

Behind the Hype – What 5G Means for the Commercial Real Estate Industry

Produced In Partnership With:

attain

Introduction

Improved connectivity is an essential driver for our future, from artificial intelligence and self-driving cars to telemedicine and mixed reality. It has the potential to make our lives easier, safer and healthier. To answer that need, the mobile industry developed 5G wireless networking technology. It comes complete with a lot of promises, including the ability to better connect people, data, applications, transport systems and cities in smart networked communication environments.

For commercial real estate, the question is how will 5G impact building management and day-to-day operations? And while there is promise, there is little proof.

This guide will be a primer for 5G covering the benefits, opportunities and challenges associated with the CRE community. It will provide building owners and managers the knowledge they need to explore the opportunities brought by 5G technology confidently.

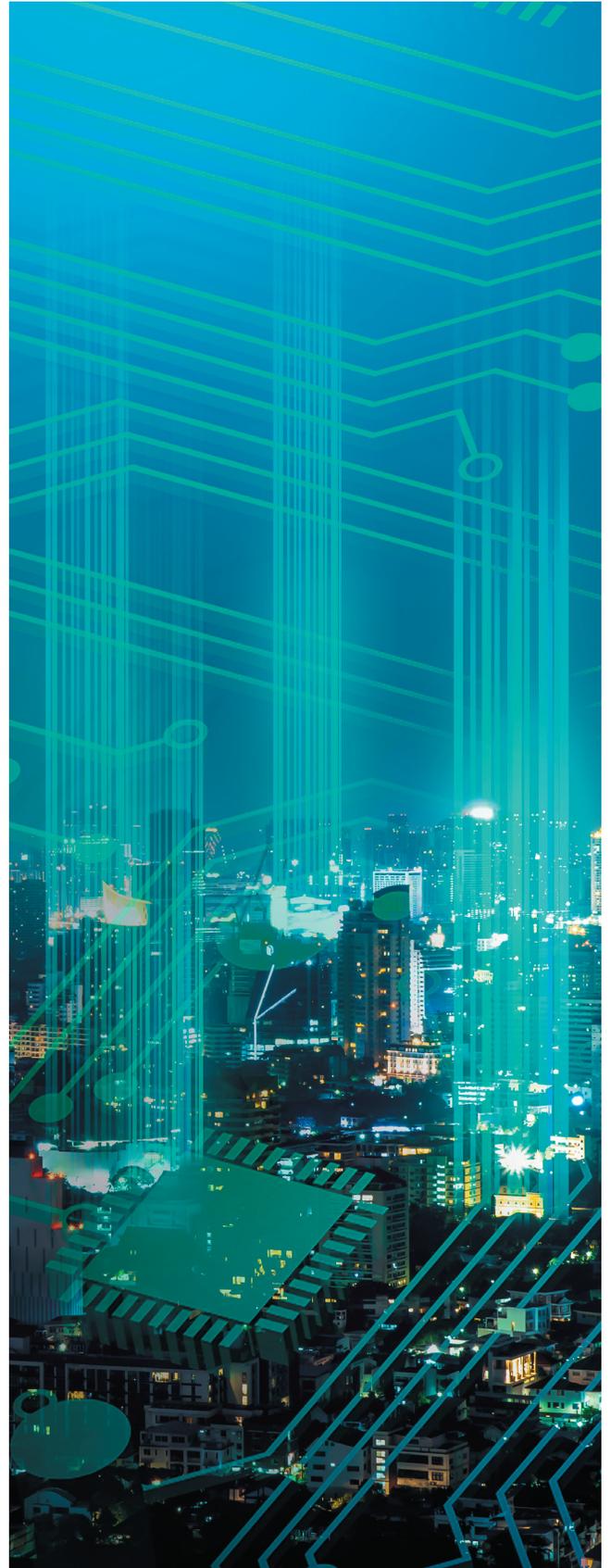
BOMA Canada and the Attain Group are committed to supporting the commercial real estate industry on all evolving telecommunication topics, in particular the developments of the 5G network.



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Everything You Need to Know About 5G

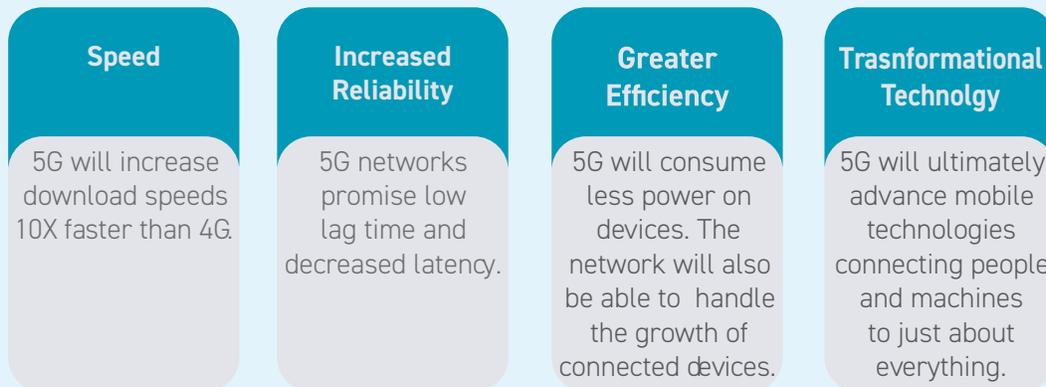
5G isn't just a faster network for your mobile phone – it's the backbone of everything we expect the future to be smart, automated and connected.

5G stands for "fifth generation" wireless technology and is the next evolution for mobile technology after 4G LTE. 5G networks are designed to carry data up to 10X faster than 4G networks. 1G and 2G were based on delivering voice services; 3G brought us mobile data; and 4G the mobile Internet. 5G will transform the role that mobile technology plays in society.

