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## THE VISION OF FUTURE: 5G

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### ABSTRACT

As a result of consistent developments and improvements ever since the first-generation technology, we have moved to an optimal technology which is known as the Fifth-generation technology system. Although it is making the human generation more dependent but it is proving out to be much more advantageous in human lives. The primary purpose of the study in this paper is to explore the various 5G activities by reviewing a wide range of research projects, recent literature and 5G white papers from key players in the wireless technology. The intention is to help to understand what 5G is about and how different 5G initiatives aim at getting there. The Rising worldwide adoption of internet-enabled devices is expected to drive the industry. These include autonomous driving, distant learning, video conferencing & multi-user gaming, telemedicine, and opera live streaming. In this Research Paper we have talked about 5G, its application in Auto driven cars and Drones, Fog clouding, Security issues with 5G, Health effects and its expected performance.

Keywords: 5G, Wireless Technology, 5G and Autonomous driving, 5G and Drones, Security issues of 5G, Health effects of 5G.

## 1. INTRODUCTION

In today's technology-driven world where from human communication to objects everything is dependent on the internet, we have come a long way starting from 1G (launched in 1979) to 5G. A property based table about the various technology generations is given follow:

ICT Generations	Related Technologies	Feature	Maximum Speed
1 G	AMPS (Advanced Mobile Phone Service)	Voice only	2.4 Kbps
1.5 G	CDMA (Code Division Multiple Access)	Voice only	9.2 Kbps
2.0 G	TDMA (Time division Multiple Access), PDA (Personal Digital Cellular)	Voice calls, SMS and MMS	50 Kbps.
3G	WCDMA (Wideband Code Division Multiple Access)	Voice calls, SMS and MMS, Mobile Data, Video calling	2 Mbps
4G	IP based packet switching	Voice calls, SMS and MMS, Mobile, Data, Video calling, Gaming services, HD mobile TV, video conferencing	100 Mbps

5G is the term used to describe the next generation of mobile networks beyond 4G networks. 5G will upgrade the level of the mobile network to not only connect the people with each other but also to connect and control machines and devices. It incorporates all types of advanced features that make it powerful and in huge demand in the near future.

The devices connected by the internet are constantly increasing as IoT and machine learning are coming into the picture, they create a connection between the physical and digital world. But with a large scale of growth and increased complexity, there is supposed to be a technology that can help manipulate this amount of large and complex data and make it available for us on time. 5G will give a very high speed of internet in Gbps peak rates, ultra- low latency, great capacity, and more smooth user experience. Its ability to connect a high number of devices makes it unique itself. 5G networks will help power a huge rise of the Internet of Things (IoT) innovations, providing the infrastructure needed to carry huge amounts of data and allowing for an even smarter, more connected world. 5g will provide better network and coverage along with infinite data broadcast together.

The 5th wireless mobile internet networks are real wireless world which shall be supported by MC-CDMA (Multi-Carrier Code Division Multiple Access), LAS- CDMA (Large Area Synchronized Code-Division Multiple Access), OFDM (Orthogonal frequency- division multiplexing), MC-CDMA (Multi-Carrier Code Division Multiple Access), UWB (Ultra wideband), Network-LMDS (Local Multipoint Distribution Service), and IPv6. In a 5G wireless network, every mobile phone will have an IPv6 address depending on the location and network being used.

Today 5G is available only in some countries like Australia, Canada, Germany, Italy, China, Russia, the United States, South Africa, South Korea (Republic of Korea), United Kingdom, Japan, United States. Companies like Qualcomm, Nokia, Verizon, Sprint, T-Mobile and AT&T are working to bring up this technology.

## 2. AUTODRIVEN CARS AND DRONES

For the purpose of research, our team started analysing data sets based on auto driven cars and electronic drones and the studies suggested that there is an optimal use of the technology to administrate these technologies but there are still concerns surrounding driverless cars, a recent fatal accident by an autonomous Uber vehicle has many questioning if autonomous cars will ever be safe enough to feel confident with them sharing our roads. The analysis of this study made it clear for us to conclude that there were issues between various ends of this technology either to coordinate or to retrieve data from the base database which is continuously changing, this study was followed by an analysis on the 4G network system which showed it is an IP based packet switching with a maximum of 100Mbps and which eventually made us conclude that the problem arises once the data is being retrieved from the base database i.e., it takes time to retrieve this data and act upon it which was because of the slow speed of the 4G network than required. The 4G network is fast enough to online stream full HD content and play online games, but it can't support safer and smarter autonomous cars. It was said in a conference that " we need to look at how long it takes for the message to be transmitted between sensors and then get to the computer in each car, and then how long it takes for the computer to make a decision, and all of this has to be in less time than a human would take to make a decision—2 milliseconds. We need a network supporting this, and 5G is that network.

