



THE ROAD TOWARDS 6G

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Abstract:

Each new day in the modern era ushers in the introduction of recently developed technologies and upgraded software. Similar to this, the emergence of new generations is accompanied by a constant evolution of the mobile network (Wireless Communication). It started out as 1G (short for "First Generation") and has since been updated to 5G (short for "Fifth Generation"). Several countries are currently using 5G, and it is currently reaching a very large number of subscribers. It offers assistance to all business sectors, as well as to academic institutions and other service industries. Even though 5G has a lot of impressive and practical features, it won't be able to keep up with the escalating demands for wireless communication. This is true even though 5G has numerous features in each area. The Sixth Generation, also known as 6G, is the result of this. This article primarily focuses on the questions of "Do we really need 6G?" and "Is 5G already enough?" as well as the shortcomings of 5G and the emergence of 6G as well as its uses and advantages.

Keywords: 5g, 6g, Artificial Intelligence (Ai), Quality Of Service (Qos), Wireless Network Communication.

I. INTRODUCTION

The mobile network is a type of wireless communication network that, by facilitating the transmission of radio waves, makes it simpler for users to send and receive data with one another. The term "wireless communication" can also be used to refer to the mobile network. It morphs into a platform that can distribute applications and makes them available to anyone and everyone. The first generation of mobile networks was introduced in the beginning, and as of right now, those networks are in the process of being upgraded to the fifth generation, which is scheduled to begin on October 1, 2022. The Internet of Everything (IoE), virtual reality (VR), three-dimensional (3D) media, and various other technologies and applications that are rapidly developing all contribute to the enormous volume of traffic that is currently being experienced. In 2010, it was estimated that global mobile traffic was 7.462 exabytes per month, and it is anticipated that this amount will increase to 5016 exabytes per month by the year 2030. These statistics can be used as evidence to support the contention that there is an immediate requirement for improvements to be made to the existing communication systems.

Current 5th Generation networks will not be capable of delivering a fully automated, intelligent network that provides everything as a service because it is currently not feasible to implement such a network. Even though the 5G communication systems will have a significant performance advantage over the ones that are currently in use, in ten years they won't be able to satisfy the requirements of newly developed intelligent and automated systems. This is as a result of the fact that 5G communication systems offer the most significant and beneficial improvements over the systems that are currently in use.

II. 5th GENERATION (5G)

The acronym 5G stands for the fifth generation of wireless cellular technology. Compared to the current 4G network, it is faster and more dependable. It has a sizable potential to fundamentally alter how we access the programmes, data, and social networks that are accessible via the internet. This one offers a connection that is more reliable and boosts the capacity of the networks in comparison to the ones that came before it.

For example: Live streaming media, advanced gaming applications, and self-driving cars all required a data connection that was very reliable and very fast. As a result of factors such as these, a 5G network offers more advantages.

India's Prime Minister Narendra Modi was the one to formally launch the 5G service in his nation on October 1, 2022. The only two telecom companies in the nation currently providing their customers with a 5G network are Bharti Airtel and Reliance Jio. South Korea became the first nation in the world to widely deploy 5G in April 2019. Software for 5G networks is being developed by Saankhya labs. TCS is the system integrator because it is assembling the various parts, including software and hardware, on an O-RAN platform.

Analyst Prakash Sangam is a member of the board of directors for the Wireless Communications Alliance, which was in charge of planning the event that took place on February 16 in the US. He moderated the conversation and stated that monetization is still a problem for operators. He acknowledged the current commercial difficulties brought on by 5G. Fixed wireless access, limitless offering options, and other related services could develop into new revenue streams. They continue to investigate various strategies, though, to profit from all of their investments. It is still unknown whether 5G will fulfil its lofty promises, such as the widespread adoption of IoT technology in commercial settings.

III. MAJOR PURPOSES OF 5G

In comparison to wireless communications of the fourth generation (4G), the fifth-generation (5G) network will provide new features in addition to a higher quality of service (QoS). The integration of licenced and unlicensed bands, advanced spectrum usage and management, and the addition of new frequency bands like millimeter-wave (mmWave) and optical spectra are some of the new additional techniques that are included in 5G technology. The network's capacity is very large. It is more dependable. It has incredibly little latency. The 5th Generation is intended to perform these key tasks, among others: deliver high peak data speeds of multiple gigabits per second (Gbps), possess enormous network capacities, be more dependable, and have extremely low latency.

New user experiences will be possible as a result of the increased functionality and productivity, which will also link previously unrelated industries.

