

Everything You Need to Know about 5G

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Anyone with mobile device is probably familiar with the term 4G which is the fourth-generation wireless cellular data that allows users to browse the Internet, make online calls and watch online videos with many other conveniences. It was only a couple of years ago that we have access to 4G, and now the world is about to experience a new evolution of mobile network and is deploying and competing over the compatibility of 5G network. In 2020, it is expected that the newer generation of wireless cellular data will be broadly available and will replace the current 4G. A number of smartphones made in 2019 are confirmed to be 5G-compatible, those of which include Samsung Galaxy Note 10, Huawei Mate 20 X, OnePlus 7 Pro, Oppo Reno, Xiaomi Mi Mix 3 and the LG V50 ThinQ. These are just some of the super-fast and super-smart phones brought by 5G. From 5G speeds to 5G phones, from smart homes and smart vehicles to smart cities, 5G is an indispensable catalyst to enable the major boost for ultrafast Internet of Things (IoT) and seamless hyper-connectivity. It is around the corner and is behind the most recent and super-fast broadband technology. Though we know that the 5G is coming, there is still very little that we know about this latest and greatest network. What exactly is 5G? How much do we know about it? What can 5G do? How will it impact our lives? This aide-memoir will briefly introduce everything you need to know about 5G.

What is 5G?

5G stands for the fifth-generation wireless cellular, the next generation of mobile internet connection that offers faster speed and more reliable

connection on smartphones and other electronic devices than the previous generations, with an average download speed of one Gigabytes per second (Gbps) (McCann & Moore, 2019). The data transmitted using 5G is much more quickly than the 4G, the current mobile network which people have been using to connect to the internet worldwide. The discussion about 5G has begun, but we cannot deny the fact that not many people who understand yet even about 1G, 2G, 3G and the current 4G.

The cellular wireless generation (G) generally refers to a generational change in the nature of service, system, speed, compatible transmission technology and frequency bands. The G in the cellular network means a generation of wireless technology. The development of first generation of mobile network using analog transmission for speech services was first operated in Japan by Nippon Telephone and Telegraph company (NTT) in 1979 before it was widely available in the United States and Europe later in the 1980s. However, the very first Generation (1G) system was not that inconvenient because of its technology limitation, and the obvious case was the fact that users could only make call. In the 1990s came the second Generation (2G) which introduced a new digital technology wireless transmission, known as Global System for Mobile communication (GSM), and brought the beginning of text messaging, including Short Message Service (SMS) and Email Services. If Compared to the 1G, 2G utilized digital multiple access technology such as TDMA (Time Division Multiple Access) and CDMA (Code Division Multiple Access) with higher spectrum efficiency, better

