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A STATE-OF-THE-ART REVIEW OF NETWORK AND MOBILE COMMUNICATION TECHNOLOGIES

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Abstract:

For several decades, wireless network technology has been evolving and evolving through various iterations. The enormous need for more connections around the world has sped up the development of wireless network standards in order to accommodate the growing user base. With the advent of the third-generation (3G) mobile communication infrastructure and the ability to develop apps especially for smartphones, the popularity of smartphones worldwide expanded considerably. Fourth-generation (4G) networks provide faster data transmission speeds and support richer multimedia applications than their 3G predecessors. Globally, the current 4G standard will be replaced by the upcoming 5G wireless technology. The 6G network system, which employs higher frequencies to improve capacity and minimize latency, will replace the 5G network system.

Keywords:

Wireless network technology, including third-generation (3G), fourth-generation (4G), fifth-generation (5G), and sixth-generation (6G) networks, as well as mobile communication systems and wireless network standards.

Introduction

The digital revolution was sparked by the development of wireless technology. Wireless networks have shown to be superior than their wired counterparts in many ways. For wireless data transport, both radio waves and infrared wavelengths can be utilized. Developing state-of-the-art transmission and signal processing systems was crucial. Without using additional power or bandwidth, these methods were crucial for greatly increasing wireless capacity [1]. The wireless network provided high-speed connectivity without requiring the expensive installation of coaxial or fiber optic lines. But because of the increased demand, this has led to network congestion, sluggish connections, and decreased capacity. These distant technologies must be updated on a regular basis since users' needs are constantly changing.

A NEW GENERATION (3G)

It was first made available in Japan in October 2001 by NTT DoCoMo, and it was the most significant step toward the actualization of 3G. To create this global network, several 2G wireless telecommunications technologies were integrated.

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This generation of technology differed from earlier ones in that it was able to combine multiple cellular technology standards, including CDMA, GSM, and TDMA, into a single framework [1]. The three interface modes—WCDMA, CDMA2000, and Wi-Max—all functioned flawlessly with the networks' established protocols. The several protocols included into this technology allow for faster data transfer as well as enhanced voice, audio, and video capabilities. The core functions of this system were voice call switching and general packet radio service (GPRS). integrated third-generation (3G) mobile networks3G's Unique Features have been shown to have more features than other networks. The 2 Mbps maximum speed was a very promising result. It provided a large range of services, including multimedia playing, data transmission, and phone conversations. It made possible the movement of people and goods, simultaneous connections, circuit and package communications, and the sending and receiving of speech and data. It can send and receive asymmetrically or in sync. It supported large file transfers and bandwidth capacities in addition to enabling the sending and receiving of large email attachments. During this era, mobile texting—also referred to as SMS and MMS—was another widely utilized service [2].

Applications

The introduction of 3G networks brought forth a plethora of new applications that distinguished them from their peers. These applications include, to name just a few: Video calling has the potential to bring people together in real time across the globe. For a number of reasons, this made it possible for online conferences and meetings to happen in real time. This tactic not only increased the network's user base and reach but also strengthened system security. This generation was particularly interesting because of its broad app store of mobile applications. Third-generation systems make use of GPS technology, which gives users access to comprehensive map data and allows for exact location monitoring. This was the most significant use case in the end. By constructing With the introduction of 3G, individuals could play 3D games without interruption, which led to a rise in their popularity.

FOURTH GENERATION (4G)

On December 14, 2009, TeliaSonera released fourth-generation technology that is still in widespread usage today. 4G is built on a multitude of technologies, including but not limited to computers, other electronics, wireless GSM, LAN, Bluetooth, and communication technology. The basis of 4G technology is the Open Wireless Architecture (OWA), which enables a smooth and quick connection to any high-speed home router that is available, including a neighbor'swifi. Based on this OWA paradigm, 4G technology offers innovative use cases to the wireless and mobile sectors, like a 3-in-1 product that combines WLAN, CDMA2000, and GPRS, or a 3-in-1 product that combines WCDMA,

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OFDM, and WLAN. [4]. Multimedia on the go, wherever you go worldwide mobility options in addition to customized and integrated wireless

Essential Characteristics

Unlike earlier iterations of mobile networks that depended on a blend of technologies, 4G is an entirely IP-based integrated system providing up to 1 Gbps of speed for fixed or low-mobility local networks. It also offers excellent security and end-to-end service quality. Because it operates at a higher frequency than the 3G network—between 2 and 8 GHz—and has a larger bandwidth—more than 100 MHz—it offers speedier connections and services. Improved spectrum efficiency, increased data speeds for wireless terminals, and enhanced control over services and multimedia applications are only a few advantages of the convergence of technologies [4]. 4G uses a more spectrally efficient modulation technique instead of phase shift keying, which was used in previous standards.