IV. WHY NOT 5TH GENERATION (5G)

When 5G technologies are used, there are a number of trade-offs that must be made. Throughput, lag, energy efficiency, deployment costs, dependability, and hardware complexity are a few of these. Their research indicates that 5G won't be able to meet market demands past the year 2030. Other significant drawbacks of 5th Generation network technologies include the following:

- Despite being available everywhere, it is only provided in a few places, so it does not offer adequate coverage all over the world. Cities will reap the greatest rewards from it, whereas more rural areas may not be covered.
- In comparison to other networks, installing a tower station is relatively expensive.
- In order to achieve its high speed, it needs a sizable structure and trees, both of which could block a 5 Gigabit per second bandwidth. It is causing a large number of problems. To increase their coverage, more towers must be installed, which is costly and time-consuming. But this is the only answer to the issue.
- The capacity of electronic device batteries will decrease as a result of the 5G network's process of draining their power. The manufacturer will need to invest in cutting-edge battery technology in order to achieve this in order to get rid of battery brokerage and other problems.
- The biggest drawback of 5G networks is their vulnerability to hacking, which gives thieves access to more data thanks to the increased bandwidth.
- It has software that exposes it to potentially harmful attacks.

V. THE EMERGENCE OF 6G

Prior to the last ten years, "BEYOND 4G," also known as "B4G," referred to the most recent and sophisticated 4th Generation. The 5th Generation was eventually born as a result of it continuing for a while. Similar to B4G, BEYOND 5G (B5G) is thought to be the path that will develop wireless communication of the 6th Generation. Due to the numerous technological advantages and upcoming demands, 6G is anticipated to become commercially available in the year 2030.

VI. SIXTH GENERATION (6G):

A 6G cellular network is one that operates in radio frequencies that have not yet been utilised, and it makes use of technologies that are analogous to artificial intelligence in order to achieve high speeds. This type of network is referred to as the sixth generation of cellular networks. The speed difference between 5G and 6G was hypothesised to be one hundred times greater in 6G. The 6G wireless communication network will use a different frequency to measure absorption, which will help in the monitoring of health as well as the making of decisions in areas such as the legal system and the social credit system. In addition, the 6G wireless communication network will use a different frequency to communicate with devices. The implementation of 6G will have a significant impact on the strategies that governments and industries employ to guarantee the public's safety and protection. Because China was able to successfully launch a satellite on November 6th, 2020 that contained a candidate for the 6G technology, it was able to acquire the largest share of the 6G patent out of the selected regions. This enabled China to acquire the largest share of the 6G patent. The satellite was able to be put into orbit without any problems. A vision document has been presented by the Bharat 6G mission in India. In the document, it is stated that the first phase of 6G will be seen in 2023, and that the second phase will follow after that.

It is anticipated that the market for 6G technology will make it possible for significant advancements to be made in the areas of imaging, technologies that are currently in use, and location awareness. Working in tandem with artificial intelligence (AI), the 6G computational infrastructure will be able to determine the optimal location at which computing should take place. This will involve making choices about the storage, processing, and distribution of data. It is absolutely necessary to bear in mind that the 6G standard is not yet a fully functional technology at this time. Even though some manufacturers have already started investing in the next-generation wireless standard, the industry standards for products that are enabled with 6G networks are still several years away. Some manufacturers have already started investing in the next-generation wireless standard.

Dan Warren is the individual who serves in the role of Director of Advanced Network Research at the Samsung R&D UK facility. He stated that we have recently established a 6G research team and that we are currently in the preliminary stages of considering what advantages 6G has over 5G in terms of technological advancements. He also stated that we are in the process of developing a 6G research platform.

VII. COMPARISON BETWEEN 5G AND 6G:

- Because 6G operates at a higher frequency than 5G, it can achieve higher sample rates.
- Mobile edge computing is expected to be a standard feature of all 6G networks, as opposed to being an optional upgrade for current 5G networks.
- Access points in 6G will have access to orthogonal frequency-division multiple access, which is not possible in 5G and allows them to serve multiple clients at once. As opposed to 5G, which can only serve one client at a time, this is possible. These specialisations have caused the Sixth Generation to start growing, and by 2030, it will have ruled the entire planet.

VIII. HOW WILL 6G WORK?

It is reasonable to assume that 6G networks will utilise extremely high frequencies of the radio spectrum given that they will be considerably faster than their predecessors. The 6G uses high radio frequencies and is higher up on the radio spectrum than the 5G, which has a smaller bandwidth capacity, so it can carry more data. 6G will operate at frequencies as high as 300 gigahertz, or even in the terahertz range, which is very close to the top of the radio spectrum.[4] By concentrating on the following areas, 6G will have significant effects on both the public and private sectors:

- The detection of potential threats.
- Monitoring the patient's condition.
- Recognition of faces.
- The decision-making process in areas like law enforcement and social credit systems.
- Obtaining readings to assess the air quality.