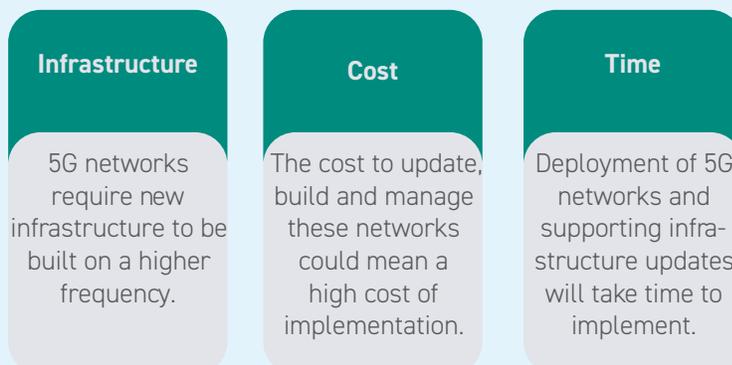
1. The Evolution



2. The Advantages



3. The Challenges



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Abbreviations

1G: First Generation
2G: Second Generation
3G: Third Generation
4G: Fourth Generation
5G: Fifth Generation
CRE: Commercial Real-Estate
IoT: Internet of Things
ICT: Information Communication Technology

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What is 5G

5G refers to the fifth generation of mobile communication systems and is expected to deliver¹ :

- data speeds approximately 100 times the speed of 4G LTE.
- less delay between the request for data transfers.
- greater than 1 gigabit per second.
- low latency of less than 1 millisecond.
- enhanced machine-to-machine communication – the Internet of Things (IOT)
- mobile broadband connection.
- ultra-reliable low latency communications.

Latency refers to device response time or the time taken for machine-to-machine communication over a wireless network.

Mobile communication networks have evolved over the years making significant improvements each time. However, it is important to note, the transition from 4G LTE will not be immediate, as 5G will initially operate in coincidence with existing 4G networks before it becomes a standalone network.²

The potential that 5G has for machine-to-machine communication is revolutionary for modern industrial practices in procurement, supply chain management, and most business practices.² Furthermore, 5G will ensure ultra-reliable low latency communications for the real-time control of devices, autonomous driving, automotive safety protocols between vehicles, industrial robotics, and even remote medical care. 5G's low latency communication capabilities will even enable doctors to perform procedures and treatments through remote medical care. If 5G is implemented successfully, it will enhance the connectedness of smart homes, intelligent buildings, smart cities, remote healthcare, and innovative autonomous vehicles globally.

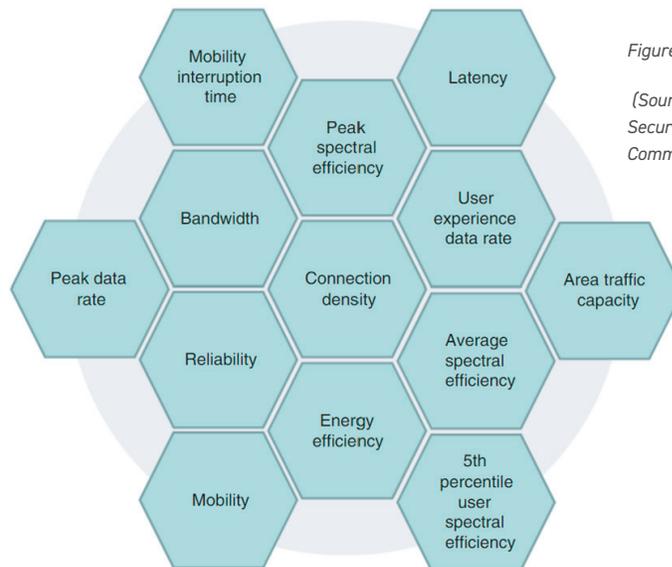


Figure 1 The potential of 5G

(Source: Penttinen, J. T. J. (2019). 5G Explained: Security and Deployment of Advanced Mobile Communications. John Wiley & Sons.)

1 <https://www.naiop.org/en/Research-and-Publications/Magazine/2019/Summer-2019/Business-Trends/The-Future-of-5G-in-the-Commercial-Real-Estate-Industry>

2 Penttinen, J. T. J. (2019). 5G Explained: Security and Deployment of Advanced Mobile Communications. John Wiley & Sons.

Where is 5G Being Used?

Innovators, academics, and telecommunication experts have long hypothesized about the potential use of 5G. But where is it actually being used? Currently, 5G technology solutions have been used in smart homes, intelligent buildings, smart cities, 3D video, remote medical services, virtual augmented reality, and artificial intelligence. It has been used across three main types of connected services, including enhanced mobile broadband, mission-critical communications and IoT.

A defining capability of 5G is that it is designed for forward compatibility – the ability to flexibly support future services that are unknown today.

Enhanced mobile broadband

Uniform data rates, lower latency, and a lower cost-per-bit can usher in a new immersive experience, such as virtual reality and artificial intelligence. Examples of use cases include virtual reality, augmented reality, and video streaming. Many of these elements have been described in features that will allow applications of the metaverse to expand.

Mission-critical communications

The implementation of 5G will enable new services that can transform industries with dependable, available, and low-latency links. Some of the popular applications of mission-critical communications are autonomous vehicles, remote surgery, and drone technology. For the successful implementation of mission-critical communications the following security capabilities will be integral:

Data Integrity

- It is integral that data is unable to be manipulated

Data Confidentiality

- Data must be protected as it travels and is received by devices; this will ensure that privacy is protected from unauthorized access to this data

Strong Mutual Authentication

- Authentication protocols and the frequency of protocols need to be established in a way that it does not compromise low latency requirements

Reliable Security Mechanisms

- There will be a need for strong verified protocols and algorithms that have strong security mechanisms without compromising the overall system reliability

Third Party Authentication For Closed Networks

- In addition to public or open networks 5G will also be deployed in closed networks where a third-party authentication system will be important to maintain data privacy

