Fall 2020

5G vs 4G, What's the Difference?

Michael Fermanis

5G vs 4G,
What's the Difference?

By: Michael Fermanis

5G is rolling out in 2020. What is going to be different than 4G? Compared to the fourth generation, 5G will have lower latency, faster download speed, and will be able to connect the Internet of Things on a world scale. The possibilities that come with 5G will revolutionize how the world works.

Introduction

For starters, 2G came out in the 1980's and 3G came out in the 1990's, the difference was a huge step in the mobile network itself. 2G only enabled people to services such as SMS and moved from analog technology to digital. When going to 3G, we enabled video streaming, live TV. Now, when you talk about the transition to 4G from 3G in the early 2000's, they mean the same except 4G is more powerful and can be used anywhere. Although 4G sounds great, with 5G the possibilities are almost endless. With 5G the world will be able to have smart cities and data run businesses. 5G will also expand the amount of devices working on a network reliably and securely.

How good is 5G actually?

In order to understand the background of 5G, first you have to know a little bit about the network. A network is an area with multiple machines that are connected to share resources. The biggest thing that can be changed within the network is how fast a machine can send and receive a message. Now with 4G, the latency is around 20-30 milliseconds, but for 5G it will drop it as low as 10 milliseconds as seen below in Figure 1.

		3G	4G	5G
	Deployment	2004-05	2006-10	2020
	Bandwidth	2mbps	200mbps	>1gbps
	Latency	100-500 milliseconds	20-30 milliseconds	<10 milliseconds
	Average Speed	144 kbps	25 mbps	200-400 mbps

Figure 1

5G is supposed to deliver data at peak rates of 10 Gbps in static mobile connections, and 1Gbps coverage for highly mobile edge users. The round trip time latency of a 4G system is around 20 ms, but this number will decrease to around 1 ms with 5G.
With this speed, within the next decade and 5G rolling out more cities will become "smart" cities. 5G industries are focusing on transportation, security, and public safety. 5G will make autonomous vehicles and Vehicle-to-Everything communication (V2X) a reality. V2X is the communication between vehicles and anything connected to the network. This allows cars to tell each other it's speed, direction, etc. through radio signals.
An early problem with 5G was the overwhelming amount of capacity clogging up the network. Just like other networks, 5G systems will communicate with stations by transmitting radio waves, radio frequencies, or electromagnetic fields. 5G will use a technique called beamforming to improve performance, where you set up hundreds of small antennas at a station to focus all the transmission of radio waves to maximize the signals as seen in Figure 2 below. When measuring these frequencies, 5G uses millimeter waves to change the radio spectrum from 700 Mhz to 2.6 Ghz for wireless communication.

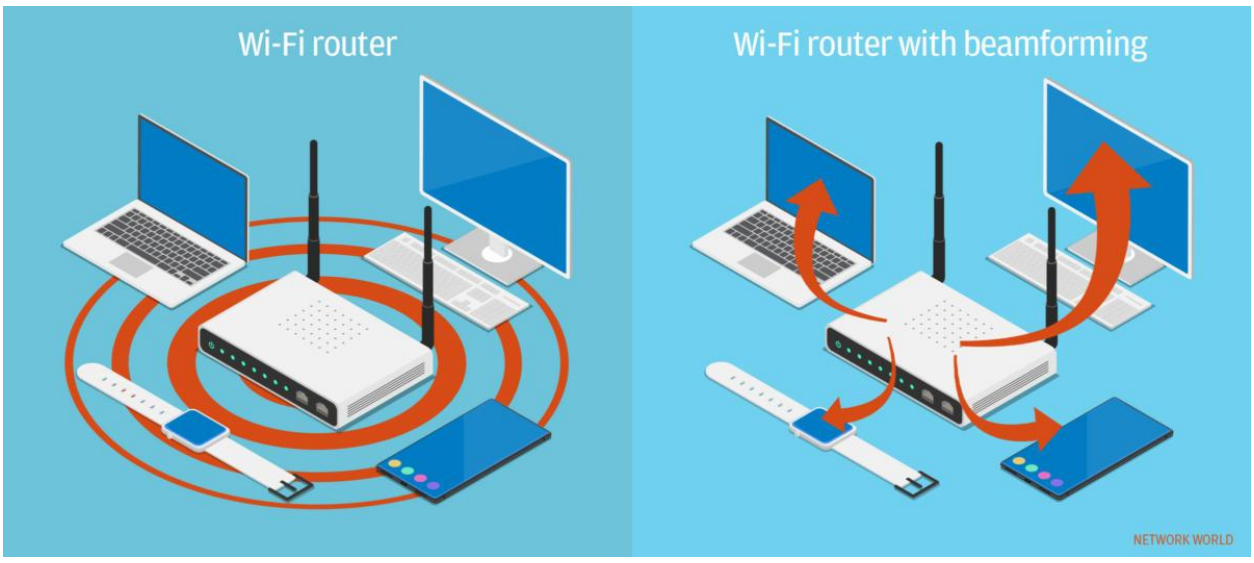

Figure 2

Disadvantages and Challenges of 5G
There are a few main disadvantages when it comes to 5G coming out, but keep in mind that as time goes on solutions will come out for these problems. One major disadvantage is that an increase in bandwidth will mean less coverage. The last network that needed the least amount of

cell towers for coverage was 2G, since then more cell towers are needed. To go along with this point, these cell towers are already connected to an overwhelming amount of signals, so as more people get connected to 5G we will see if the traffic will become a problem. Some problems that come with releasing 5G is that it needs to be flexible with other communication infrastructures, so that the network can have its global access. Also the network will need to be compatible with systems on previous networks. I believe these problems will exist when 5G first comes out, although I don't think it will be long till there are solutions.

Conclusion

All in all, 5G will be one of the most important changes to our world. It will allow for more efficient technological advancements. There are some negatives when it comes to 5G, but nothing that outweighs the positives. Compared to 4G, 5G will be 10 times faster when trying to load or do anything on a machine. 5G may seem like a basic internet feature for downloading things, although it will be the building block to making smart cities along with stable companies. Overall 5G will be the biggest technological advancement transforming the way the world runs.

References

"Millimeter Wave Mobile Communications for 5G Cellular: It Will Work!" *IEEE Xplore*, ieeexplore.ieee.org/abstract/document/6515173.

Agarwal, Arun, and Kabita Agarwal. "Evolution of Mobile Communication Technology towards 5G Networks and Challenges." *American Journal of Electrical and Electronic Engineering*, 4 July 2019.

Storck, Carlos, and Fatima Duarte-Figuieiredo. "A 5G V2X Ecosystem Providing Internet of Vehicles." *MDPI*, 29 Jan. 2019.