku, K. G. Eze, and S. M. Musa, "5G Wireless Technology: A Primer," *International Journal of Scientific Engineering and Technology*, vol. 7, no. 7, July 2018, pp. 62-64.
3. "[Burning issue] 5G technology,"  
<https://www.civildaily.com/burning-issue-5g-technology-2/>
4. R. S. Sapakal and S. S. Kadam, "5G mobile technology," *International Journal of Advanced Research in Computer Engineering & Technology*, vol. 2, no. 2, February 2013, pp. 568-571.
5. "How 5G technology works,"  
<https://www.rfpage.com/how-5g-technology-works/>
6. D. H. Latha et al., "A study on 5<sup>th</sup> generation mobile technology – Future network service," *International Journal of Computer Science and Information Technologies*, vol. 5, no. 6, 2014, pp. 8309-8313.
7. "Guest blog: Business @ speed of thought: The power of 5G, Edge, and IoT," December 2020,  
<https://www.techuk.org/resource/guest-blog-business-speed-of-thought-the-power-of-5g-edge-and-iot.html>
8. S. Andreev, "Delivering uniform connectivity and service experience to converged 5G wireless networks," *Proceedings of the IEEE World Forum on Internet of Things*, 2014, pp. 323-324.
9. M. H. Alsharif et al., "How to make key wireless technologies environmental friendly: a review," *Transactions of Emerging Telecommunications Technologies*, vol. 29, 2018.
10. L. Banda, M. Mzyece, and F. Mekuria, "5G Business models for mobile network operators—A survey," *IEEE Access*, vol. 10, September 2022, pp. 94851 – 94886.
11. H. Remmert, "What can 5G do for business: Enterprise, industry and transportation," January 2022,  
<https://www.digi.com/blog/post/5g-for-business-enterprise-industry-transportation>
12. M. van Rijmenam, "The impact of 5G technology on business and when 6G will come?" August 2022,  
<https://www.thedigitalspeaker.com/impact-5g-technology-business/>
13. "Benefits of 5G technology in healthcare industry,"  
<https://www.openteqgroup.com/blogs/benefits-of-5g-technology-in-healthcare-industry>
14. R. Goodwins, "New 5G business models," February 2019,  
<https://www.zdnet.com/article/new-5g-business-models/>
15. N. Abbey, "Challenges in implementing 5G," December 2022,  
<https://stl.tech/blog/challenges-in-implementing-5g/>
16. C. D. Nardo, "5G networks: What they are and how they will improve our work," March 2022,  
<https://deltalogix.blog/en/2022/03/07/5g-networks-what-they-are-and-how-they-will-improve-our-work/>
17. D. Chandramouli, R. Liebhart, and J. Pirskanen (eds.), *5G for the Connected World*. John Wiley & Sons, 2019.
18. W. Vieira and M. Dixit, *The 5Gs of Family Business*. SAGE Publications, 2019.
19. D. A. Maxwell, *5G, AI & The Future of Business in Africa: How These Technologies and Create a More Prosperous Africa*. Independently Published, 2020.

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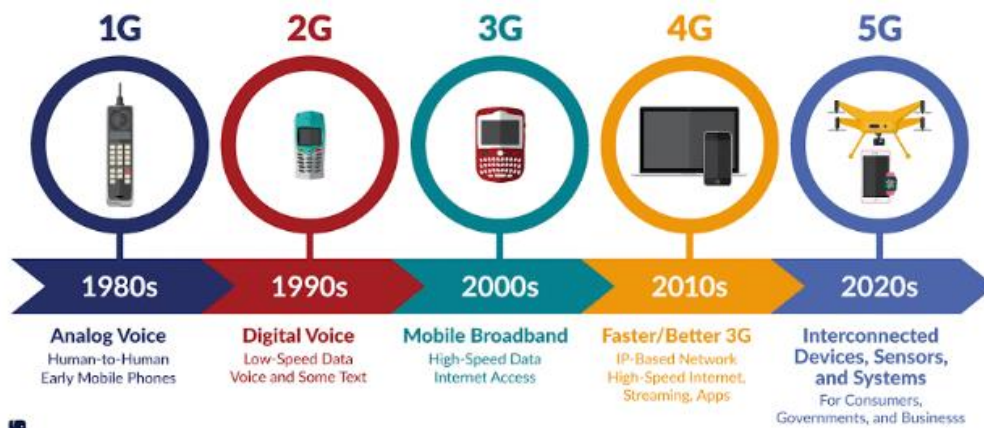


Figure 1 Evolution from 1G to 5G [3].

