

5G NETWORK (REVOLUTION OF NETWORK)

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ABSTRACT

Due to revolutionary development in electronic and communication, mobile and handheld devices become the part of our daily life. As a result, volume of data traffic on internet is increasing day by day. To provide unlimited, uninterrupted and content-rich services to these devices, the 5th generation (5G) of network technology is emerged. 5G network can provide better Quality of Services (QoS) along with higher data rates than 4G network and have least latency. The paper appraisals various generations of wireless network. This paper presents evaluations in the field of mobile communication technology. Multiple challenges were encountered during each evolution, which were captured with the support of next-generation mobile networks. And also we will discuss some statistics of 5G network and technology.

Keywords: 5G, Applications, Evolution of 5G, Architecture, Advantages, Disadvantages

1.

INTRODUCTION

5G technology stands for 5th generation mobile technology. 5G represents the next major phase of mobile telecommunication ethics beyond the upcoming 4G standards. 5G technology is contribution the service in product manufacturing, documentation, support electronic communication, etc. as the purchaser become more and more aware of the mobile phone technology, he or she will look for a decent package all together including all the advance feature a cellular phone can have. Hence the search for new technology always the main motivation of the top cell phone colossuses to out innovate their competitors. The aim of 5g based telecommunication network would perfectly answer the challenges that a 4G prototypical would present once it has entered ubiquitous use.

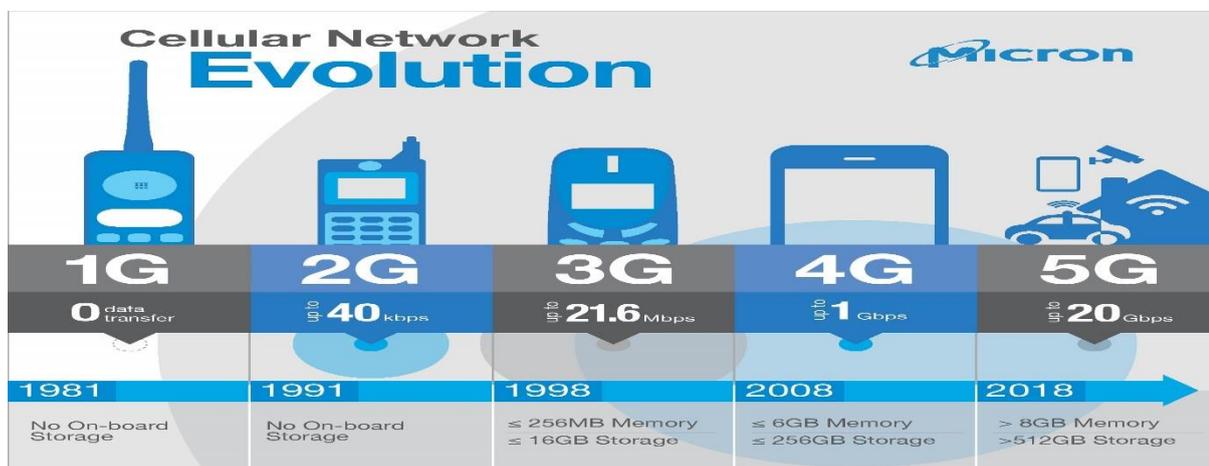


Figure 1: History of mobile technology

Beyond the current 4G standards, 5G is the next important phase of mobile telecommunication ethics. 5G technology is helping to improve product manufacturing, documentation, and electronic communications, among other things. As the buyer becomes more knowledgeable about mobile phone technology, he or she will search out a good package which includes all of the advanced features that a cell phones can offer.