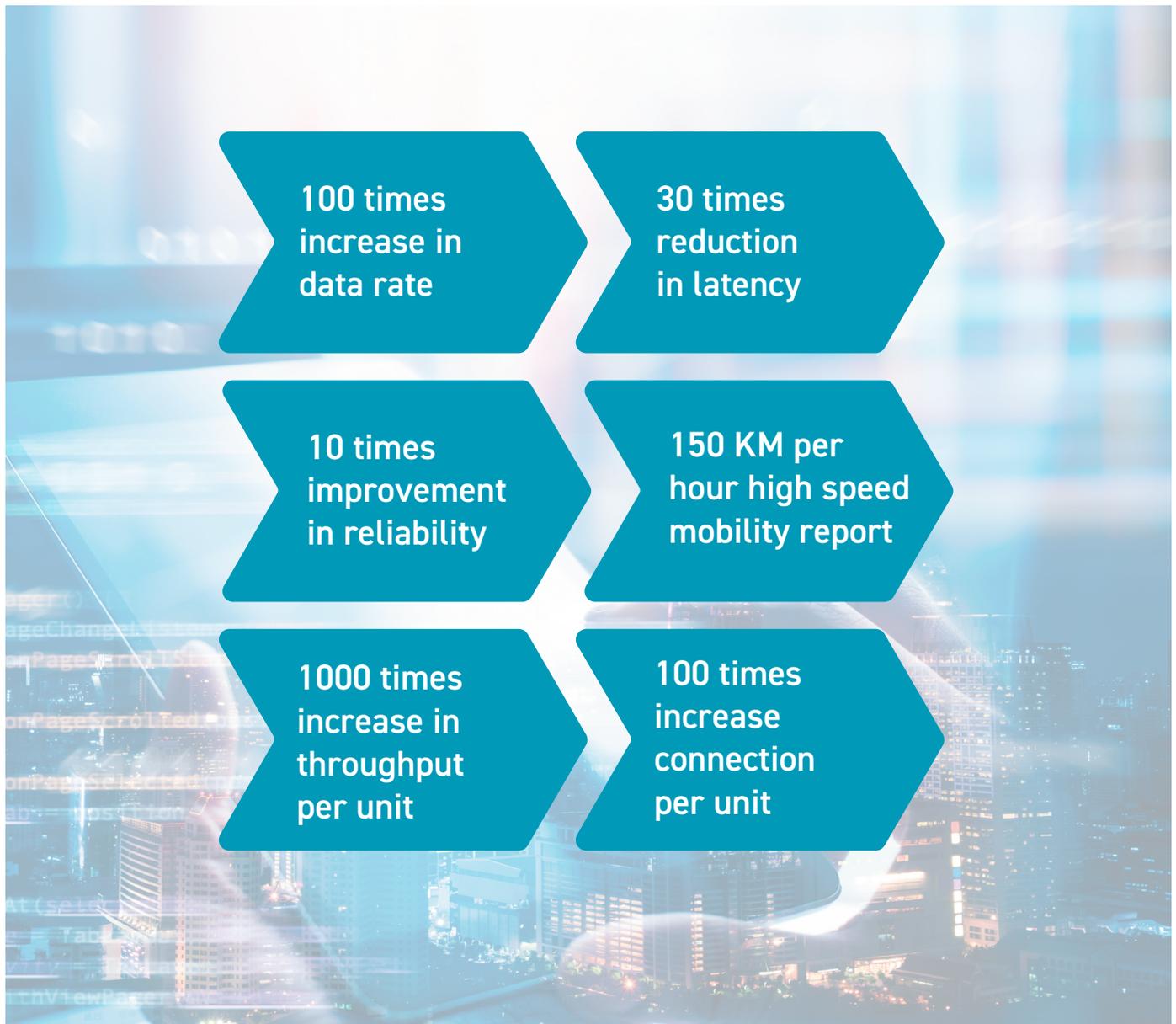
Prioritized Access

- For cases where devices need to have priority access to the 5G network, it will be essential that mission-critical communication devices are authorized in a way that cannot be manipulated

Internet of Things

5G seamlessly connects embedded sensors in virtually everything through the ability to scale down in data rates, power, and mobility. Due to these embedded sensors, 5G inherently provides a highly lean and low-cost connectivity solution. 5G has the demonstrated capability for wide coverage inside buildings through a one million internet of things connection per square kilometer and an extended battery life. The IoT building block is designed to be efficient and flexible, specifically addressing use cases with a large number of devices interacting with each other. This will be integral for smart services in suburban, urban, and rural areas that will need sensor networks that are characterized by a very high density of devices, long battery life, and very low complexity.¹

In comparison to 4G, 5G has a demonstrated improvement in the areas listed below:²



¹ Penttinen, J. T. J. (2019). 5G Explained: Security and Deployment of Advanced Mobile Communications. John Wiley & Sons.

² Liu. (2022). Optical communications in the 5G era. Academic Press, an imprint of Elsevier.

5G and the Commercial Real Estate Industry

Increased demand for the advancement of information communication technology (ICT) continues unabated in commercial real estate. While 5G can answer these demands, it more significantly has the potential to fundamentally change how the industry operates.

From a building owner/manager perspective, the expectation is that 5G will support IoT-enabled building management systems through real-time connectivity, low latency, and high bandwidth. This will give building managers a better sense of how their buildings are being used and how to make them more efficient and effective. An example of this is energy use. 5G will provide building managers with insights into making their buildings more energy efficient. For efficient energy distribution in buildings, digital components such as sensors, meters, and energy management systems must communicate seamlessly via communication networks.

The low latency of 5G provides a tangible solution for machine-to-machine and user-to-machine communication for the digitalization of buildings in their edge clouds. Furthermore, the digitalization of commercial real estate is based on decentralized energy generation, energy distribution and storage, the installation of intelligent building networks, and the creation of added value for applicable building administration, and tenants.⁶ In the figure below the digitalization of commercial real estate is demonstrated; here you can see the value add that 5G has for data transmission, application servers, and cloud storage in the transition to intelligent buildings.