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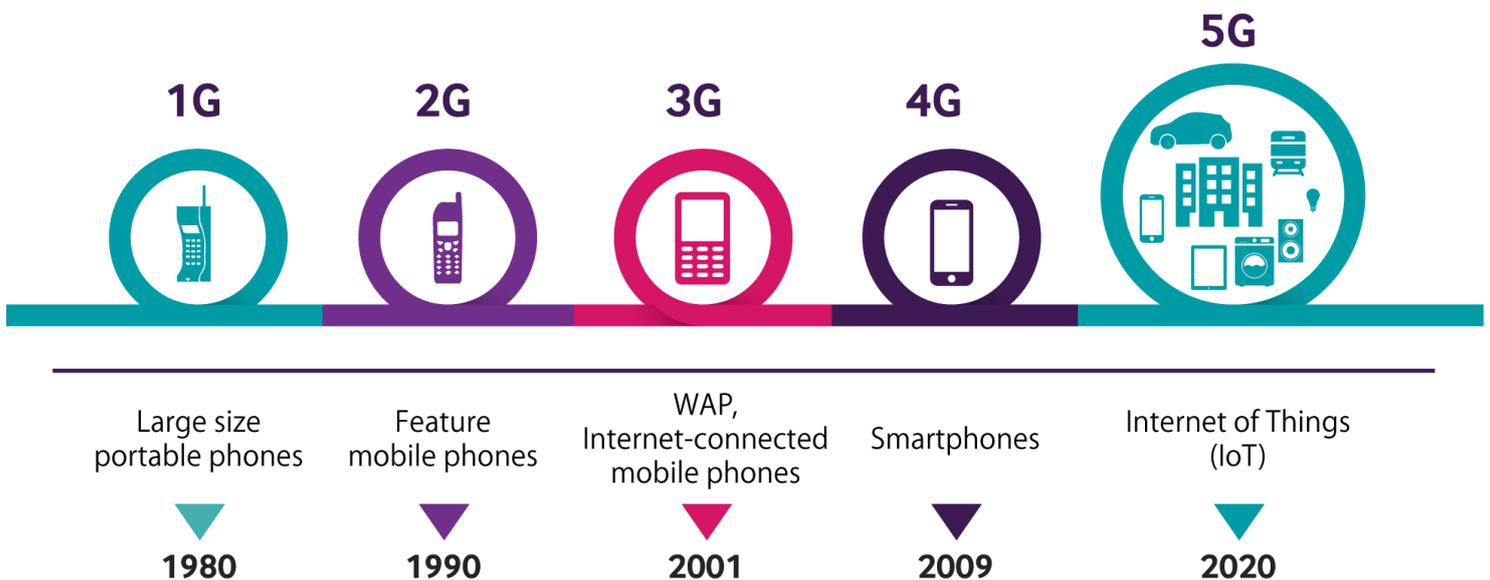
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data services and more advanced roaming. In the early year of 2000, the third Generation of mobile network (3G) using wide band wireless network was made available with the introduction Universal Mobile Terrestrial / Telecommunication Systems (UMTS). The 3G system has enabled users to browse internet on their smartphones and supported mobile apps and internet-based applications such as FaceTime, Google and Facebook. In 2010, the fourth and current generation of mobile network system (4G) came into place and took over the role of 3G with better and more advanced technology, which thus is more useful and convenient to users than ever before. It comes with faster speed of transfer, higher transfer quality, lower cost and capability to handle more advanced multimedia services, which runs 8 times faster than 3G, allowing online users to stream videos and games without much lag and interruption.

Here in 2019, the world is anticipating another technological breakthrough, which is the advent of 5G, a network that uses a type of encoding that resembles those of 4G LTE, but with lower latency and greater flexibility. 5G uses a system of cell sites that divides their territory into sectors and send encoded data through radio waves (Segan, 2019). 5G will be a continually developing network of networks encompassing a far broader array of devices than merely mobile phones, which is known as the Internet of Things (IoTs). In the broadest sense, it incorporates devices connected together via an internet network, in which these devices communicate with other devices and work on the information transmitted from one another by themselves though they were set up and given instructions by human. The technology will enhance the quality of communication network and enables high-end service and internet-based automation.

THE EVOLUTION OF MOBILE COMMUNICATIONS FROM 1G TO 5G



Source: PHD-Media

How Does 5G Work?

5G New Radio or 5G NR, known as the global standard for a more capable 5G wireless air interface, is a new radio access technology which will be operated in high-band spectrums not the

same in 4G. 5G antennas further incorporate massive MIMO (stands for multiple input, multiple output), mmWave, small cells and Li-Fi (short for Light Fidelity) allowing multiple transmitters and receivers to transfer multiple data simultaneously.

Unlike previous generation where the functions also depended on hardware platforms, 5G is a fully software-defined-platforms advancing in virtualization, cloud-based technologies, information technology (IT) and automaton. These super advanced technologies have made 5G very much flexible and responsive at anytime and anywhere.

Furthermore, 5G offers its users tremendous benefits that its predecessors could not. One of the main benefits is the increased bandwidth for all users. Bandwidth is the amount of space available for users to use data to download files, browse the Internet and watch videos. The less bandwidth available, the slower everyone's devices will run, and it is the other way around when there is more bandwidth. Thus, when 5G is available, people would no longer have to fight for data with other users when they enter into crowded spaces, and that problem will eventually become a thing of the past. Take downloading a movie as an example. While 4G connections would take around 30 minutes to download an HD movie, 5G system, with speeds as fast as 1 Gbps, enables the download of the same movie size in about only 25 seconds (Hern, 2019). Lower latency also means users will experience less delay or lag. The latency of 4G network is typically around 40-50 milliseconds, in contrast to the one millisecond or less provided by 5G networks (Wray & Rogerson, n.d.). Equipped with faster speeds, higher capacity, more reliability and lower latency, 5G brings enormous benefits and opportunities that are beneficial to various sectors including education, health and business sectors.