This research was followed by a study on electronic drones that require high-speed internet connectivity for performing operations like command and control, media sharing and autonomous flying. Drones are constantly improved to perform tasks like delivery, disaster recovery, precision agriculture, inspection of oil, and even defence, so this technology also needs a similar network for constant management and data connectivity, which is expected to be provided to an optimum rate by the 5G network. It is predicted that 5G, when adopted at the full scale, will offer internet speeds up to 100 times faster than 4G. It will present exciting possibilities for the automobile industry used for vehicle-to-vehicle (V2V) and vehicle-to-everything (V2X) connectivity. Furthermore, the technology's low latency will make these vehicles extraordinarily safe and reliable on the roads—safer than vehicles today that are operated by people. This fifth- generation wireless technology is expected to connect almost everything around us with an ultra- fast, highly reliable, and fully responsive network. 5G will allow us to leverage the full potential of advanced technologies such as artificial intelligence, virtual reality, and the Internet of Things (IoT).

## 3. FOG Clouding with 5G

### 3.1 Need of Fog Computing in 5G network

Fifth generation (5G) cellular network offers its users with low latency and high data transfer. Although 5G provides high-frequency millimeter waves and low latency radio interfaces provide sub-millisecond communication, the cloud-based computation and data delivery model do not allow 5G services to be used efficiently, due to the number of hops of wired networks between the 5G-base stations and the cloud, that leads to a significant increase in latency.

All the data generated by devices that is transferred to the cloud may consume the bandwidth and lead to congestion. Therefore, it is necessary that processing be hosted near the devices, close to the source of the data, so that the high speed transmission of 5G can be utilized and data can be processed and filtered out by the time it reaches the cloud. This can be accomplished with fog computing.

### 3.2 What is Fog Computing?

Fog computing, also called fog networking or fogging, describes a decentralized computing structure located between the cloud data centres and devices that produce data. This flexible structure enables users to place resources, including applications and the data they produce, in logical locations to enhance performance.

Fog computing supports time-critical applications that require sub-millisecond reaction time that is demand of 5G network. Autonomous vehicles, emergency responsiveness, drones and virtual reality are among the dozens of applications that require rapid latency.

<sup>[9]</sup> For example, a drone can travel at 100 miles per hour, or roughly 147 feet per second. During its journey, it requires continuous software updates, produces massive amounts of data that require computation and communication. If you consider that the best cloud round-trip latency is around 80 milliseconds, the drone would fly about 12 feet between cloud messages. Fog nodes can reduce the latency to such a degree that a drone will only travel two inches before the next update is delivered.

### 3.3 Small cells and F-RAN

Fog computing can be enabled in 5G with the use of "small cells". Small cell is a term for low-powered radio access nodes and have a range between 10 meters and two kilometres.

<sup>[10]</sup> From the viewpoint of fog computing, both small and macro-based stations can be leveraged to achieve the ultra-low latency demanded by 5G networks. These network nodes could provide storage and computation power too. A fog computing-based radio access network (F-RAN) could provide 5G networks with high spectral and energy efficiency as well, drawing from capabilities in edge devices like local radio signal processing and distributed storage.

### 3.4 Challenges

Along with several benefits of fog computing, it has some challenges. It faces Security and privacy issues due to certain features of the technology, such as mobility, heterogeneity and geographical distribution. Additionally, testing and auditing it can be expensive and complicated on account of the distribution of hardware and poor network connectivity.

## 4. Security Concerns of 5G

<sup>[11]</sup> Mobile network operators are mostly running 5G non-standalone networks (NSA), which are based on 4G LTE infrastructure. Positive Technologies said these 5G NSA networks are at risk of attack because of long-standing vulnerabilities in the Diameter and GTP protocols, which were reported on by Positive Technologies earlier this year. Vulnerabilities and threats for subscribers and mobile network operators stem from the use of new standalone 5G network cores. The vulnerabilities in protocols HTTP/2 and PFCP, used by standalone 5G networks, include the theft of subscriber profile data, impersonation attacks and faking subscriber authentication.