Applications

With the evolution of the 4G network, new software was created to capitalize on these advancements. This network satisfied the demand for more sophisticated applications, such as content-rich mobile commerce and mobile health and medical monitoring. Common usage include mobile entertainment, mobile multi-player gaming, mobile telemedicine and monitoring, and mobile programs requiring a lot of data transfer [5]. 4G employs intelligent routing with Ashco networks to choose the best route with the least amount of power consumption. OFDM provides more reliability with 4G than Wi-Max does.

Drawbacks

A large user base is attracted to services that provide a broad variety of useful features and functions. Congestion in the network is caused by this, which in turn slows down connection and data throughput. If several networks are highly integrated and interdependent, then they are more likely to be attacked by malicious code like viruses and worms [6]. Every other network provider usually uses the same "core" network, so if it goes down, the whole system will crash and burn. While the 4G network's complicated design helps keep costs down, it also makes it more difficult to maintain.

The NEXT GENERATION (5G)

5G is not the sole possession of any one person or entity; rather, it is the result of numerous telecom companies working together. Since it is still in the testing stage, it is not yet available everywhere. In April 2019, 5G was first only accessible in select parts of Minneapolis and Chicago. The 5G terminals are expected to transform wireless communications through the use of software-defined radios, modulation schemes, and innovative error control mechanisms that can be downloaded over the internet [7]. 5G is anticipated to completely

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transform wireless technology by offering speeds of several gigabits per second along with extremely low latency. The Third Generation Partnership Project is driving the development of 5G in several areas (3GPP). This time, the objective is to connect

Essential Characteristics

The emergence of 5G will permanently change the wireless communication environment. With 5G, real-time speeds exceeding 20 Gbps are now achievable as it is deployed in many locations worldwide. A two-hour and thirty-minute movie downloaded in full HD in just ten seconds, according to a study that involved the download of numerous movies and other files. 5G networks offer nearly instantaneous responses together with far greater dependability, significantly higher network capacity, and a more consistent user experience. It proposes significant bandwidth shaping in both ways as well as bidirectional UHD video streaming. 5G depends on a policy-based architecture to minimize errors and maximize efficiency. It possesses a transporter-class gateway in addition to

Applications

Due to its exceptionally fast speed and little latency, this network is ideal for a wide range of complex applications, such as virtualized homes, which allow you to control every aspect of your house from any location. The 5G network may also pave the way for "smart cities," where everything can be accessible remotely and work is done more swiftly and precisely. The 5G network environment would provide strong support for both heterogeneous and scalable user equipment. Web browsing, phone calls, and multimedia data needs would all be satisfied by QoS standards [8]. 5G will also have an effect on PLC and SCADA atomization, which are increasingly used to control industries and the equipment they use. 5G, or the World Wide Wireless Web, will create the best wireless connections in the

GENERATION V SIXTH (6G)

It is anticipated that shortly, the 5G network will be replaced by the 6G network. This network is expected to go into commercial operation in 2030. Experts have conjectured that it will include features like digital reproductions, fully immersive extended reality (XR), and high-fidelity mobile holograms, though nothing has been proven yet. Even while 5G is still in its commercial phase, research and development are already starting to create the foundation for what comes next. According to reports, the 6G network would have data transmission speeds that are far higher than those of earlier generations, and traffic can be handled more efficiently with almost no latency. 6G aims to provide a network that can satisfy the need

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VI SUMMARY TABLE I THE FOLLOWING TABLE SUMMARIZES ALL THE ASPECTS OF 3G, 4G, 5G AND 6G:

	3G	4G	5G	6G
Data rates	7.2Mbps – 21.6Mbps	500Mbps – 1Gbps	Upto 20Gbps	Multi Gbps to 1Tbps
Bandwidth	15-20Mhz	2-8Ghz	24-52Ghz	NA
System	Broadband, CDMA, IP	Unified IP and combination of LAN/WAN /PAN/WLAN	Unified IP and combination of LAN/WAN /PAN/WLAN and wwww	NA
Service	Integrated high quality audio, video and data	Dynamic Information access	Dynamic Information Access, wearable devices with IA capabilities	NA
Core Network	Packet Network	Internet	Internet	Internet
Handoff	Horizontal	Horizontal and Vertical	Horizontal and Vertical	Horizontal and Vertical
Standards	WCDMA, CDMA2000	OFDMA, MCDMA	CDMA, BDMA	NA
Technology	WCDMA	LTE, WiMAX	MIMO, mm Waves	NA

CONCLUSION

We discussed the features, applications, and technological aspects of wireless network systems in this study. We also talked about the several ways in which these systems are susceptible. Demand for features is growing in tandem with the advancement of technology. Thus, it's critical to meet user expectations. Each of these generations has met and will continue to meet the expectations of their own ages. Every generation has improved upon the shortcomings of the one before it, added new features, and then presented itself. The way we access and connect to different networks has changed due to wireless technology, making it easier for us to complete jobs. Systems for wireless communication have long been a

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