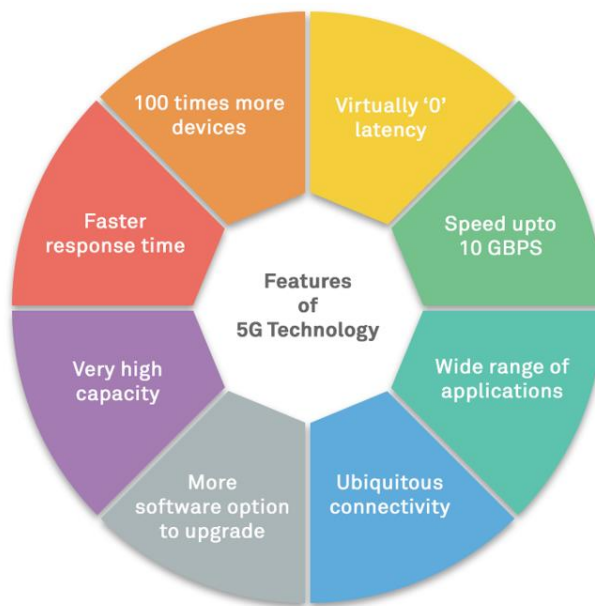


Figure 2 Some of the features of 5G [7].

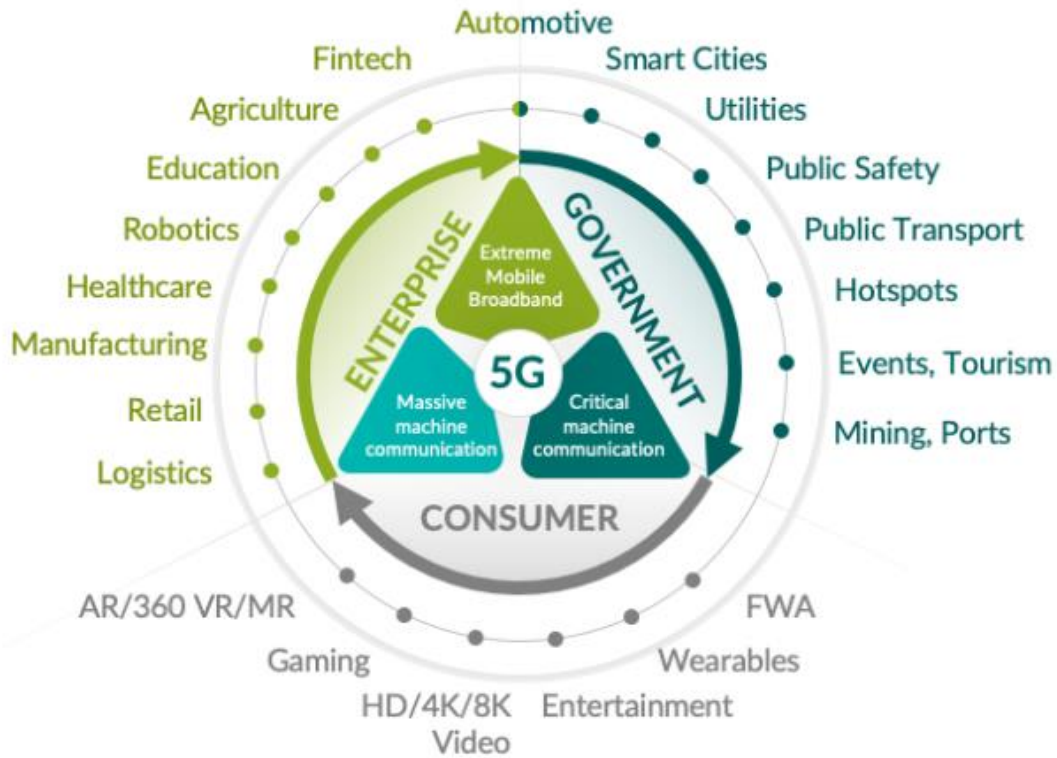


Figure 3 Industries that use 5G technology [3].



Figure 4 Some benefits of 5G technology in healthcare [13].



Figure 5 Typical autonomous vehicles [14].

