

An Overview on fifth generation (5G) mobile wireless Technology

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Abstract—In this fastest growing world of telecommunication, the growth of mobile technology is beyond our expectation. Here, also we throw some lights on the upcoming fastest or emerging mobile wireless communication technology i.e. 5G. 5G stands for fifth generation. It has advanced features which make it more important and efficient than other invented wireless technologies like 1G, 2G, 3G and 4G. In this paper we present a concise view of its architecture, waveform concept, requirements and challenges of 5G technology.

Keywords—1G; 2G; 3G; 4G; 5G; GSM

INTRODUCTION

The communication technology has seen many tremendous and special changes from last few years or decades. From the era of 1G to 4G, the area of telecommunication has seen many improvements as improved performance is concerned. Due to the advanced specification all previous generation differ from each other. So, now 5G is on its way to bring a new revolution in the history of telecommunication. Now, we look back at the development of previous technology from 1G to 4G. A way from old 0G to the fastest 5G.

A. Old 0G

It exists just after World War II. Technologies used in 0G are PTT (Push to Talk), MTS (Mobile Telephone System), OLT (Norwegian for Offending Land Mobil Telephone), AMTS (Advanced Mobile Telephone System), and IMTS (Improved Mobile Telephone Service)[1].

B. 1G (GSM)

This generation was based upon AMPS i.e. Advance Mobile Phone Service which is an analog technology. It has channel capacity of 30 KHZ and frequency band from 824 MHz to 894 MHz. It is designed for voice calling as it uses circuit switching. It is first launched in US, it replaced 0G technology. It supports analog cell phones whose speed is limited to 24 kbps. It provides spectrum efficiency of low levels and security.

C. 2G

After 1G it is the time for 2G mobile communication system which was the first digital cellular system launched in earlier 90's. In this generation two schemes of digital modulation are used: TDMA (Time Division Multiple Access) and CDMA (Code Division Multiple Access). It has 64 Kbps speed with bandwidth of 30 to 200 KHZ. The family members of second generation are 2.5G and 2.75G. It provides data rate up to 144 as it uses Packet Switched and circuit switched domain. It also provides services such as text messages, picture messages and MMS (Multi Media Messages). Different TDMA technologies are GSM, PDC and IDEN, I. S-136 and CDMA technologies like IS-95. International Roaming was first established by GSM.

D. 3

It is also known as Pre 4G and introduced in year 2000. To send the data in 3G network packet switching technique is used.

This network has a bandwidth of 15 to 20 MHz at a range of 2100 MHz for a video chat and high speed internet service. The family members of this generation are 3.5G and 3.75G. The biggest advantage of 3G technology is video chatting and high internet service. GLOBAL ROAMING is the new service launched in this generation. Mobile T.V, video conferencing, Multi-media messages (MMS), 3D gaming, Multi-gaming etc. are also available in 3G phones[2].

E. 4G

It is capable of providing data rate up to 1Gbps. It was launched in year 2011, it includes wireless broad band access, Multi Media Messages and Digital Video Broadcasting (DVB)[2]. The main focus of this generation was on additional gaming services, HD mobile, T.V, video conferencing and 3D T.V. LTE (Long Term Evolution) and Wi-Max (World Wide interoperability for microwave Access) Are the technologies under 4G Umbrella?

It is Cheaper than previous versions or previous generations because it doesn't require redesign and structure. It supports global mobility.

F. The fastest or Amazing 5G

It stands for fifth generation Mobile technology; it may be launched or ground by year 2020. The special feature of 5G technology is that it has a very high bandwidth which provides such a high speed that hasn't experience by anybody till this date[1].

It includes all the advanced features which make it more demanding in upcoming years.

It provides high streaming, MP3 Recording, Video player, large phone memory, dialing speed, audio player and many more things which a user can't imagine. Bluetooth technology has made data sharing easy and compatible and Pico nets have organized in market.