The stack of 5G technologies potentially leaves the door open to attacks on subscribers and the operator's network. Such attacks can be performed from the international roaming network, the operator's network, or partner networks that provide access to services. For example, the Packet Forwarding Control Protocol (PFCP) that is used to make subscriber connections has several potential vulnerabilities such as denial of service, cutting subscriber access to the internet and redirecting traffic to an attacker, allowing them to downlink the data of a subscriber. Correct configuration of the architecture as highlighted in Positive Technologies GTP protocol research can stop these types of attacks.

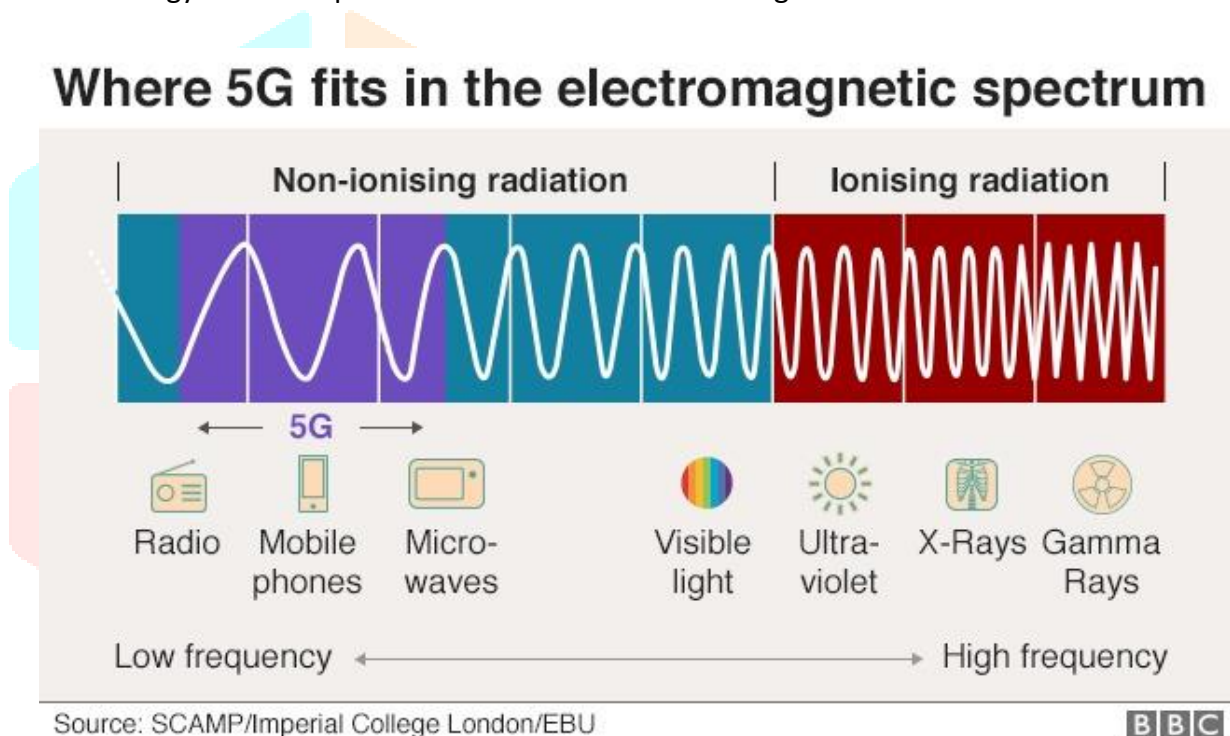
The HTTP/2 protocol, which is responsible for vital network functions (NFs) that register and store profiles on 5G networks, also contains several vulnerabilities. Using these vulnerabilities, attackers

could obtain the NF profile and impersonate any network service using details such as authentication status, current location, and subscriber settings for network access. Attackers can also delete NF profiles potentially causing financial losses and damaging subscriber trust. In these cases, subscribers will be unable to take action against threats that lurk on the network, so operators need to have sufficient visibility to safeguard against these attacks.

## 5. Health effects of 5G

5G network works by producing a type of energy called electromagnetic radiation. It uses higher frequencies than previous wireless networks, making it faster and more efficient. This raises a concern about how 5G affects health.

<sup>[12]</sup> In 2011, WHO together with the International Agency for Research on Cancer (IARC) classified EMFs are “possibly carcinogenic” to humans. According to David Robert Grimes, physicist and cancer researcher, the radio wave band used for mobile phone networks is non-ionising which means it lacks sufficient energy to break apart DNA and cause cellular damage.



