5G TECHNOLOGY

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ABSTRACT

The full form of 5G technology is Fifth Generation Mobile Technology. All 5G mobile technologies are anticipated to be operational by 2020. The next-generation 5G network can be treated as ultra-high-speed technology with the growth of cellular networks. Hence, it is needed to know the 5G technology studies and developments. This paper provides a thorough analysis of the latest developments in 5G. It highlights 5G's key characteristics like low latency, flexibility, high-speed transmission, accessibility that will make sure the future of mobile communication technology as an important testament to global connectivity.

Keywords: 5G, ultra-high-speed technology, global connectivity.

1. INTRODUCTION

Cellular communications and wireless networks began in the early 1970s. Mobile wireless technology has grown steadily from 1G to 4G generations over the next four decades. Besides, the success of technological advances cannot achieve the desired satisfaction. The key challenges for 5G are high bandwidth and capacity, low cost, low latency, and great in-app connectivity.

5G technology provides the highest bandwidth that has never been there before. 5G technology offers many new advanced features that make it more powerful in the future. The benefits of 5G technologies are large phone memory, MP3 recording, video player, camera, an audio player which one could never think of. 5G wireless multimedia networks can be completely wireless.

The frequency spectrum of 5G has 2 mm waves, mid-band, and low-band. The frequency range of Low-band is similar to 4G. 5G millimeter wave is the quickest one with a speed of 1–2 Gbit/s down. 5G mid-band is the most widely deployed, with a speed of 100–400 Mbit/s down. Speeds can go over a gigabit per second occasionally. The frequency ranges from 2.4 gigahertz to 4.2 gigahertz.

When technology advanced from the 2G GSM (Global System for Mobile communication) to the 3G UMTS (Universal Mobile Telecommunications System), higher network speed and faster download speed allowed real-time video calls. 4G constitutes mobile broadband truly. 3G was originally designed for voice with some multimedia and data consideration, although 3G was the first mobile broadband standard. Whilst 2G was the first digital mobile voice communication standard to improve coverage . The data rate has increased from 64 kbps in 2G to 2 Mbps in 3G and 50–100 Mbps in 4G. 5G is expected to improve the speed of data transfer of mobile networks, scalability, connectivity, and energy efficiency of the network.

The low-band 5G offers the same bandwidth as the enhanced 4G. IT-Mobile and AT&T, the United States, launched low-band services in the first week of December 2019. Almost all 5G and Verizon, AT&T providers, in 2019, have a rating range between 25-35 milliseconds. The air latency is 8 - 12 ms for 2019 devices (between the phone and the tower). The latency can be reduced to 10 - 20 ms by adding Edge Servers near the towers. Low latency, such as 1 tout, often goes away for years and does not add time to the server.

5G technology supports many things such as multimedia communication, video, voice, Internet, and other Broadband services. The new spectrum has been assigned to 5G in mm-wave bands to support increased throughput requirements of 5G. 5G will use MIMO (Multiple Input Multiple Output) to significantly increase network capacity.

A growing number of companies are investing now and creating 5G products. In response to the growth of the Internet of Things (IoT) and the increased demand for access to video and services over wireless broadband, the move to 5G wireless communication standard is an action.

2. 5G ARCHITECTURE

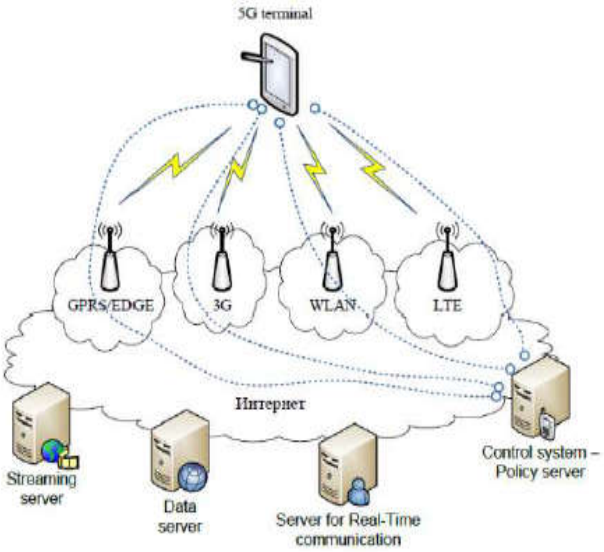

Figure 1. 5G Architecture

As the network elements and various terminals are upgraded to afford a new situation characteristically, the 5G architecture is highly advanced. Service providers can also prioritize technology to accept various services added easily.

The 5G system model is a fully supported IP model for wireless and cellular networks, as shown in the figure. The system comprises of the main user terminal and several independent and autonomous radio access technologies. All radio technologies are considered as the IP link for the outside internet world. The IP technology is designed to make sure sufficient data control for appropriate routing of IP packets related to a certain application connection exclusively. Routing of packets should be fixed by following the given policies of the user to make accessible.

3. GENERATIONS OF WIRELESS NETWORK

1G

The first generation of mobile networks - or 1G was introduced to Japan by the Nippon Telephone and Telegraph (NTT) Company in Tokyo in mid-1979. It gained popularity in the US, Finland, the UK, and Europe in the early 1980s. This system used analog signals that suffered from several drawbacks.

Advanced Mobile Phone System (AMPS), the Nordic Mobile Phone System (NMTS), the Total Access Communication System (TACS), the European Total Access Communication System (ETACS) were the most popular 1G systems during the 1980s. Low voice quality, poor battery life, large size calls, a limited number of users and cellular closure, roaming would not be possible between the similar systems are some of the 1G problems.