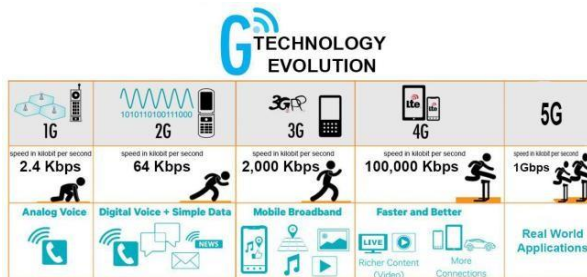


Fig. 1 Wireless communication Technologies.

5G Architecture

The 5G architecture is generally based on the TCP/IP protocol that stands for transmission control protocol/internet protocol, it is well known as communication protocol[3]. It uses four layers that logically span equivalent to the top six layers of the OSI (open source interconnection). 5G mobile network mainly focuses on user terminals. As it is the IP based model and IP technology offers a sufficient data control for appropriate routing of IP packets that are associated to application connections i.e. session between client application and servers. As the radio access technology is carefully looked or examined by IP links outside the Internet world. So, the main motive of this technology is to access different wireless technologies at the same time[4]. It can also combine some attributes or aspects from other technologies. It focused on user mobility. The following four layers of IP protocol used in 5G technology is described below:

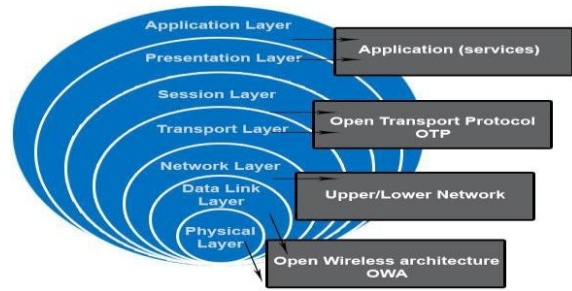


Fig. 2 Layers stack of 5G

Physical/Mac Layer4G

The Top two OSI layers i.e. Physical and Data Link Layer are define as a network environment where physical layer provides data transmission and reception and other data link layer provides framing of bits , flow control and data control[5].

Network Layer

It is responsible for providing logical device addressing, data packaging, manipulation and delivery of data packets with the different routing process. The IPv4 and IPv6 are the example of network layer. Ipv4 is world wide spread and it has many problems like limit address space etc. which are then resolved in IPv6[5].

Open Transport Protocol Layer

It supports host to host communication and end to end communication over an inter – network. The key protocol worked at this Layer are:-

1. TCP (Transmission control protocol)
2. UDP (User Datagram Protocol). It is important in 5G for higher downloads and installed speed.

Application Layer

It provides user interface it includes different application protocols Like HTTP, FTP and SMTP etc. for providing end user services. In this layer, the quality testing and information storage have access by the terminal in terminal database. In 5G mobile phones to mold terminal into intelligent behavior different algorithms are used. Intelligent behavior means to pick a network that selects best wireless connection over different networks for a given service.

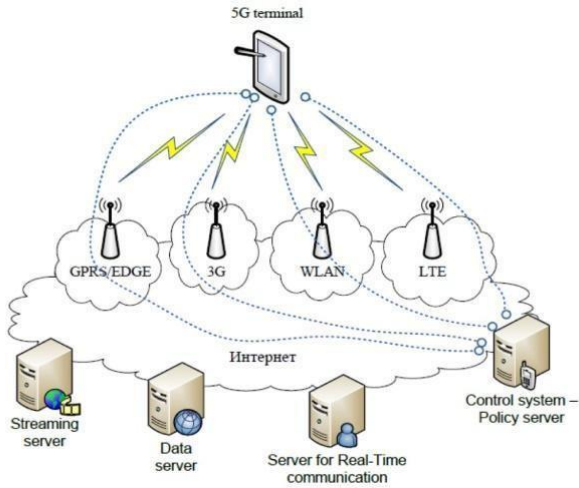


Fig.3 5G Architecture

II. WAVEFORM CONCEPT

Orthogonal frequency division multiplexing is proved as a best choice for 4G as an excellent waveform as it provides superior spectrum efficiency. There are many advantages to use the new waveforms for 5G. OFDM want to use a cyclic prefix which occupy space within data streams[6].

