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We often don’t pay attention to the bars on the top right of our phones unless our internet is running slower. An immediate connection can be made when we see 4G vs 3G or even 1X. The higher the number, the faster the Youtube video will load. This is because of what the numbers represent, generations. Each improving on the next and creating a standard for each new generation to come. With 5G fast approaching, it is important to know how it works, the benefits that this type of connection will bring and potential consequences that this type of connection can imply. As we learn about the benefits, consequences, and latest news around 5G technology we will explore what can be of our future with such power, however, it is important to remember a golden question. Are we moving too fast? Allowing for the law and research to catch up with technology can sometimes be a good long term idea, or is the benefits just too good for us to deny it to the public?

Having an internet connection is no longer a novelty for us, it is more of an expectation. Every new phone that reaches our hands must play our videos without much trouble. However, this wasn’t the case in 1979 when the first generation of phone connection was released in Tokyo (Mercer, 2018.). By 1984 the whole world was now connected over the first generation connection with the US joining the world in 1983 (Mercer, 2018.). As many people mistakenly think however, connection over the Nth-generation doesn’t mean it is different levels of internet connection. The first generation, for example, allowed the connection for analog voice calls(Fendelman, 2019.). The speeds allowed through this generation was 2.4 kbps(Fendelman, 2019.). The second generation of phone connection was introduced in Finland in 1991 on the Global System for Mobile Communication (GSM). “The 2G telephone technology introduced call and text encryption, along with data services such as SMS, picture messages, and MMS”, which ran on speeds that ranged between 50 Kbps to 1 Mbps. (Fendelman, 2019.). In 1998, the third generation that we are more familiar with, only when our 4G is not working, was released. This generation is known as the “mobile broadband” generation as it brought faster speeds that would allow for video calls and mobile internet access. The speeds allowed by this generation were up to 2 Mbps(Fendelman, 2019.). This brings us up to date to our currently used generation, 4G. The fourth generation, 4G for short, was released in 2008 and allows more data intensive actions like that of “gaming services, HD mobile TV, video conferencing, 3D TV” and much more(Fendelman, 2019.). 4G allows us to surf the web at 100 Mbps while in a moving vehicle to 1Gbps while stationary(Fendelman, 2019.).

The quick history lesson on different phone generations now allows the understanding of what 5G is. 5G is the fifth generation phone connection that is currently being implemented and released sometime this year or in 2020. The maximum speed that is currently being theorised is between 10 to 20 Gbps, a 10-20 time improvement on current 4G networks (de Looper, 2019.) . However, there are some drawbacks to this kind of connection. The main problem with 5G is actually how it makes such fast speeds possible. 5G runs on a frequency that only allows it to go a block or two, and has much trouble getting through walls. This is why the network has to rely on three different frequencies to make sure you are always connected. The first is low-band spectrum, which current 4G LTE is running on, however it runs at around 100 Mbps (de Looper, 2019.). The second is Mid-band spectrum which will allow the user to reach up to 1 Gbps, however, this spectrum fails to get through walls as well as low-band spectrum (de Looper, 2019.). The third, and most important, is high-band spectrum. High-band spectrum will allow a user to reach up to 10 Gbps, but this is the frequency that fails heavily at penetrating walls and can only go at most a mile away from its tower (de Looper, 2019.).

Even though the 5G network has not been publicly released yet, it has gotten heavy news attention lately. The reason being is that major phone companies are releasing phones that are 5G ready. These companies include, Samsung, Oppo, Huawei, Xiaomi, LG, and ZTE, and other companies like Sony and OnePlus are showing prototypes for phones to release this year (Tibken, 2019.). However, the big push in 5G has been coming from Asia. In Japan in September of 2018, “NTT DOCOMO successfully achieved 25–27 Gbps download speeds in a 5G trial with Mitsubishi Electric” (Fisher, 2019.). This allowed “DOCOMO and Toyota [to test] controlling a humanoid robot on 5G in November 2018. Toyota's robot, T-HR3, was initially tested using a wire but can now run remotely on 5G with low latency” (Fisher, 2019.). In South Korea the company SK Telecom is already providing enterprise solutions to connect to a 5G network in “six metropolitan areas: Busan, Incheon, Daegu, Daejeon, Ulsan, and Gwangju” (Fisher, 2019.). This came after the company successfully used 5G in their self-driving test suite K-city (Fisher, 2019.). This does not mean that the US is behind, but rather, “as early as 2008, NASA formulated a partnership with the Machine-to-Machine Intelligence (M2Mi) Corp, a platform for M2M and IoT development. This partnership was set up specifically to develop 5G technology” (Mercer, 2018.).

