

# 5G Wireless Technology

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## Abstract —

The main objective of this paper is comprehensive study related to 5G technology of mobile communication. We will also discuss the evolution, architecture and comparison of 5G, with all preceding generations from 1G to 4G along with their important characteristics, advantages and disadvantages. 5G technologies will change the way most high-bandwidth user access their phones. 5G will offer services like documentations, electronics transactions like e-payments e-transactions etc. Users have never experienced this type of network that is completely wireless network. Currently 5G term is not officially used. Researches have being made on development of WWW. World Wide Wireless Web (WWW) allows completely wireless communication without limitations, it will fulfill all the requirements of customers who always needs new features in their mobiles. 5G technology includes all types of advanced features which will make 5G technology most dominant technology in future.

*Key Words* — WWW, 1G, 2G, 3G, 4G, 5G

## I. INTRODUCTION

Wireless communication has shown a phenomenal growth in last few decades. With the rapid development of wireless transmission and mobile networking techniques, various wireless services have emerged and smart devices become more popular, which has led to an explosive increase in the data traffic of wireless networks. This was started in early 1970s. Since approximately after every 10 years new mobile generation is been introduced. Wireless technology have experienced 5 generations of technology evolution, namely from 1G to 5G . The First generation has fulfilled the basic mobile voice, telephone was introduced in 1982. while the Second generation was commercially came in 1992 which has dealt with capacity and coverage. The third generation focused for higher data rate, multimedia support and spread spectrum followed by Fourth generation providing access to wide range of telecommunication services including advanced mobile services, along with a support for low to high mobility application. Fifth generation of wireless technology known as 5G is expected to create the “network of networks” which will deliver higher bandwidth and lower latency than ever before that user never imagined. Also it should be more intelligent technology that interconnects the entire world without limits. This generation is expected to be released around 2020.

Few Features of 5G technology

- High data rates and coverage at cell edge.

- Less consumption of battery.
- 1Gbps data rate.
- Better security.
- WWW – World Wide Wireless web
- IPv6 (Internet Protocol Version6)
- Wireless world with no zone issues and limited access.

## II. EVOLUTION

Mobile communication has become one of the most popular in past few decades due to fast revolution in mobile technology. As this technology is growing day by day, data rate, mobility, coverage and spectral efficiency increases. This revolution is from 1G-First Generation, 2G-Second Generation, 3G-Third Generation, 4G-Fourth Generation, 5G-Fifth Generation. The brief descriptions of these generations are as follows:-



Fig. 1. Image

### A. 1G-First Generation(1970-1980)

In 1980s, First Generation of Mobile Technology was emerged in Europe. Analog transmission of speech signal services was used in First Generation of Mobile Communication Systems. A voice call gets modulated to a higher frequency, typically 150MHz and up. By using 1G, this regulation is known as Frequency Division Multiple Access (FDMA). It has many disadvantages like no security, inferior voice association, low capacity, unreliable handoff. Since voice calls were stored and played in Radio towers

due to which vulnerability of these calls from unwanted calls eavesdropping by third party increases. [1]

### B.2G-Second Generation

In 1990s, the second generation was emerged at Finland. This was commercially launched on the GSM (Global system for mobile communication) standard. It was developed for voice transmission with digital signal providing speed up to 64kbps. It provides the services as Digital voice communication, SMS (Short Message Services), MMS (Multimedia Messages) etc. In this generation, Time Division Multiple Access (TDMA) or Code Division Multiple Access (CDMA) technologies are used. 2.5G system uses packet switched and circuit switched domain. It gives data rate up to 144 kbps. [2]

### C.3G-Third Generation

In 1980, Third generation (3G) technology is accomplished by the International Telecommunication Union (ITU). In Japan, NTT Docomo has established the first commercial 3G technology. 3G has fast data transfer rate. 3G technology is used to convey packet switch data proficiently at better and increased bandwidth [3]. It has a transmission speed from 125kbps to 2Mbps. Through Circuit Switching, Voice calls are interpreted. Some of the advantages of 3rd generation are fixed Wireless Internet Access, Mobile Internet Access, Wireless Voice Telephony, Video calls, 3D gaming and Mobile TV. With the help of this, we can access to Global Roaming also.

### D.4G-Fourth Generation

4G is the fourth generation of broadband cellular network technology, succeeding 3G. A 4G system must provide capabilities defined by ITU in IMT Advanced. It has some applications like amended mobile web access, IP telephony,

gaming services, high-definition mobile TV, video conferencing, and 3D television. [4] 5G gives all features of 3G with some additional features. The data transfer of 4G is faster and less expensive than 3G. It provides data rate up to 1Gbps. The most important feature of 4G technology is the elimination of parallel circuit-switched and packet-switched network nodes using Internet Protocol version 6 (IPv6). The IPv4 which is used in 3G has some limitation on the number of IP addresses that can be assigned to devices. IPv6 provides more available addresses, and is able to provide streamlined experience for users. [5]

### E..5G-Fifth Generation

5G will be the most advanced technology which users have never experienced before. Though we have few years to experience this amazing technology. Nowadays wireless services are not new to anyone. 5G will be having all the features of 4G but there will be much more. 5G is expected to create the "network of networks" with higher bandwidth and lower latency than before. When 5G will be introduced then there will be not much more difference in mobiles and computers. 5G technology includes all advanced features which makes 5G technology most powerful and demanding in future. Some specification requirements of 5G technologies are:

