

Impact of the 5G mobile network compared to the third and fourth generation

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ABSTRACT: Telecommunications networks have been with us for a long time, and every year new technologies emerge that make our day-to-day life easier. With the arrival of the third generation, we obtained an improvement in the internet service in the sense that we could obtain higher speeds. This gave way to a very wide path to continue with the networks. Thus comes the fourth generation network with the intention of being compatible, interoperable and convergent for all telecommunications services, also, with a high internet speed, greater capacity, improvements in its antennas and signal quality. One of its problems remains the unpredictability of its service as it is not entirely stable in its speed because it depends on the region and the users connected to the network. This article helps to know the characteristics of the third and fourth generation mobile networks, their evolution over time and talks about the changes and innovations that will bring the fifth generation mobile network (5G).

KEYWORDS: Mobile Network, Telecommunications, 3G, 4G, 5G.

1 INTRODUCTION

Mobile networks are important and have an impact on a wide range of sectors, from communication to the economy. For years, technology has been changing and the institutions and companies that adapt to it are progressing. Today, a large part of the world's population has mobile telephony. In fact, this technology is part of the tools necessary for day-to-day life. For example, a person who interacts with clients from a distance needs to use mobile networks to make video calls, send data via chat, call other countries, etc. And it is not only people interacting with remote users who use mobile networks, but also teachers, students, doctors, hoteliers, lawyers, police officers, etc. The reality is that, whether you use it or not, mobile telephony is part of everyday life in education, work, entertainment and communication in general.

5G technology is expected to introduce improvements across the entire network architecture. The new 5G radio, the global standard for a better 5G wireless air interface with higher capacity, will cover spectrum that 4G does not use, let alone 3G. The new antennas will implement technologies known as MIMO (multiple-input, multiple-output) en masse, allowing multiple transmitters and receivers to carry more data at the same time. But 5G technology is not confined to the new radio spectrum. It is envisioned to support a converged, heterogeneous network that combines licensed and unlicensed wireless technologies [1]. This will add bandwidth available to users without interruption. While, connected in real time with no perceptible delay.

The installation of microcells will also grow over the next few years. It is estimated that there will be around ten microcells for every macrocell in large urban areas. Microcells are used to obtain more and better coverage and network capacity. As microcells are closer to mobile users, phones will work more efficiently and data speeds will improve [2]. Microcells and macrocells provide area coverage and increase network capacity, this favors connectivity and coverage range to be always connected "without losing the internet", and this will be a new implementation of the internet (internet of things) in terms of structure and benefits.

The objective of this article is to investigate 3G, 4G mobile networks and their evolution in terms of characteristics, applications and the impact of the fifth generation mobile network, also taking into account the speeds, latencies, bandwidth, coverage and availability that imply their operability.

2 MOBILE NETWORK FUNDAMENTALS.

According to Vidal [3], a mobile network consists of a network of base stations that cover a delimited area (cell) and route communications in the form of radio waves to and from user terminals [4].

Mobile communications follow the general principle of telephony: connecting two remote users through the network equipment of an operator responsible for managing the service. However, unlike fixed telephones, in the mobile network there are no copper pairs or optical fiber, and radio transmissions constitute the final link. The user's cell phone communicates through the air with an antenna, which in turn communicates with the operator's central office [5]. The latter routes the communication to the corresponding part in the fixed network or through other antennas.

For communication to be effective, the mobile user must be in range of an antenna. This has a limited range and covers a small area around it, called a "cell" (hence the other name "cell of network" or "cellular network" often used to designate mobile networks).

So, mobile networks are those networks intended to allow the user's phone or equipment to move freely in the area covered by that network even while maintaining a conversation or data connection. A mobile network must allow movement even at the speed of a car without loss of connection. Current mobile networks allow this connection to be maintained even at the speed of a high-speed train with speeds in excess of 300 km/h.

3 METHODOLOGY

A qualitative theoretical research was established as a methodology, where the analytical-argumentative method was used as an example, to consider the benefit of 5G networks over 3G and 4G networks, considering the already existing infrastructures to implement the new mobile network, analyze the difficulties or limitations existing with the current networks, the information was collected in various consultations mentioned above. It is worth mentioning that this research, being qualitative, does not have a population and a sample as such. The mode of investigation involves studying the subject in general, covering the objective set. Information was taken from various sources to gather the necessary information. These sources consist of approved articles, journals.

4 COMPARISON OF DIFFERENT GENERATIONS

4.1 SPEED COMPARISON OF 3G, 4G AND 5G NETWORKS

The advances in 3G networks allow data transfer speeds ranging from 14.1 Mbps to 42 Mbps. These advances were the beginning of Internet browsing that allowed real-time interaction with different content and media on the network.