2. APPLICATION AREA OF 5G NETWORK

It is presumed that 5G will be up to 100 times faster than present cellular system with lowest latency and quality of services. The future application area may include:

- Immersive entertainment
- Environmental monitoring
- Smart agriculture
- Smart metering
- Smart transportation

3. EVOLUTION OF NETWORK

A. First generation network (1G)

First generation (1G) of wireless networks was standardized in initial 1981 for voice communication. It was able to handle data transfer speed up-to 2.4kbps. the most popular 1G-access technologies are advanced mobile phone system (AMPS), Nordic mobile phone system (NMTS), total access communication system (TACS) etc. analog signals were responsible to carry out voice in 1G. it suffers from various issues such as low graded signal quality, low capacity, less secure and unreliable handoff.

B. Second generation network (2G)

Second generation (2g) of wireless networks was standardized in 1990. It was primarily used of voice communication and able to data communication with limited 64kbps. It was also able to data communication with limited speed. The most popular 2G access technologies are global system for mobile communications (GSM), code division multiple access (CDMA) and IS-95. 2G technology was also able to sent text message, picture message, and multimedia messaging services (MMS). It is also able to provide secure point-to-point communication i.e. only intended receiver could receive and read the message.

C. Extension to second generation networks (2.5G)

It was an extension of second-generation wireless system. It introduces packet-based switching technique known as General Packet Radio Services (GPRS). Furthermore, it is able to provide better communication by use of packet switching and circuit switching techniques along with services provided by 2G. It is able to handle data transfer speed up to 144kbps. The most popular 2.5G-access technologies were GPRS, Code Division Multiple Access-2000 (CDMA2000) and enhanced data rate for GSM evolution (EDGE).

D. Third generation networks (3G)

Third generation (3G) of wireless networks was standardizes in 2000. The basic objective to design 2G was voice communication and high-speed data transfer up to 2Mbps. The most popular 3G-access technologies were Wideband Code Division Multiple Access (WCDMA), CDMA2000 and Universal Mobile Telecommunications System (UMTS) technologies. To utilize benefit of 3G smartphone based specific application were developed to handle video-calling, online games, email services, social media services such as Facebook and Orkut etc.

E. Extension to third generation (3.5G)

It was an extension of 3G wireless networks and standardized in 2008. It was primarily designed to improve data rate of present 3G networks and able to handle data transfer speed up to 3.6Mbps. the most popular 3G-access technologies were HSDPA (High Speed Downlink Packet Access) and HSUPA (High Speed Uplink Packet Access). 3.75G system was proposed as an improved version of 3G network. The technology used in it was, High Speed Packet Access Plus (HSPA+). The technology used in it was known as Long-term Evolution Technology (LTE) and Fixed Worldwide Interoperability for microwave Access (WiMAX). These technologies are able to provide high-speed services such as on demand videos, composite web services, social media services etc.