A part of the 5G spectrum falls within the microwave band. Microwaves generate heat in objects through which they pass. <sup>[12]</sup> At these levels, that is used for 5G and earlier mobile technologies, the maximum radio frequency level is so small that no temperature rise has been observed to date, says Prof Rodney Croft, an adviser to the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

<sup>[13]</sup> A new report by Deloitte titled Technology, Media, and Telecommunications Predictions 2021 says that the fears around 5G are hype. The report notes that the most common perception about 5G is that it causes cancer, and the second fear is that 5G-emitted radiation weakens the immune system. 5G does generate radiation, but at very safe levels, and none of it is radioactive radiation. 5G base stations, phones, and the frequency ranges, are very likely to be operating well within safe parameters. The power transmission from mobile telephony, including 5G, is far lower than that from light bulbs, TV, radio towers, or even sunlight on an overcast day. By design, 5G is more effective than all previous mobile technologies. It not only ensures higher speeds and low-latency, but the technology also uses less power than 4G or 3G, and thereby emits lesser power. 5G base stations also can be put into sleep

mode when there are no active users, for example, at night. This capability is not available with 4G networks, which transmit control signals even when there are no users in range, the report says.

As a result, there is no solid evidence that 5G causes negative health effects in humans or animals. Though more studies are needed to understand 5G.

## 6. Expected 5G performance

5G networks will help power a huge rise of the Internet of Things (IoT) innovations, providing the infrastructure needed to carry huge amounts of data and allowing for an even smarter, more connected world. Speedier connections that stay online no matter where you are and average download speeds of around 1 Gbps are expected to be the norm. Speed and streaming often top the list here, since improvements over 4G downloads combined with 4K streaming are big draws for consumers and C-suite members alike. 5G also offers connection reliability even when users are indoors or in congested areas, while bandwidth improvements significantly increase the total allowable number of connected devices.

The initial wave of 5G smartphones expected will be able to reach peak speeds of up to 5 Gbps. As networks and chipsets mature, peak speeds of tens (or even hundreds) of gigabits per second will theoretically be achievable and devices capable of 10-20 Gbps are expected in the next 5 years. In comparison, the fastest 4G LTE networks in the world are breaking the 1 Gbps mark and the latest 4G LTE devices are capable of reaching 1.4 Gbps.

## 7. Result and conclusion

An analysis of the research on the 5G network suggests that the partially installed network system is highly expected to enhance the whole networking and management of the technology system, from helping better coordination between various ends of the technology, it is expected not only to improve the technological system but also to enrich human living by giving foundational infrastructure for building smart living standards like smart cities, auto driven cars, learned drones etc. An improved internet experience for using the internet for streaming, video and audio calling. Its application is expected to make a world real Wi-Fi zone. Also, it will facilitate people to avail of radio signals at higher altitudes as well. Businesses, city developers, and other industrial enterprises are expected to connect more devices with better capability, for much less – all with the power of 5G speeds at their fingertips.

## 8. References

1. A Text Book of Research Papers On 4G & 5G Technologies and its Applications on Online Learning and Banking Book · April 2018 By Krishna Prasad Karani (Page 67- 69)
2. Conference Paper - 1st International Conference on 5G for Ubiquitous Connectivity (5GU), At Levi, Finland (DOI: 10.4108/icst.5gu.2014.258061) Author - Pekka Pirinen
3. ICT Express (Volume 1, Issue 3, December 2015, Pages 132-137); 5G mobile technology: A survey
4. International Journal of Scientific Engineering and Technology ISSN: 2277-1581, Volume No. 7, Issue No. 7, PP : 62-64
5. G WIRELESS COMMUNICATION IEEE PAPER 2018
6. International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056 Volume: 03 Issue: 04 | April-2016
7. International Journal of Computer Science and Mobile Computing A Monthly Journal of Computer Science and Information Technology ISSN 2320–088X IJCSMC, Vol. 3, Issue. 3, March 2014, pg.1080 – 1087
8. A. Campanaro, —What is 5G? The next wireless revolution Explained,||
9. Fog computing is the future of the cloud in the 5G/IoT world, By Lynne Canavan on January 13, 2017
10. The role of fog computing in 5G, By Nathan Cranford on January 31, 2018
11. 5G Security Vulnerabilities detailed by Positive Technologies; ITU-T and 3GPP 5G Security specs, By Alan Weissberger on December 17, 2020
12. Does 5G pose health risks?, By Reality Check team BBC News on July 15, 2019
13. 5G poses no health risks, new report debunks fears, By Manu Kaushik on January 24, 2021