IX. NEED FOR SIXTH GENERATION (6G):

There is a wealth of evidence that supports the requirement of Sixth Generation. The following are some of the most important requirements that must be met:

- The convergence of technologies The sixth generation (6G) of cellular networks will integrate technologies that were developed in the past in a piecemeal fashion. Deep learning and analytics on large amounts of data are two of these technologies.
- Edge computing: The requirement to implement edge computing is one of the most important drivers of 6G. This is because edge computing is necessary in order to guarantee overall throughput and low latency for communications solutions that are ultrareliable and low-latency.
- Internet of things (IoT): Another one of the primary motivating factors behind the development of 6G is to offer support for machine-to-machine communication in IoT. This is one of the primary motivating factors behind the development of 6G.
- High-performance computing (HPC): It has been discovered that there is a significant connection between 6G and HPC. Although some of the data generated by mobile and Internet of Things devices will be processed by edge computing resources, the majority of it will need to be processed by more centralised high-performance computing (HPC) resources. This is because edge computing resources are not as powerful as HPC resources.
- The impact of 6G technology is primarily felt across four significant pillars of the evolution of the future. Some of these keys include global coverage, a variety of spectra, an assortment of new applications and services, and robust security.
- Ben Coffin has a degree in wireless engineering and works for the company Keysight Technologies, which specialises in testing and measurement. In addition, he holds the position of Solutions Marketing Manager for Advanced Wireless at Keysight Technologies. In addition to the benefits for technology, he lauded the positive effects that increased communication speeds and bandwidth would have on society.

These include the following:

When we think about 6G, we think about the unification of a lot of different moving parts that are already present in the ecosystem. Not only is it a connection between the physical and digital worlds, but it is also a connection between the digital world and the world in which humans live. It is essential to have an understanding of both aspects, whether we are talking about sustainability or simply the connectivity vertical and what the people's access means to them.

X. PROSPECTUS AND APPLICATIONS OF SIXTH GENERATION (6G):

The 6G communication systems' artificial intelligence component has been fully integrated. AI will be incorporated into every aspect of network instrumentation, management, physical-layer signal processing, resource management, service-based communications, and so forth in the sixth generation of network communication. This development aids the revolution known as Industry 4.0, which is the digital transformation of industrial manufacturing.

- A Very Intelligent Culture
- Extensions for virtual reality
- Internet-connected robots and self-driving vehicles
- The relationship between the brain and wireless computers
- Touch as a Means of Communication
- Biomedical Information Communication and Intelligent Healthcare
- Industrialization and Production Techniques
- Data Collected Using All Five Senses
- Everything is Internet-connected

Industry experts Josep Jornet and Paul Challoner, who both attended the 6GSymposium Fall 2022 in Washington, D.C., discussed what is being done in 6G fields like the Internet of Nano-Things, Non-Terrestrial Networks, new Materials, and even biosensing.

XI. CONCLUSION:

Exciting new features are added with every new generation of communication technology. The 5G communication system, which was formally introduced to the world in 2020, has a wide range of exceptional and unique features. However, 5G won't be fully able to meet the growing demand for wireless communication by the year 2030. The rollout of 6G is necessary as a result. 6G technology research and development are currently in their early stages. The prime minister of India launched 6G research and development test projects and provided funding for them totaling about \$481.7 million. These 6G technology projects help India keep the top spot in the world's network infrastructure rankings.

REFERENCES:

- [1] <https://ieeexplore.ieee.org/abstract/document/9144301>
- [2] <https://ieeexplore.ieee.org/abstract/document/9003619>
- [3] <https://ieeexplore.ieee.org/abstract/document/8808168>
- [4] <https://blog.peigenesis.com/the-emergence-of-6g-technology-what-it-is-and-how-it-works>
- [5] <https://ieeexplore.ieee.org/abstract/document/9349624>
- [6] <https://www.techtarget.com/searchnetworking/definition/6G>
- [7] <https://futurenetworks.ieee.org/tech-focus/ten-experts-get-real-with-5g-in-2022>
- [8] <https://diginomica.com/plan-now-6g-expert-panel-says>
- [9] <https://technologymagazine.com/articles/6g-predictions-for-the-network-of-the-future>
- [10] <https://hcis-journal.springeropen.com/articles/10.1186/s13673-020-00258-2>