F. Fourth generation network (4G)

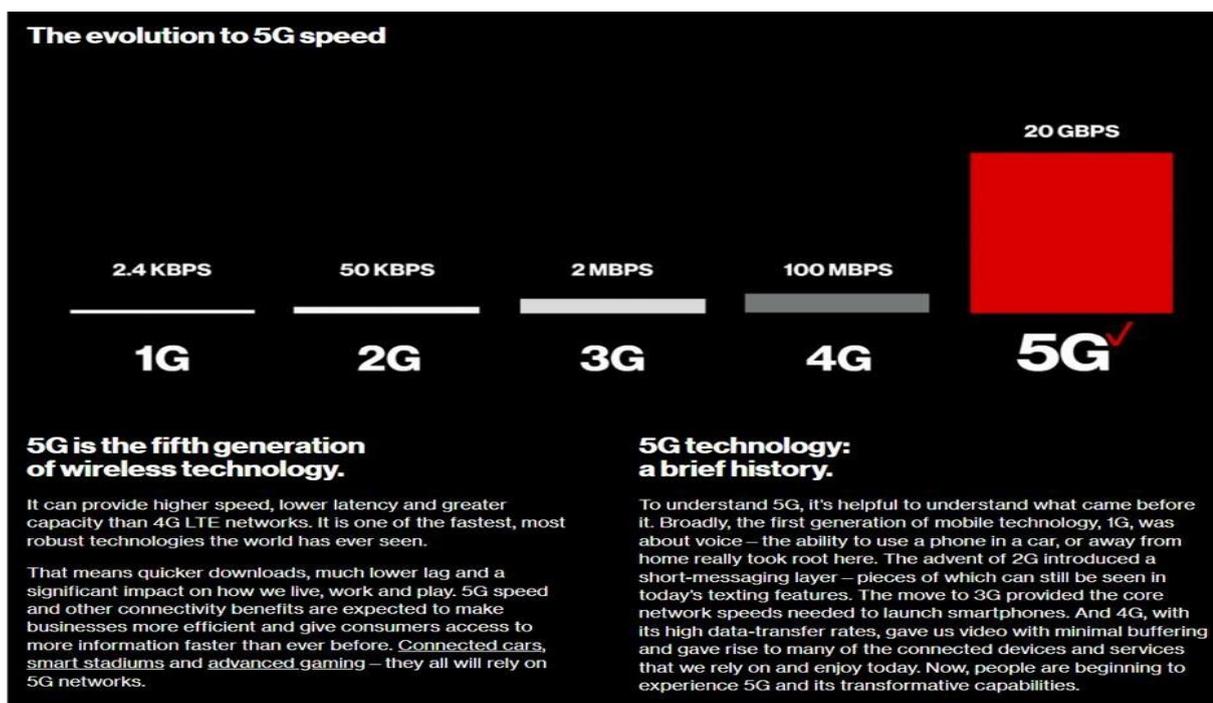
Fourth generation (4G) of wireless network was standardized in 2010. 4G has designed to handle data transfer speed up to 300Mbps along with Quality of Services (QoS). In 4G, the use can watch online High Definition (HD) video and can play online games. The most popular 4G-access technologies are voice over KTE network VoLTE (use IP packets for voice). 3G Partnership Project (3GPP) is presently standardizing Long-Term Evolution (LTE). It reduces latency for critical application and provides secure mobility. It also supports IoT enables devices to interact in an efficient manner. Like 3G, 4G also costlier in terms of hardware and implementation. For communication, it requires high-end multifunctional devices, which should be compatible with 4G technology.

G. Fifth generation network (5G)

5G is the fifth generation of wireless network technology, and its promised to offer faster data speeds, lower latency, and greater network capacity than previous generation. 5G technology uses advanced radio technology and a new network architecture to provide faster and more reliable connections, with the ability to support a vast number of devices and user simultaneously. One of the key benefits of 5G network is its ability to support high-bandwidth applications, such as virtual and augmented reality, and 4K video streaming.

ADVANTAGES-

- 1: Higher capacity, 2: data rate higher,
- 3: End to End latency has been lowered, 4: connectivity to massive device,
- 5: reduced cost



4. 5G NETWORK ARCHITECTURE

Designers of 5G networks face a number of challenges. The physical scarcity of radio frequency (RF) bands required for cellular communications is one of the most pressing issues. Furthermore, these frequency spectra have been extensively utilized, and the present cellular bands no longer include any supplemental information. Another issue is that the functioning of modern wireless technology is associated with excessive energy consumption. In terms of environmental considerations, cellular operators have observed and reported that the energy utilized by base stations accounts for more than 70% of their electricity expenditure. When looking at the current 5G network on the market, it is apparent that the network's various access mechanisms are nearly at a standstill and require immediate upgrade. Current technology, such as OFDMA, are expected to last at least 50 years. Furthermore, no technological changes are required. The wireless connection had progressed from 1G to 4G. Alternatively, the inclusion of an application, or better yet, an improvement made to the basic network to meet user needs, is prompting package providers to migrate to a 5G network as soon as 4G is commercially available. However, there was widespread consensus that, as compared to the 4G network, the 5G network should provide the following advantages:

1. 1000 times the system capacity
2. 10 times the spectral efficiency
3. energy efficiency
4. Data rate.
5. 25 times the average cell throughput.