Edge cloud is an extension of cloud computing and operating practices that rely heavily on automation

Building managers are also trying to identify how to monetize the technology by leasing space for new 5G cellular towers on-site and developing strategies to deploy and control 5G network and data rights within their properties.¹

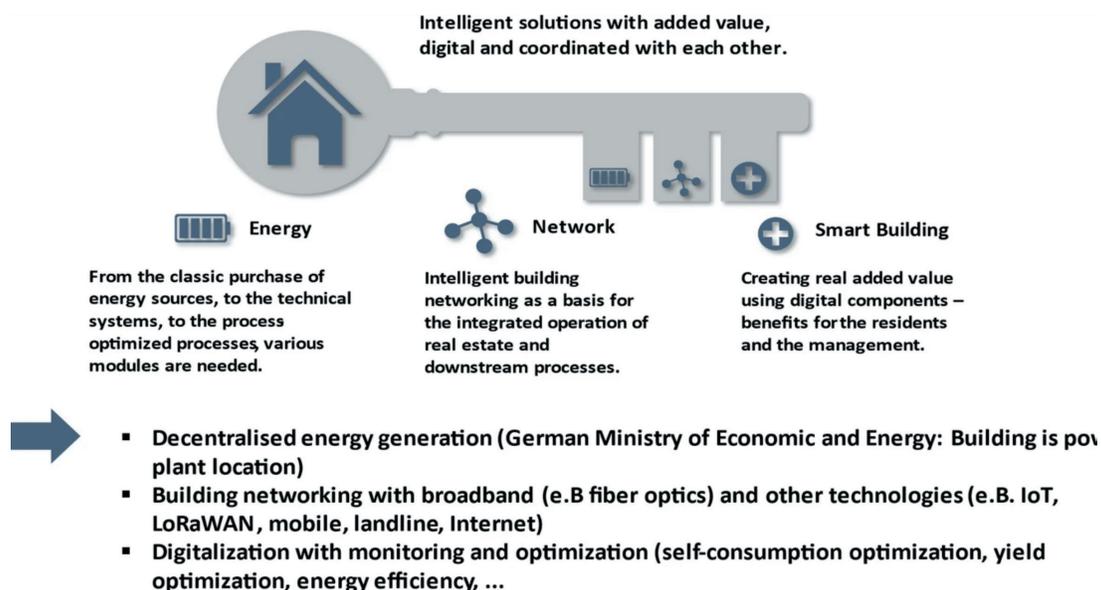


Figure 2: Digitalization of commercial real estate. Source (Konhaeuser. (2021). Digitalization in Buildings and Smart Cities on the Way to 6G. Wireless Personal Communications, 121(2), 1289–1302. <https://doi.org/10.1007/s11277-021-09069-9>)

1 Konhaeuser. (2021). Digitalization in Buildings and Smart Cities on the Way to 6G. Wireless Personal Communications, 121(2), 1289–1302. <https://doi.org/10.1007/s11277-021-09069-9>

Moreover, 5G will have a direct impact on many spaces in commercial real estate including aspects of smart cities, smart homes, healthcare, and office spaces. Fundamentals of how 5G will be utilized in smart homes, healthcare, and office spaces are described below.¹



SMART CITIES As more cities begin adopting 5G strategies and generating vast quantities of data on an hourly basis, it can be expected to impact wait times at traffic lights, reduce water waste, drivers being guided to available parking spaces, bins that report when they need emptying and more. These areas are only going to evolve and grow as 5G becomes more available across municipalities.



SMART HOMES With more home using connected devices, centralized servers that process data collected from these devices increase privacy risk and latency. 5G can address those challenges by enabling mobile or IoT devices to process data within the periphery of the home network rather than the cloud.



HEALTHCARE With more and more connected technologies coming online, it provides the opportunity to be measured and monitored continuously. With data being processed and analyzed instantaneously, devices can automatically adjust or alert healthcare professionals, both of which could improve the quality of care and reduce healthcare costs dramatically.



OFFICE SPACE 5G networks can eliminate excess core cabling infrastructure. This would allow us to reduce the amount of cables being run to desks, phones and conferencing rooms saving time and money. It would ultimately open up a lot of possibilities for the way floor plans are designed for flexible workspaces moving forward.

From the tenant perspective, 5G is likely also to influence tenant demand and expectations. There has been an increased need for lower-latency video conferencing and demands for faster connections. This includes app-driven access to parking and other facilities, work order requests, food delivery, and light and temperature controls strengthens the connection between individuals and the spaces they occupy.

Tenants are also in the process of reconfiguring workspace and/or considering hoteling or hotdesking, features like sensor-activated doors, wayfinding maps showing high-traffic office areas, or on-demand cleaning of a common space through a building app powered by the IoT may be worthwhile amenities. Today's work-primarily-from-home environment is likely not permanent, and new recruits often put substantial weight on the physical workplace when making employment decisions.