What are the Real Impacts of 5G?

5G will not only build the era of super amazing network infrastructure but also denotes the era of connected experiences and automated lifestyles as it can do much more than its predecessors and what users could ever imagine. Besides its huge technology upgrades, 5G covers all advancements in both social and economic aspects of life, and has the potential to bring smart cities into reality.

➤ Education

First and foremost, 5G will bring tremendous changes in the deployment of technologies in educational sphere. The ultra-modern IoT, which connects the existing assets to the internet for improving efficiency, will be incorporated in school and contribute significantly to the learning-teaching and management system. It is capable of including everything from automatically emptying full trash cans to tracking students' attendance and monitoring students' heart rates during physical education sessions (Teachlr, 2018). Reports showcased that the future learning model would be an international, immediate, virtual and interactive environment that allows students to learn and interact in so many different ways compared to today's learning (Mirzamany, Neal, Dohler, & Rosas, n.d.). Due to the impressive technology of 5G, applications such as Virtual Reality (VR) and Augmented Reality (AR) will play significant roles in the quality of education and understanding-based learning. When they are combined, the learning experience will go far more advanced, leading to the discovery of many innovative ways of learnings and teachings such as tele-teaching, tele-mentoring, virtual universities and virtual classrooms, all of which are not possible with 4G technologies (Exertis, 2019). As 5G provides lower latency to its users, teachers and students can have immediate access to teaching-learning resources, especially videos that require high speeds and a great capacity to access and download. Online classes and video calls between teachers and students can be made more and more comfortable with the superfast speed of 5G network.

➤ Automotive and Cooperative Vehicles

A lot of people might be impressed by autonomous vehicles and flying cars in the sci-fi movies and video games. These are way closer and more realistic than expectation with the transforming tech of 5G, which will generate a great leap in autonomous and cooperative vehicles. In terms of infrastructure monitoring and traffic control solutions, 5G can make ease of gathering data from sensors deployed

on junctions and roads and spotting where traffic jams and snarl-ups occur. Moreover, drivers can be notified about speed and road condition with real-time alerts or accidents, and that can reduce time prolonging on the road and transportation. When it comes to parking lot issues, it can help drivers to identify the available parking space remotely from sensors and avoid crowd in particular places. In addition, 5G can help public transports run smoother and smarter since travelers will be able to receive immediate updates and notices on where the busiest areas on trains or public buses are. Reducing the time-spent on the road will indirectly contribute to lessening the environmental impact of commuting.

➤ **Healthcare and Medical Support**

In healthcare and medical support, 5G technology introduces the so-called E-health and M-health (mobile health), the smart or portable devices for health service and information, which varies from electronic prescribing and medical recording to constant alerts of key health indicators. It enables patients to be monitored via connected devices that deliver data such as heart rates, blood pressure and glucose level. The advent of 5G allows patients to receive doctor's care and distant check-up through telehealth and remote home monitoring systems. Doctors could also make smooth and uninterrupted video calls to check up on patients, make recommendations and even submit prescription requests (AT&T Business Editorial Team, 2019). Beyond what we could ever think of, the fastest 5G technology can establish virtual hospitals and health centers, making it possible for remote surgery by the doctors and even performed by robotics.

➤ **Energy Saving**

How can 5G enable energy-saving and make lifestyles more environmentally friendly? Simply put this way, 5G has the ability to operate with a huge number of sensors which are used and needed for tracking energy and utilities. Using sensors, 5G can gather data on pedestrians and vehicles habits, dim or switch off the light around low-traffic areas and reactivate when it detects

persons walking nearby. In addition, smart energy system can be used to turn off lightbulb, heating or even air conditioning when no one is present at home, office building or shopping centers. 5G can also offer ability for connected devices of small cell basis which create effective and interconnected wireless infrastructure in the city at large. Small cell networks will be broadcasted for monitoring air quality using in-depth sensor. These save both money and the planet.

