Luann Dias

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The Future of 5G and Mobile Applications

Abstract:

For my second paper this semester, I’ll be discussing about the future of 5G technology and how it will benefit mobile applications. It’s a new technology that’s currently growing and I’m curious to learn more about it. I’ll also be comparing and contrasting it with 3G and 4G and going over all its benefits.

Introduction:

Broadband cellular networks have been improving and increasing mobile devices drastically within the last few years. This telecommunication technology has been providing wireless network services for mobile devices to make calls, send messages, fixed wireless internet access, video calls, etc. As of recently, the newest generation of these cellular networks, originally introduced in 2016, is now being used widely for new mobile devices. 5G (short for fifth generation), is a new kind of network that is designed to connect everyone along with everything together virtually using computers and other devices. With its improved performance compared to its previous generation, 5G includes low latency, faster speeds, increased connection density, improved precision, along with several other technological advancements. However, 5G has been quite controversial within the last two years due to its consequences and side effects. Regardless of its downsides that we’ll be getting into, 5G is also known to improve mobile application experiences along with improvements for software development.

Technical / scientific Core:

The technological advancements of 5G have been astounding. By using Ultra-Reliable Low Latency Communication (URLLC), 5G’s low latency will aim to have an average latency of just one millisecond compared to 50 milliseconds from its predecessor. According to author Akhil Gupta, “Massive MIMO permits a substantial decrease in latency on the air interface.” (Gupta). MIMO stands for multiple-input and multiple-output that is used for radio link using cell towers. With these large number of cell towers and antennas, low latency gets decreased with 5G. Along with low latency, 5G has faster speeds that allows a smoother cellular connection experience. According to a research developed by OpenSignal, 5G smartphone users had and average download speed of 111.8 Mbps compared to 4G’s 75.8 Mbps, showing a 48% increase in download speed (MindInventory). 5G’s increased connection density can also support to almost a million devices which is a huge upgrade compared with 4G where they can only connect up to 2000 devices within 0.38 square miles. With an increased bandwidth, 5G will have better precision towards plenty of services such as GPS-enabled devices and artificial and virtual reality-based applications.

5G’s network architecture aimed to improve the wireless connectivity for its users. One of the main issues that current 4G users experience according to author Gupta, is that “most of the wireless users stay inside for approximately 80 percent of time and outside for approximately 20% of the time”. Indoor users unfortunately experience slower connectivity issues due to walls that decrease radio penetration. To improve this issue, 5G’s design was made so that it can detect whether the connection will be outside or inside for faster connectivity using massive amounts of MIMOs with hundreds of antennas. These antennas are setup around hexagonal cells and linked to a base station using optical fiber cables. Other facilitators such as Content Delivering Networks (CDN), traffic management, and big data-driven network intelligence supports the overall quality of experience and plays an important role in 5G’s design fundamentals.

For mobile application developers, 5G will be supporting user experience for various types of tasks. Mobile applications such as video streaming apps, AR and VR based apps, apps using 3D technology, GPS related apps, and cloud storage apps will be improved to help developers and their users. Developers will now be able to upload 4K videos with higher performance within their apps and they’ll now have a better chance to include AR and VR capabilities now that they’ll have faster network speeds. Navigation apps will also be improved with the proper precision and information delivery for the user. 5G so far is a huge improvement from its previous predecessors, 4G, 3G, 2G, and 1G, and yet, there has been a lot of controversy over its consequences.

Analysis, Discussion, and Conclusions:

As of last year, COVID-19 began to spread around the same time 5G started to dominate the technological industry. Because the pandemic was something new that the world hasn’t seen, conspiracy theories began to develop overtime and one of the most insane beliefs that people made was that 5G networks played an important role in spreading the virus. According to the World Health Organization, “Viruses cannot travel on radio waves/mobile networks. COVID-19 is spreading in many countries that do not have 5G mobile networks.” Other concerns such as radiofrequency radiation emitted by 5G cellular towers has also been a topic of discussion. According to author Marguerite Reardon, 5G is a non-ionizing radiation in the electromagnetic spectrum. Due to its lower frequencies and bigger wavelengths, 5G is harmless and in fact less harmful than radiation coming from FM radio, TV signals, and most cellular devices. Ionizing radiation emitted from medical x-rays and radioactive sources on the hand can be very harmful and 5G emits much less. Overall, it is too early to tell whether 5G radiofrequency will be harmful towards us in the long run since it’s a new technology, but the controversy towards it has been the same with every new generation of mobile broadband networks like 3G and 4G in the past.

Back in the 1980’s, 1G mobile networks was first introduced with data rates up to only 2.4kbps and had low security. Eventually 2G – 2.75G was introduced in the 1990’s that improved voice communication using Global System for Mobile communications (GSM) and was then merged with General Packet Radio Services (GPRS) with speeds ranging from 64kbps to 144kbps. Then in the late 2000’s, my personally first experience with 3G came along with improved performance from speeds ranging from 5 – 30 Mbps. As of now, 4G is the most widely used cellular network that was improved with what we know as Long-Term Evolution (LTE) that allowed for high-speed services. Now that there has been an increased demand, 5G is coming along and being improved with a new technology called Beam Division Multiple Access (BDMA). With BDMA, “an orthogonal beam is allocated to each mobile station and BDMA technique will divide that antenna beam according to locations of the mobile stations for giving multiple accesses to the mobile stations, which correspondingly increase the capacity of the system.” (Gupta). This will then improve its performance as discussed previously by having low latency, faster speeds, and increased connection density.

Overall, the future of 5G networks is looking bright and we’re only at the beginning. With mobile applications and devices, user experience will be improved with better performance, faster speeds, and low latency. 5G’s architecture is continuing to grow as MIMO systems expand. Despite all the controversy over this new technology, I honestly believe that we will be fine and have something to look forward to. Mobile application developers will also prosper with their applications now that they’ll have more capabilities with faster speeds. Applications such as AR and VR based-apps, navigation, and video streaming will have a noticeable difference.

Bibliography/References

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