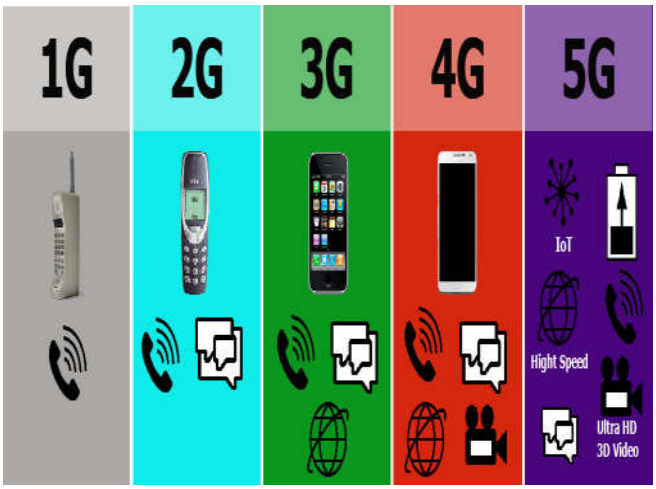

Figure 2. Generations of wireless network

2G

The second generation of mobile networks, or 2G, has introduced a new digital transmission technology called GSM (Global System for Mobile Communication). 2G was more than just telecommunications, for the first time, people could send SMS (text messages), MMS (Multimedia Messages), and picture messages to their mobile.

SMS services, roaming, high security, secured (encrypted) voice transmission are some of the characteristics of 2G. Low data rates, limited mobility, less features on mobile devices, a restricted number of users and hardware capabilities are bad things for 2G.

3G

3G or third-generation communication was developed by NTT DoCoMo in the year 2001. This generation focused on standardizing the network protocol used by vendors. It means that users can access data from any place in the world as the data packets that drive web connectivity were standardized.

Smartphones are popular after the launch of the 3G mobile communication system globally. Mobile app support, multimedia messaging support, location tracking and maps, better web browsing, TV streaming, high-quality 3D games are some of the important characteristics of 3G. Expensive spectrum licenses, expensive infrastructure, equipment and startups, high bandwidth requirements to support high data rates, expensive mobile devices are the cons of 3G.

4G

The fourth-generation or 4G was first used as the LTE (Long term Evolution) 4G standard in Stockholm, Sweden, and Oslo, Norway in 2009. The 4G systems are an enhanced version of the 3G networks developed by IEEE, which provide high-quality data and are capable of handling the most advanced multimedia services. The technology used in the 4th generation systems was LTE and LTE wireless technology. To increase data rate and improve network performance, wireless transmission technologies such as WiMax are introduced in the 4G system.

Voice over LTE VoLTE network improved security, and mobility, reduced latency for sensitive applications, high-speed video streaming, and gaming are some of the key features of 4G. Expensive hardware and infrastructure, expensive visualization, extensive deployment, and optimization are time-consuming are some of the drawbacks of 4G.

5G

5G will enhance the mobile network to control machines, materials, and devices, interact with people.5G is a platform for expanding today's broadband mobile services, expanding mobile networks, connecting new industries with efficiency, cost, and functionality.

To provide a fast Internet and multimedia customer experience, 5G will use advanced technology. 5G technology will use millimeter waves and an unlicensed spectrum for data transmission, to attain a higher data rate.

4. FEATURES OF 5G

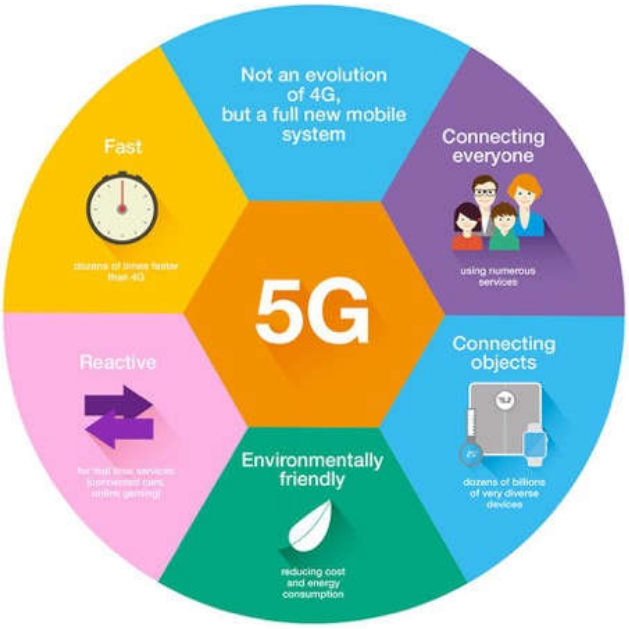

Figure 3. Features of 5G

1) Better coverage
2) High data rate at the edge of the cell
3) More security
4) Spectral efficiency
5) Energy efficiency
6) Low battery consumption
7) Multiple data transfer rate

5. ADVANTAGES OF 5G

1) Higher speed
2) Network slicing
3) Power Efficiency
4) Beam Forming
5) Lower latency
6) IoT improvements
7) Faster response

6. DISADVANTAGES OF 5G

1) Security issue
2) High cost
3) Research
4) Infrastructure

7. CONCLUSION

This paper presents a comprehensive overview of a number of the latest efforts towards 5G communication. The architecture of 5G and wireless network generations was discussed. Yet several issues could not be mentioned due to limitations and space.

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