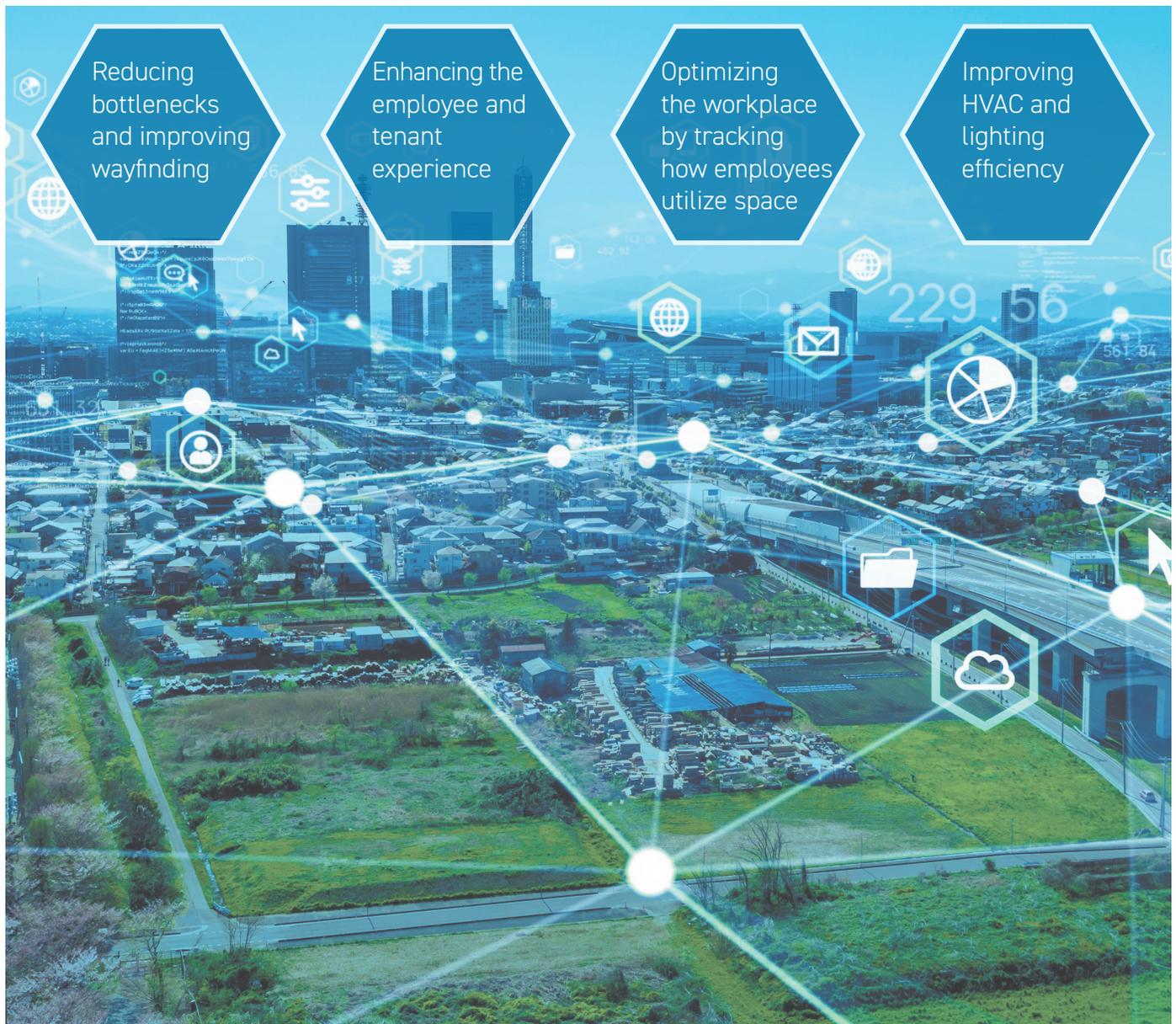
Examples of 5G as an added value:



1 Phan, X. (2022). WHY 5G IS MORE IMPORTANT THAN EVER FOR COMMERCIAL REAL ESTATE. Cushman and Wakefield

Cellular carriers are bringing 5G technology to customers worldwide while expanding available connectivity options. For some property owners and developers, the 5G and real estate combination will force new questions about whether the network could ever replace Wi-Fi. Understanding the nuances in these applications will be critical for staying ahead of customer interest and aligning with the market expectations.

Furthermore, smart buildings or intelligent commercial real estate will be the most integral piece to a highly functional smart city. The current smart trend of commercial real estate may just usher in a new era of highly advanced smart real estate. This shift will transition buildings from static, cost-absorbing structures to versatile and dynamic entities that embody innovation and improve the overall user experience. Smart real estate and 5G will undoubtedly be crucial for smart initiatives that hope to implement seamless data transmissions and streamlined communications. Though IoT works with 4G, 5G will exponentially enhance the speed and density of connected devices. Some examples of smart real estate initiatives that utilize 5G are as listed below:¹



1 Why 5G is More Important Than Ever for Commercial Real Estate | Vietnam | Cushman & Wakefield (cushmanwakefield.com)

5G and Wi-Fi 6 In Commercial Real Estate

Both cellular and wireless LAN (WLAN) have introduced new technology generations, and the time has come for the technologies to join forces. While there are several differences between Wi-Fi 6 and 5G, these differences are mostly standard differences between cellular and Wi-Fi technologies. Wi-Fi 6's focus is to provide increased IoT capabilities and multiuser support. For cellular, 5G users can gain real-time communication capabilities, and 5G could enable development of various new applications and features to support both users and businesses.

Like the evolution of 5G, Wi-Fi 6 presents new improvements that have the potential to transform how users interact with technology. In the figure below, the progression of Wi-Fi since 1999 demonstrates improvements in dense environments, faster throughput, increased network efficiency, and extended battery life. Wi-Fi 6 also introduces improvements in efficiency and capacity as it is designed to accommodate the growing number of internet-connected wireless devices in an average workplace or household. As previously discussed with 5G, Wi-Fi 6 will not replace Wi-Fi 5 as a stand-alone network, as it will initially complement existing Wi-Fi infrastructures.¹