➤ **Business Sector**

5G improved-features are also beneficial to the business sector because fast and reliable connections are vital for business productivity, profitability and success. Businesses will be able to stream high-resolution videos, audio and images with little or even almost no latency. For this reason, the videos and images hosted by the companies would appear to be more attractive to customers compared to advertisements that are in low quality and come with poor image and bad soundtrack. As businesses continue to involve more online platforms such as digital transactions and cloud documents sharing, having access to faster internet speed means that businesses will be able to get things done a lot quicker, which inevitably has a positive effect on business efficiency (Pickard-Whitehead, 2019). Improved efficiency also results in higher productivity among staffs and better communication among management team and the operatives, thus paving a way for lower overhead cost and ultimately increasing bottom lines.

➤ **Assistance to Government Work**

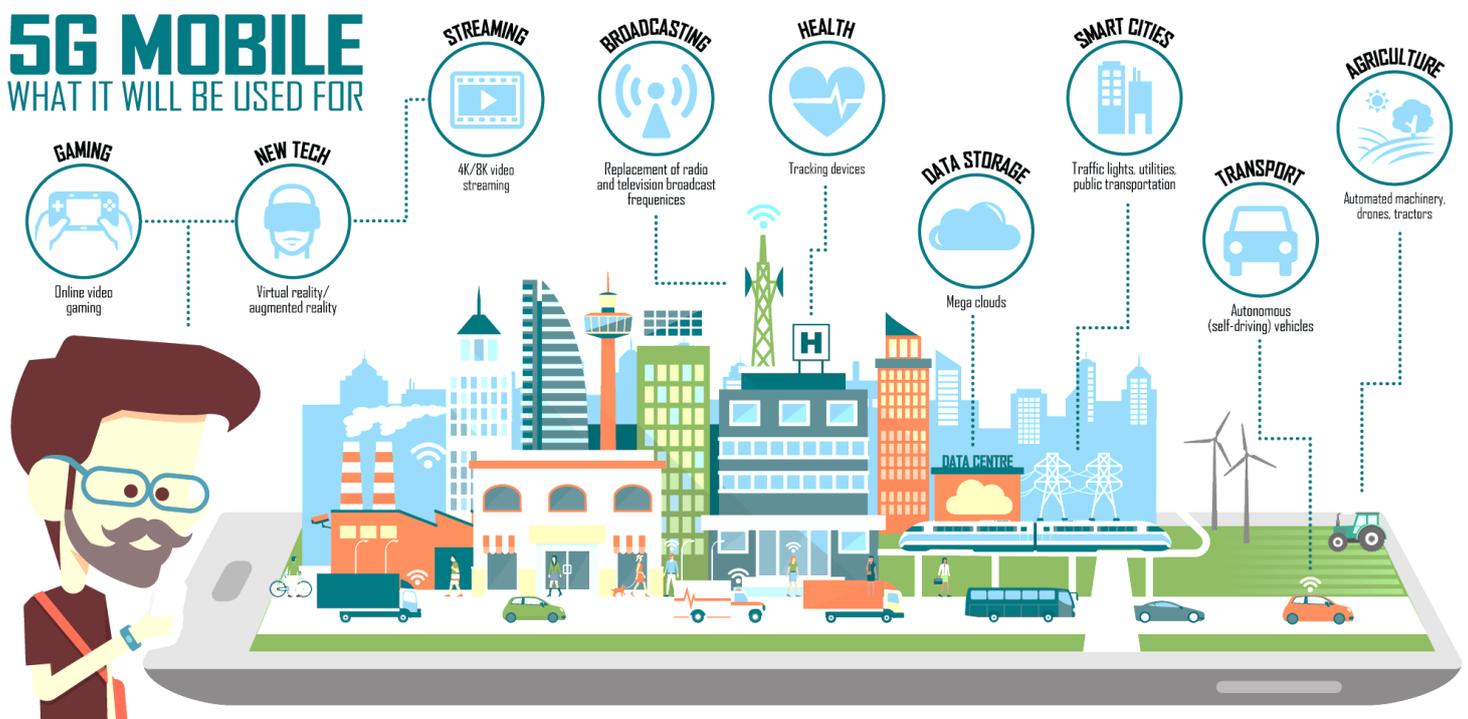
5G does not only help private sector and respective individual lifestyle, but it is also capable of providing assistance to the government. Full deployment of 5G can bring multitude benefits for execution of government works starting from digitalizing public services, creating and operating of smart cities and even smart military bases, enhancing cybersecurity capabilities and advancing government workforces and officers, to encouraging citizens' engagement (Smith, 2018). The pervasive 5G's IoT network has