To meet the difficulty of the user and overcome the obstacles posed by the 5G system, drastic changes in the policy of constructing the 5G wireless cellular architecture are required. An outside base station is always present in the midst of a cell in the wireless cellular architecture for a mobile user to get connected or to communicate whether inside or outside. The signals must pass through the walls of the interior to provide connection between the inside and outside base stations, resulting in significant penetration loss and accompanying costs due to reduced spectrum efficacy, data rate, and energy competency of wireless communications. To overcome this challenge, a new concept for constructing 5G cellular architecture has emerged: separating the outside and interior settings. The loss due to penetration through the building walls will be decreased to some amount with the help of this designing strategy.

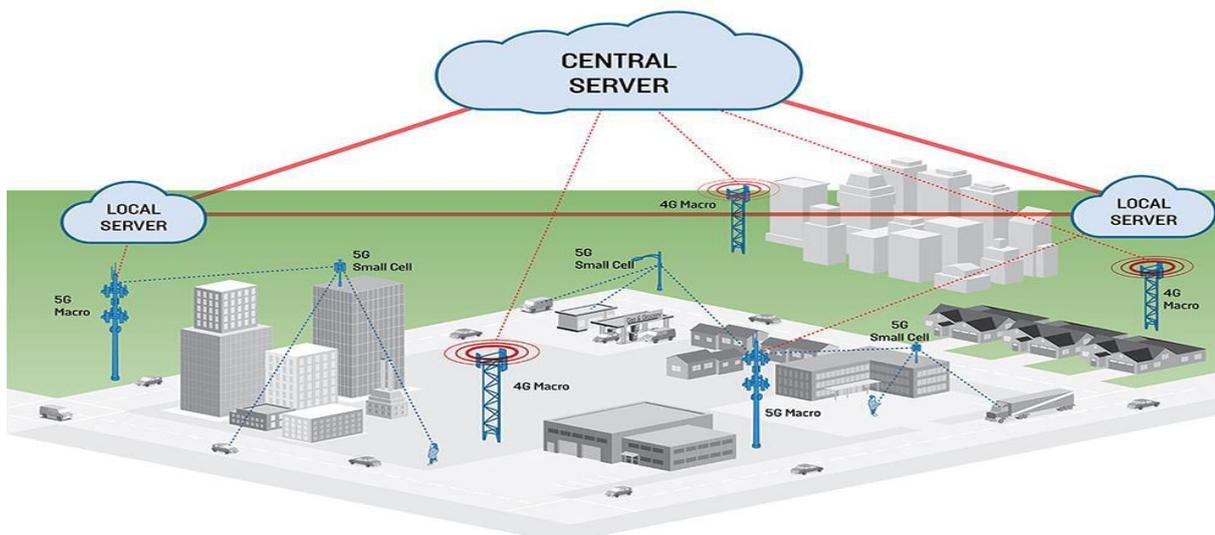


Figure 3: 5G network architecture

5. STATISTICS AND NEWS

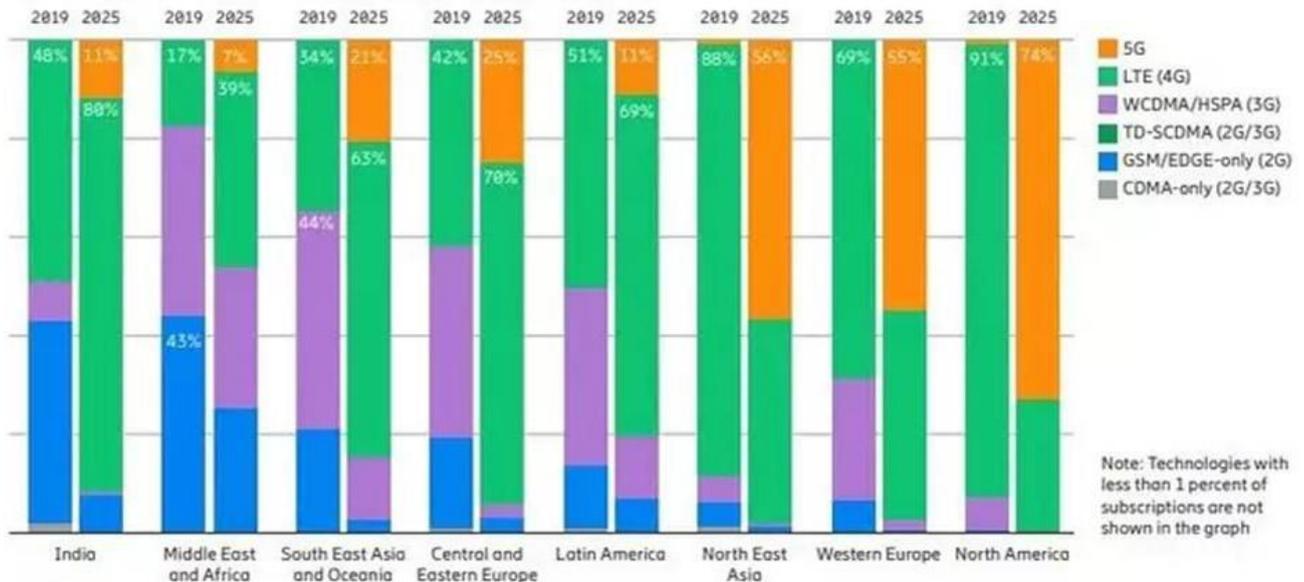


Figure 4: Mobile subscriptions by region and technology (percent)

More than half of North East Asia, Western Europe and North America will be on 5G by 2025, according to Ericsson’s latest Mobility Report.

But in India, 5G will only account for 11% of total mobile subscriptions. The Indian region — which also includes Nepal and Bhutan — will be the slowest to adopt 5G, second only to the Middle East and Africa, where 5G penetration forecasted to be at 7%.

NEWS:

- India is likely to launch 5G services by the end of this month (May 2022).
- The DoT also announced that 5G services will be offered in 13 Indian cities at first.

The DoT has earlier stated that the 5G project would be conducted by December 31, 2021. The government plans to auction off 5G spectrum, including airwaves, in early June, according to Telecom.

6. ADVANTAGES

- High determination and bi-directional large bandwidth shaping.