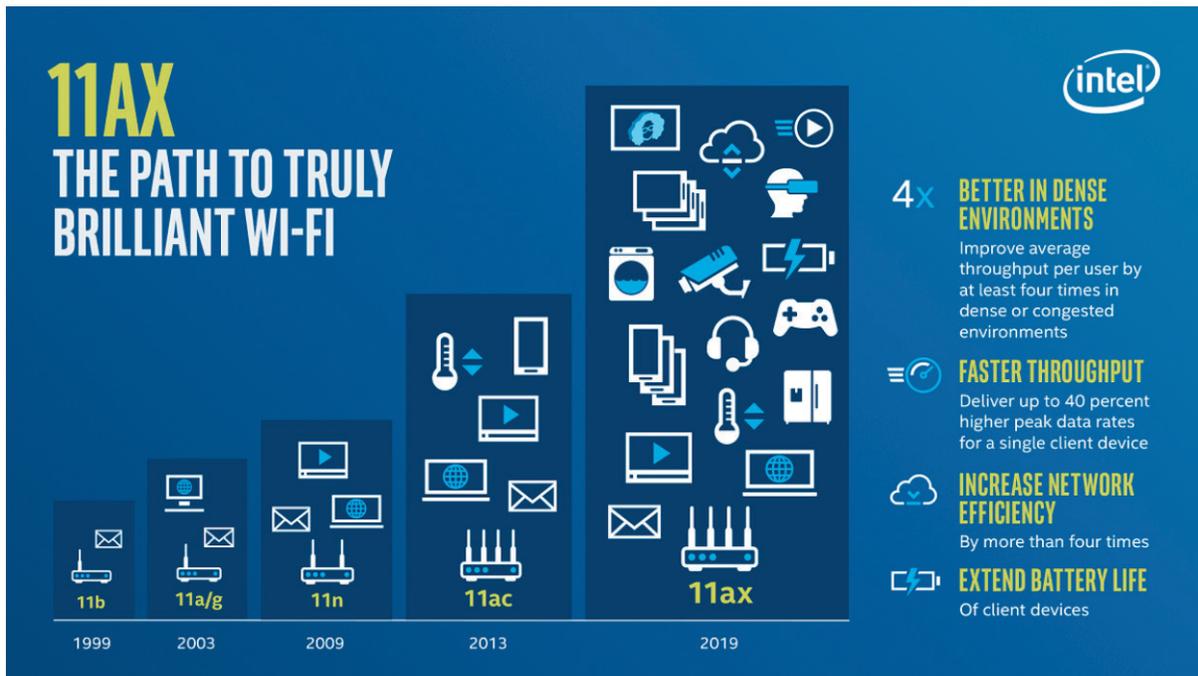


Figure 3 Evolution of Wi-Fi (Source: 5G vs. Wi-Fi: How they're different and why you'll need both | Digital Trends)

The shared goals of Wi-Fi 6 and 5G include increased bandwidth, faster network speeds, and ultra-low latency. Wi-Fi 6 and 5G both aim to improve upon their respective former generations by focusing on enhancing the user experience. Although there are many similarities, 5G and Wi-Fi 6 have key differences that make them complementary of each other such as providing alternate connectivity options for organizations. As demonstrated by the figure below 5G and Wi-Fi 6 work better together in co-existence to support different use cases.

1 5G vs. Wi-Fi: How they're different and why you'll need both | Digital Trends

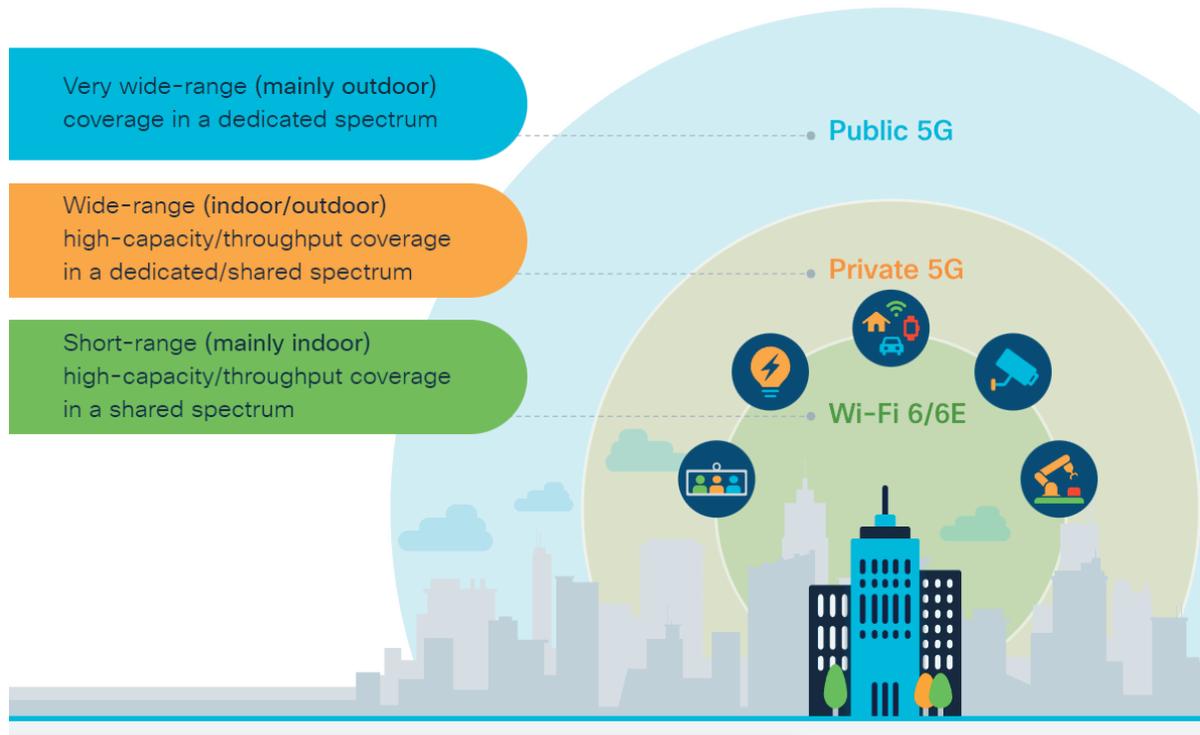


Figure 4: 5G and Wi-Fi 6 (source)

As Wi-Fi 6 and 5G are adopted globally, the potential benefits that these emerging technologies offer are readily evident. Although there are different use cases for 5G and Wi-Fi technology it is evident that together they can deliver the user friendliness and seamless transitions that organizations require. 5G particularly is a great fit for outdoor applications such as college campuses, or outdoor parks. The advantage that 5G has over Wi-Fi 6 in outdoor spaces are lower costs associated to implementation and installation. 5G also has the capability to advance smart city applications and to enable governments to deliver services remotely. 5G can also help with ensuring the reliable connection to services such as readings from smart meters and emergency responses. Wi-Fi 6 on the other hand is primarily used for indoor large spaces such as stadiums where existing towers exist but are unable to handle the high demand.



Stadiums are a good example of how Wi-Fi 6 and 5G can work together. Stadiums have the capability to augment their Wi-Fi 6 installation with 5G as the number of base stations increases. The alignment of 5G and Wi-Fi 6 for use cases such as stadium events are incredible, as both technologies are designed for high speed, low latency, high-capacity forms of telecommunications. Lastly, this means that user-to-device communication and machine-to-machine communication in the Stadium can process at speeds that have never been seen before.