The potential that 5G can have on our society in general is very broad. The simplest things will now become a thing of expectation. For example, during a big event, current phones struggle to all connect to the same network, but with 5G it allows for a lot more devices to connect; ultimately, everyone in the event can be confident to do any activity on their phones. Another amazingly potential use case will be how this network will allow autonomous vehicles to communicate with each other in real-time (de Looper, 2019.). Each vehicle will be able to broadcast its next planned movements while other cars receive that information in a matter of milliseconds to be able to use that information to make the next best movement. A great example of this would be if a deer were to suddenly cross the street and a cars sensors detects that it needs to pull the brakes as fast as possible, other cars would then need to sense that they need to brake as well, but not by how much. This scenario leaves a lot of wasted seconds that would avoid a collision. With 5G all vehicles around it would instantly know the cars plans on braking to a complete stop, ultimately saving precious seconds that could mean life or death. In a more direct form of saving lives that 5G could innovate would be to allow remote surgery (de Looper, 2019.). With 5G’s extremely low latency, the difference in live video with what is happening in real life and what is shown on a screen, remote surgery can become possible. Improving the livelihood of remote areas and possibly saving thousands of lives. Another great area that will be improved because of 5G, but won’t exactly save lives but rather improve life efficiency, is that of the IoT world or Internet of Things (de Looper, 2019.). Allowing for more devices to be connected to the network with low latency will allow mass items to be equipped with connection and instantly be in sync with your life. For example, security cameras that need to stream and upload video can now do so with ease and with much higher quality straight to your phone, allowing you to protect your home better.

A consequence to this technology comes in its shortfalls of range. Because 5G can’t go far this will lead companies to try to build as many towers as possible in short ranges. This would mean that a small tower would need to be installed at least every mile in radius. LA is 503 sq miles, meaning that 503 small towers would need to be installed for full coverage of the city for use of the High-band spectrum. Not every neighborhood will be happy with living alongside a tower, especially if its most efficient right next to their home. Verizon has set up a way to remedy this problem by releasing the Verizon 5G Home device which will install inside the home (Fisher, 2019.). This would allow customers to install at their own will from within their home and allow for others to connect to it as well, increasing the 5G ecosystem. Even though people are starting to take action to prevent small 5G cell towers from being installed around their neighborhood, they are facing a lot of opposition from big companies and even the President. Very recently we got a very positive speech from President Trump about removing barriers from the FCC for 5G to take off. He implied that it is a representation of the U.S. culture and economy by saying that the push for 5G internet was “private sector driven and private sector led” (Haselton, 2019). He almost made it a duty for the American citizens to allow and push for 5G as he said “The race to 5G is a race America must win, It’s [a] race that we will win” (Haselton, 2019). On one hand the push will be a good thing as Trump says because “According to some estimates, the wireless industry plans to invest $275 billion in 5G networks, creating 3 million American jobs quickly, and adding $500 billion to our economy.” (Haselton, 2019). But on the other hand there we don’t really know the consequences these radio waves will have on our health. Regardless, there is a very active community of people who are finding ways to deny these small cells from being installed in their neighborhoods by writing letters of denial, educating the public, and even encouraging to make as many speeches as possible at events (“How to oppose 5G…”).

In conclusion, 5G is just another generation that will build on top of that of 4G capabilities. Saying it is just an update is an understatement, however, as the speeds will 10-20 times what 4G can currently offer. These speeds could mean life or death for so many people in vehicles or in remote areas that require remote surgery. With organizations like NASA testing 5G since 2008 and so many other companies in Asia, one can agree that is it time for the technology to be released to the public. Companies like Verizon, AT&T, and so many others are making this happen by releasing 5G capable phones, and home installable networks before the network is even officially released. The technology is moving so fast and has well known penetration issues that people are already taking action to stop the spread of the small cell towers that will scattered at roughly every mile. With so much potential in the technology, multibillion dollar telecommunication companies, and the president backing the rise of 5G it will be interesting to see the fight of those worried about our health. As a last note, and even a fact to ponder, in the creation of this essay, Verizon, AT&T, and C Spire have prematurely and officially released their networks to compete with South Korea’s unexpected 5G network release (McCurry, 2019.). The race is on.

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