- Technology to wrinkle all networks on one platform.
- More active and efficient.
- Easily manageable with the previous generations.
- Possible to afford uniform, uninterrupted, and unflinching connectivity across the world.
- Technological sound to support heterogeneous service area (including private network).
- Most likely, will provide a broadcasting data (in gigabit), which will support more than 60,000 connection.

7. DISADVANTAGES

However, 5G technology is examined and abstracted to solve all radio signals problems and hardship of mobile world, but because of some security reason and lack of technological development in most of the geographic sections, it has following limitation

- Technology is silent under process and research on its possibility is going on.
- The speed, this technology is pleasing seems tough to achieve (in future, it might be) because of the useless technological support in most parts of the world.
- Many of the old devices would not be able to 5G, hence, all of them need to be swapped with a new one expensive deal.
- Developing infrastructure need high cost.
- Security and privacy problems yet to be solved

8. CONCLUSION

5G network and services will be deployed in stages over the next few years to provide a platform on which new digital services and business model can thrive. 5G will mark a turning point in the future of communications bringing high-powered connectivity to billions of devices. It will enable machines to communicate in an IoT environment capable of driving a near-endless array of services. 5G network will revolutionize transportation and will reliably connect patients and doctors all over the world providing access to medical treatment. As digital transformation is shifting user experience away from the text, image, and video into immersive VR and AR, 5G cellular technology will be facilitate this new shift by offering high speed, superior reliability, extreme bandwidth capacity, and low latency.

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