Challenges of 5G and Commercial Real Estate

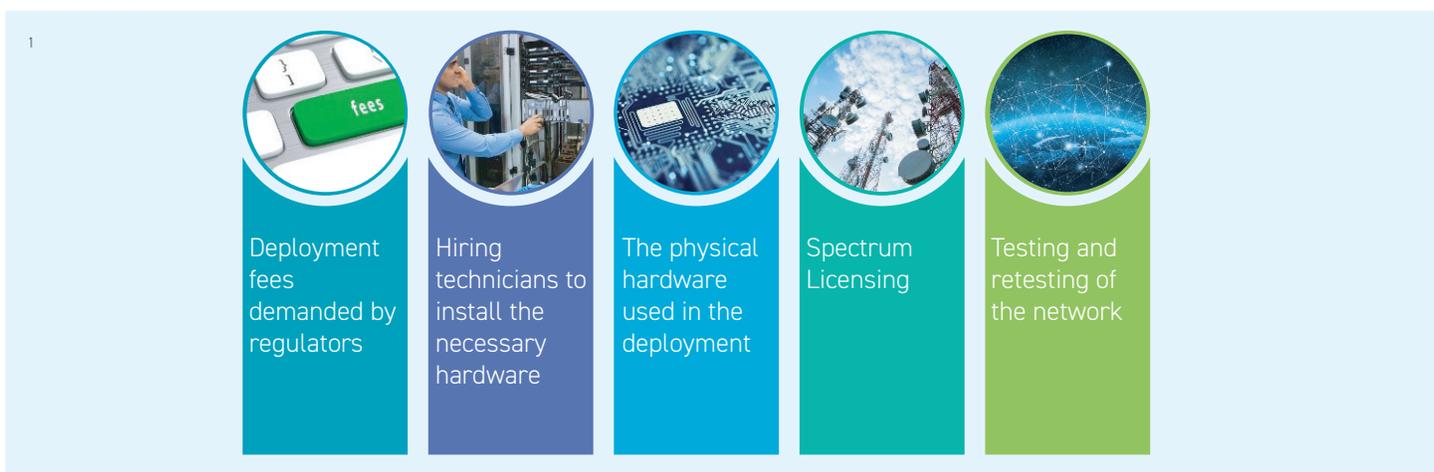
Although it is evident that 5G offers valuable use cases, significant barriers and challenges exist that prevent a seamless transition to implementation. One of the challenges of 5G implementation expressed by the Canadian government was surrounding security and network breaches. Given the greater interdependence and interconnectedness of 5G networks, there is a higher risk of security breaches or exploitation that could have a significant impact on the wellbeing of Canadians and Canadian critical infrastructure compared to previous network generations.¹⁰

For Canadians to reap the complete social and economic benefits of 5G technology, further measures should be taken to secure the foundation of its telecommunication systems.¹⁰ This may have implications with rolling out 5G infrastructure in the commercial real estate industry in Canada.

In addition to the security risks of 5G implementation, there are also deployment challenges. 5G is particularly vulnerable to cell signal attenuation or amplitude reduction, where signal strength becomes difficult over long distances. Another problem is that 5G transmissions through mediums deteriorate compared to traditional lower frequencies. This means that objects such as buildings, trees or foliage along with severe weather conditions can severely weaken 5G signal strength. In addition, 5G signals have difficulty penetrating solid surfaces such as walls and event-coated windows. That is why it will be integral for carriers to partner with real estate firms and building owners to implement 5G successfully. Although connectivity issues are not an entirely new challenge for the commercial real estate industry, having experienced similar connectivity challenges with 4G LTE. There will be a significant need for more antennas and boosters that can support the 5G transition. The 5G transition will also require the costly installment of hundreds of thousands of cell towers.

Challenges for the commercial real estate industry also include occupancy leases for carrier facilities hosted within buildings. 5G introduces a higher number of distributed devices which can be difficult to manage when multiple carriers want a presence within a given location. Buildings will need to consider the idea of "Neutral Host" agreements with an incumbent carrier to host proceeding carriers who wish to make services available in a property. This approach also minimizes power consumption and disruption of retro fitting placement for 5G equipment.

Furthermore, cellular service providers will need a much larger footprint to roll out the smaller 5G cell towers. Property owners will have an opportunity to monetize 5G with leases for small cell towers on rooftops and parking decks, as well as light poles and other structures. The deployment and rollout of 5G is expected to cost telecom companies as much as 275 billion in 5G infrastructure before 2025. This is because mobile operators have to account for the following below during the rollout of 5G before it can reach customers:



Lastly, municipality regulations may be one of the biggest barriers to a fast rollout of 5G across Canada. Provincial by-laws, policies, and procedures may prove to be roadblocks for telecom companies as they aggressively try to implement 5G networks. Some examples of these by-laws can be lengthy permitting processes, high fees, and even aesthetic concerns due to 5G hardware installations on utility poles or streetlights.²

1 5G Challenges: Why It Isn't Rolling Out Faster (lifewire.com)

2 5G In Canada Guide: WhistleOut Answers Your Questions | WhistleOut

Understanding Carriers and Private Networks

National 5G Carriers

Canadian cellular carriers aggressively work to bring 5G network technologies to their customers nationwide. There are three major telecom carriers in Canada that are offering 5G, these include: Rogers, Bell, and Telus. Other telecom providers such as Videotron and Xplornet are entering into the 5G market as operators of 5G spectrum. This further illuminates Bell, Rogers, and Telus's control over the Canadian telecommunications market.

On the global market, several companies own 5G new radio (NR) patents; those include Ericsson, Nokia, Huawei, and Samsung. For example, Rogers is recognized as the first carrier to implement 5G in Canada, and the infrastructure was built with Ericsson equipment. In addition, Bell uses equipment from Ericsson and Nokia, while Telus uses Samsung, Nokia, and Ericsson to build its infrastructure. Currently Rogers, Bell, and Telus provide nationwide consumer 5G networks in Canada that are available in dozens of markets extending from Quebec to British Columbia.¹



Rogers 5G Coverage Across Canada



Bell 5G Coverage Across Canada



Telus 5G Coverage Across Canada

Private 5G Networks

With the major carriers are working to deploy 5G to the public across Canada, it is important to note that the commercial real estate industry has the option of taking a different route by looking at private 5G networks. A private 5G network, also known as a local or non-public 5G network, refers to a mobile network that is technically the same as a public 5G network, but which allows the owner to provide priority access or licensing for its wireless spectrum. This can be beneficial when deploying private wireless networks at facilities where coverage, speed and security capabilities are needed beyond those traditionally offered.