In the 4G network, data transfer speeds range from 100 Mbps to 1 Gbps using the IP protocol in its entirety. In general terms, it can be stated that 4G networks improve data transmission speeds, service quality, as well as data, internet and application reliability.

In addition, it is estimated that 5G networks will extend the probability of transferring more data and information at better speeds, around 1-10 Gbps, and will have lower latencies to obtain real-time performance [6].

4.2 BANDWIDTH

In terms of radio frequency, 3G networks operate in frequencies of 800 MHz, 850 MHz, 900 MHz, DCS 1800 MHz, PCS 1900 MHz and AWS 1700/2100 MHz, with a bandwidth ranging from 5 to 20 MHz.

Today the most developed commercial technology for providing wireless access services is LTE, generally known as 4G, which uses up to 20 MHz of spectrum.

5G networks require 100 MHz of radio frequency in mid-bands and 500 MHz of radio frequency in high bands, which is the aggregate amount of radio frequency required to be made available to the market for 5G networks. In distinction with 4G

networks it is in the order of 400 % in mid frequencies and 2400 % in high frequencies, something that is currently difficult to achieve [7].

4.3 USES OF DIFFERENTS NETWORKS

The third generation generated innovations with specialized voice services, faster Internet browsing, GPS systems as well as navigation maps, banking services and video calls.

With the arrival of 3G, the population saw a significant change in terms of speed, and a greater number of uses arrived with the start of the 4G network, for example, gaming services, HD mobile TV, videoconferencing, cloud computing, video broadcasting, as well as phones with a greater number of mobile movements and access to dynamic information.

The aspect of radio frequency allocation intended for 3G and 4G will serve to contrast the size of radio frequency that will be required for 5G network and hence support in understanding 5G in current state. The cell phone industry has pushed the 5G mobile data network as the most powerful network in terms of connectivity, and it is even expected that the 5G network will usher in a new era in the cell phone industry that will completely change the landscape of what we know today about mobile networks. The high speeds and low latencies of the 5G network are expected to be integrated into highly useful and reliable applications, such as medical applications, emergency electronic circuits, valve closures, as well as a variety of industrial and telecommunications applications.

4.4 NETWORK PROBLEMS

Our research provided evidence that the 3G network presents problems since its operation due to problems with the low internet speed, the inefficient amount of users it allows connected simultaneously and the poor coverage it has due to failures or lack of stable service.

Some of the problems present in the 4G network is one that has been delayed since the 3G network, which is the coverage issue, since not all geographical areas have this network, it supports more users connected at the same time, but still not enough. Another problem is that the 4G connection is only stable in cities and not in rural areas or when traveling by road.

In the case of 5G, being a generation in full growth, there will be multiple problems at the beginning, as in all previous networks, one of them will be the instability of the internet speed at the beginning due to the problem that there will not be enough infrastructure to provide 100% coverage, which will be solved as the investment is developed along with new knowledge and improvements in the network, also, possible internet leaks due to hackers for vulnerabilities that may still be unknown.

5 RESULTS

5.1 IMPACT OF THE 5G NETWORK ON SOCIETY

According to National Geographic (2019), the deployment of the fifth-generation mobile network will change the way we communicate, multiply the capacity of information highways and enable everyday objects, from refrigerators to cars, to connect (with us and with each other) in real time. Its deployment represents a true technological revolution that will make it possible, for example, to perform tele-assisted surgery, deploy new fleets of autonomous vehicles and coordinate agricultural work through sensors installed at different points in a field of crops.

The most significant advance will come from the hand of speed. 5G will allow browsing at up to 10 GBps (gigabytes per second), 10 times faster than the main fiber optic offers on the market. At that rate it will be possible, for example, to download an entire movie in a matter of seconds [8].

In addition, latency (network response time) will also experience significant progress. According to the operators, this could be reduced to 5 milliseconds, a period almost imperceptible to humans, allowing us to connect in almost real time. This is particularly important, for example, to minimize the response time of an autonomous vehicle in order to improve the safety of both the occupants and any surrounding pedestrians.

5.2 ANALYSIS

According to the research conducted, mobile networks went from being a way to communicate occasionally, as a last communication option, to being a necessity nowadays.

Based on the results provided in the research and documentation carried out, we can show that 5G networks will greatly reinforce the advances already achieved with 3G and 4G technology, since once it is fully operational the effects on our daily lives will be much more noticeable and satisfactory. For example, we will always be connected in real time and without any delay with all our devices at the same time.

6 CONCLUSION

The levels of network demand increased and with this new needs arise, problems that the 3G and 4G network present, the 5G network promises to solve, for example, greater connectivity of devices simultaneously, better quality of internet service with the lowest possible latency and a higher speed than the current one or with optical fiber. In addition, the 5G network will provide solutions to problems that have been present since 3G and much earlier, all of them are expected to be solved, not to mention that energy usage will be reduced by 90%.

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