Some key requirements that need to provide by the overall waveforms include:

- a. It should capable of handling high data rate wide bandwidth signals.
- b. It should provide low latency transmission for long and short data bursts.
- c. It should provide fast switching between uplink and downlink for TDD system.

III. FEATURES OF 5G TECHNOLOGY

- a. It is a real wireless world network with no limitations.
- b. The most interesting feature of 5G technology is HD TV because it includes multimedia features also.
- c. In comparison with other generations it provides increased data rates.
- d. It provides an artificial intelligence capability that helps users to know about artificial intelligence.
- e. It provides a way to share unused range and bandwidth by providing smart radio technology.
- f. It gives error control mechanism.
- g. It offers connectivity speed up to 25Mbps.
- h. It also provides worldwide roaming.
- i. It supports remote control management environment.

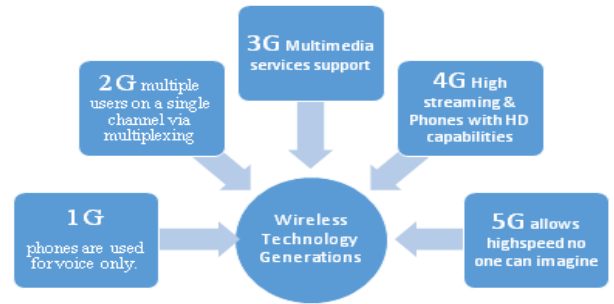


Fig.4 Features of wireless Technology

IV. CHALLENGES

The biggest challenge is to convert wireless network 4G to 5G.

- a. The migration of 4G network to 5G network is the increased cost (high operational cost). As cost is directly related to the transmission energy consumed. By making wireless communication energy efficient we can overcome the cost of 5G network.
- b. 5G technology can reduce the transmit energy per bit, but unable to decrease the operating energy.
- c. In 5G wireless network, problems like power utilization occur in which a single terminal is operated in different wireless networks.
- d. In this 5G technology a security issue is caused due to large (wide) range and higher operability.
- e. Due to the use of software radio approach user can able to access different wireless network without any restriction of size and cost which again leads to some security issues.
- f. The measure problem to shift LTE into 5G is that current 5G technology focuses on EE (Energy Efficiency).
- g. In case of signal transmission criminal attacks can be possible. But this problem can be overcome by the use of Data Encryption.

V. REQUIREMENT OF 5G TECHNOLOGY

In 5G technology, there are two key aspects about what 5G wireless technology should be:

Hyper Connected View

This view of the requirements of the 5G wireless systems is to serve higher coverage and availability, along with dense networks. In this a key Differentiator provides new services like Machine to Machine, M2M applications along with added Internet of Things, IOT applications apart from having needed to fulfill traditional services[6].

Next Generation Radio Access Technology

This view of 5G technology sets data rates specifications, latency and other key specification.

5G Requirements Summary

- a. In the field 1-10Gbps connections are provided to deadline points (i.e. not theoretical maximum).
- b. End-to-End round trip delay latency is around 1 millisecond. 1000 x bandwidth per unit area.
- c. Number of connected devices up to 10- 1000x.
- d. Availability of perception is 99.999%.
- e. Coverage perception is of 100%.
- f. There should be a decrease in network energy usage.

Need of 5G Technology

- a. It provides high speed and high capacity with low cost per bit.
- b. It offers interactive multimedia, voice, video, internet and other broadband services.
- c. It supports remote management so a user can get better and fast solution.
- d. It provides Global accessibility and service portability.
- e. Because of high error tolerance it offers high quality services.

VI. CONCLUSION

Last but Not the Least finally we concluded that a 5G wireless technology is the enhanced version of 4G technology. In this paper we provide an overview about the fastest and upcoming 5G technology.

To understand 5G technology we have also discussed some aspects of previous generations. This paper throw the lights on the topic that 5G technology is based on i.e. IP or TCP/IP protocol and based on networks like IPv4 and IPv6 .5G technology bring a remote management service,SDR and nanotechnology etc.5G should be more intelligent technology that helps to interconnects the entire world without limits.

At the end, we sum with that 5G is the fastest upcoming technology that can bring new revolution in the Internet speed.

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