Private networks can be designed for protection and human safety, sensor control and security, and improved bandwidth. Benefits of a private network include:

Private institutions, such as colleges, large manufacturing facilities and other businesses that operate large physical campuses, can deploy their own network of towers operating on their own wireless spectrum to deliver 5G speeds locally.

¹ Phone providers in Canada: How to choose the best one | Moving2Canada

² 5G In Canada Guide: WhistleOut Answers Your Questions | WhistleOut

Although there are benefits for private 5G networks, the technology is still in its early days with regulators sorting out the spectrum that will be available for 5G. It is encouraged that regulatory policy makes 5G spectrum available for the purposes of private 5G networks to allow building owners and managers the freedom to select the correct 5G



Next Steps for 5G

Assessing the smartness of a building is an important aspect to consider when positioning them to adopt emerging technologies. This is significant because technology is never static as it is constantly evolving and changing. Even if a building is accessible to new emerging technologies, property owners must be willing to adapt to new business behaviours, practices, and applications. This has been difficult for commercial real estate professionals who are already trying to keep up with the latest tech trends. Industry standards such as the BOMA BEST Smart Buildings Certification help building owners and managers leverage technology to realize significant value in their assets. It sets the benchmark for guiding the industry toward their digital transformation journey to optimize operations, drive sustainability, create unique user experiences, and deliver financial value to their stakeholders and customers.

Most property owners are still in the early stages of mapping out strategies to manage their properties 5G implementation. One of the first steps for property owners will be to assess the current state of their building(s) infrastructure to see if renovations are necessary. Many of the buildings that are already equipped to acquire 5G have good modern fibre, distributed antenna systems and back-up sources already in place. The second step for property owners will be to create a strategic roadmap and capital plan for 5G implementation. Every property owner will have a different strategy depending on their building type, asset class, and region located. For example, a three-story office building in a suburban office park, an apartment complex, shopping mall, or distribution centre will need different 5G implementation plans. Once these considerations have been made, the next steps for property owners will be to consider the associated costs of implementation.

Now is the time for property owners to better understand the needs of their buildings, as the rollout and adoption of 5G have already begun. Widespread adoption will not be available for at least two years, that is why commercial real estate professionals should take the time to understand the full advantages and implications of 5G.¹⁴ Property owners should think about their assets location and what equipment will be needed for implementation. As a property owner it could be a costly mistake not to consider how valuable an investment 5G could mean too leasing rates in the future. 5G is more than just an improvement over past generations (1G, 2G,3G, 4G LTE) we have entered a new era of communication technology where more than fifty percent of internet traffic is wireless.¹⁴

The BOMA BEST Smart Buildings Certification Program is the industry benchmark – defining how building owners and managers can leverage technology to realize significant value in their assets.

You can't improve what you don't measure - who benefits from industry standards?



Know your Terms

Artificial Intelligence: Artificial Intelligence or AI describes the intelligence of machines and is the opposite of natural intelligence that describes the intelligence of humans or animals. Specifically, AI refers to machine intelligence that has the capability to perceive its environment and makes decisions based on maximizing its ability to accomplish its goals.

Attenuation: Attenuation is the loss of signal strength in networking cables or connections. This typically is measured in decibels (dB) or voltage and can occur due to a variety of factors. It may cause signals to become distorted or indiscernible.

Information Communication Technology: Information Communication Technology is focused on the role of unified communications via telecommunications, middleware, enterprise software, and more communicative tech that enables users to access, exchange, manipulate, and store information.

Internet of Things: Internet of Things or IoT describes physical object(s) that have processing ability, sensors, and other software that can connect and share data with other devices via the internet or other communication networks

Latency: How long it takes a device to respond to other devices over a network. Faster response time is a big promise of 5G, which could be critical for things like emergency alert systems or self-driving cars.

Low-Band Frequencies: Bands below 1 GHz traditionally used by broadcast radio and television as well as mobile networks; they easily cover large distances and travel through walls, but those are now so crowded that carriers are turning to the higher end of the radio spectrum.

Spectrum: All radio wave frequencies, from the lowest frequencies (3 kHz) to the highest (300 GHz). The FCC regulates who can use which ranges, or bands, of frequencies to prevent users from interfering with each other's signals.

Mid-Band Spectrum: The range of the wireless spectrum from 1 GHz to 6 GHz, used by Bluetooth, Wi-Fi, mobile networks, and many other applications. It is attractive to carriers because it offers lots of bandwidth while presenting fewer challenges than the millimeter-wave range.

Millimeter Wave: The range of the wireless spectrum is above either 24 GHz or 30 GHz, depending on whom you ask. There is plenty of bandwidth on this chunk of the spectrum, which means carriers can achieve much faster speeds. But millimeter-wave signals are less reliable at long distances.

Neutral Host: a neutral host allows third parties such as enterprises, managed service providers, and other mobile operators to leverage existing cellular networks to provide service.

Virtual Reality: Virtual Reality refers to a computer-generated simulation that is three dimensional and provides the user with an experience that mimics reality. The Virtual Reality experience is usually paired with electronic equipment such as gloves, and a helmet to give the user full interaction with the simulation.

Wi-Fi 6: Wi-Fi 6 is the newest generation of WLAN technology and is also known as 802.11ax. It is an IEEE standard for wireless local-area networks and is a high efficiency Wi-Fi for dense environments.

1G: in the early 1980s introduced us to wireless telephones (mobile communications). These phones were only for talking and had almost no capacity to transmit data. They existed alongside other wireless technologies, but these technologies were not able to connect or "talk" to each other.

2G: launched in the early 1990s, provided better sound quality, better security, and more capacity for our mobile phones. Services such as email and text messaging came on stream. Consumers started swapping their pagers for mobile phones because they could now send text messages directly to another person.

3G: networks brought us higher-speed transmissions, multimedia access and global roaming. In other words, wireless phones could stay connected in more places and over greater distances.

4G: has introduced new apps and services as connectivity to the Internet has become faster and cheaper. 4G has allowed us to send data, surf the Internet, watch, post and send videos, listen to live streamed music, access social media and many other applications on our smartphones.

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