more capabilities to equip a number of sensors for gathering and transmitting information, which therefore allows the government to utilize such richer resources for managing and improving public works. More importantly, the use of augmented reality and virtual reality as well as other digital-based applications can be used to support the defense missions for the country. Through the integration of data streaming from the connected sensors, wearables and drones, national defense units will be able to generate a near-real time action and proactive strategy. In the area of cybersecurity where poor internet connections are prone to external attacks, such resourceful data given by the massive edges of 5G improved-features will make the government well-prepared to combat, detect and mitigate potential threats and cyber anomalies.

What are the Downsides of 5G?

Despite bringing with greatness and excitement to many people, 5G unfortunately also has a number of drawbacks given its enormous benefits. 5G's

capability to provide an increased bandwidth comes with a concern about the cell towers. Technically speaking, for 5G to be able to provide the users with more bandwidth, the wavelengths have to be short, and in order to have short wavelengths, the cell towers need to be built within a short distance to the devices. Disruptions from buildings, walls, trees and other surrounding issues also have impact on transmitting the wavelengths. Given these circumstances, the telecommunication companies need to deploy more towers in addition to the existing ones and use beamforming technology so that the signals can be directed around the objects and get straight to the devices. Another problem is radio frequency. Cell towers communicate using radio frequency that is measured in Hz. 5G networks' data transmit range is around six GHz, which is a problem because this range is crowded with other signals such as satellite links. As a result of this overcrowding signals, users can expect to face problems with trying to transmit their data or sending and receiving data (Whatsag, n.d.).



Source: *Independent.ie*

Where is Cambodia at 5G?

After the official authorization of 4G networks back in 2014, Cambodia is now the first Southeast Asian

country to develop 5G network while South Korea claimed to be the first country to launch 5G by rolling out 5G service network on April 2019. The

Kingdom has signed an agreement with a Chinese giant tech company, Huawei Technologies, on April in the Chinese Capital during the country's Prime Minister official trip to China for the 2nd Belt and Road Forum. According to the Prime Minister, he wants the tech giant company to help build Cambodia's capacity, especially in the technology sector, and to speed up online services in the Kingdom (Phnom Penh Post, 2019). Cambodia's early adoption of 5G infrastructure is applauded by the Prime Minister as a critical step and a great leap for economic and technological development.

Despite seeming to be a good sign for improved network in Cambodia, it is important to note that it would take several years for 5G to be fully adopted by all users and deployed in particular fields. The launch of 5G network in Cambodia took place amid a rising trade war tension between the United States and China, in which the US has urged its allies not to adapt Huawei's 5G technology as it will hinder their data privacy. In spite of the warning from the US, Huawei has been working with many countries to set up or test 5G network, including Cambodia's neighbor, Thailand (VOA, 2019).

Locally, major telecommunication companies in Cambodia, including Metfone, Cellcard and Smart Axiata are starting their 5G networks roll-out. They are also competing against each other to launch 5G and provide better services to the costumers. Cellcard, one the largest mobile operator in Cambodia, plans to launch by the last quarter of 2019 with 3.5GhZ frequency, according to the statement from its CEO Ian Watson to the Nikkei Asian Review in May 2019 (Asian Nikkei, 2019), in which the company will at first stage install 1,000 5G bases throughout the country's major cities: Phnom Penh, Siem Reap and Sihanouk Ville. On the other hand, Smart Axiata and Metfone also plan to roll out 5G this year as the consumption of data in Cambodia is now more substantial than it has ever been (Asian Nikkei, 2019). One of the biggest challenges of 5G, not only to Cambodia but also to every country that is operating with 5G, is the

infrastructure. As mentioned earlier in the text, 5G requires higher bandwidth; thus, calling for more towers. Therefore, upgrading the device will come at a relatively high cost. For this fact, people should expect the rollout to be slow and uneven. And when the telecom companies announced the launch of 5G in Cambodia's capital, what it actually implies is that the 5G will be accessible in a handful of designated spaces only, hence indicating another form of the so-called development gap and inequality among the users.

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