- Up to 100x number of connected devices per unit area (compared with 4G LTE)
- 100% coverage
- 1 millisecond latency
- 10 year battery life of low power devices
- 1000x bandwidth per unit area
- Up to 10Gbps data rate
- 99.99% availability
- 90% reduction in network usage
- Also support virtual private network

Technology →	1G	2G	3G	4G	5G
Features ↓					
Start/Deployment	1970 – 1980	1990 - 2004	2004-2010	Now	Soon (probably 2020)
Data Bandwidth	2kbps	64kbps	2Mbps	1 Gbps	Higher than 1Gbps
Technology	Analog Cellular Technology	Digital Cellular Technology	CDMA 2000 (1xRTT, EVDO) UMTS, EDGE	WiMax LTE Wi-Fi	WWWW(coming soon)
Service	Mobile Telephony (Voice)	Digital voice, SMS, Higher capacity packetized data	Integrated high quality audio, video and data	Dynamic Information access, Wearable devices	Dynamic Information access, Wearable devices with AI Capabilities
Multiplexing	FDMA	TDMA, CDMA	CDMA	CDMA	CDMA
Switching	Circuit	Circuit, Packet	Packet	All Packet	All Packet
Core Network	PSTN	PSTN	Packet N/W	Internet	Internet

### III. 5G ARCHITECTURE

5G Architecture has network elements and various terminals which are characteristically upgraded to afford a new situation. Architecture of 5G technology is based on OSI Model as shown in below figure. In OSI Layers, Physical Layer and Medium Access Control Layer i.e. Layer 1 & Layer 2 defines the wireless technology. 5G Technology is based on Open Wireless Architecture (OWA) for these two layers. This OWA refers to the open broadband wireless platform that can support diverse wireless and mobile standards and, can converge multiple wireless networks. Application layer makes the data into proper format i.e. it decrypt the data which is in encrypted form.

The Network Layer will be Internet Protocol (IP) .IPv4 (version 4) is a type of IP which is used in 5G technology .IPv4 has some problems such as limited address space, so these are resolved in IPv6. IPv6 is a version 6 of Internet Protocol. But it has mobility so there is a Mobile IP standard on one side as well as many micro mobility solutions. In 5G, all mobile networks will use Mobile IP.A mobile can be connected to different wireless networks or mobile at the same time, it will also maintain different IP address for each of radio interfaces [7]. Virtual multi-wireless network environment will maintain by 5G mobile phone. So in 5G mobile phone there should be separation of network layer into lower network layer and upper network layer, because of initial design of Internet. The translation of addresses is maintained from Upper network addresses to different lower network IP addresses, and vice versa. Open Transport Protocol (OTA) layer Regarding the transport layer, the mobile and wireless networks differ from wired networks. In all TCP versions there is a assumption that lost segments are due to network congestion, but the wireless network loss is occur due to higher bit error ratio in the radio interface. Thus, it has proposed TCP modifications and adaptation for the mobile and wireless networks. The TCP retransmit the lost or damaged TCP segments over the wireless link. 5G mobiles will have the possibility to download version which is targeted to a specific wireless technology installed at the base stations.[6]

### IV. ADVANTAGE

- About 10 Gbps or higher data rates can be achieved. Hence the peak of uploading and downloading speed of 5G technology is increasing.[8]
- With the help of carrier aggregation feature, higher bandwidth can be used.

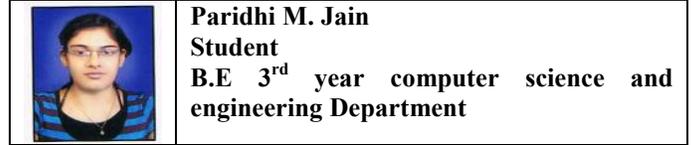
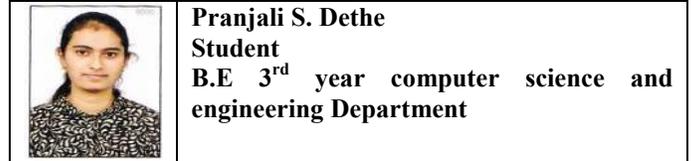
- It will provide a huge broadcasting data (in Gigabit), which will support almost 65,000 connections.[12]
- The 5G technology is providing up to 25 Mbps connectivity speed [11].
- It will be easily manageable with the all previous generations. It provides omnipresent computing as user can simultaneously access the different wireless technologies like (3G, 4G, and 5G) [9, 10].
- Lower battery consumption is another main goal of 5G technology. 3G devices required one battery while 4G required two batteries. Battery drain is a persistent problem of wireless devices. 5G aims at breaking this directly proportional rule.
- It support Network heterogeneity (including private network).Network heterogeneity means connecting computers and other devices with different operating systems and protocols like wimax, Wi-Fi (Wireless Fidelity), UMTS (Universal Mobile Telecommunications System) and which differ in their coverage area, data rate, latency and data loss rate. Each of these networks caters to different user requirements. In 5G, all these networks will provide common services independent of their capabilities.
- It provides efficient security approach to secure communication.
- The high quality services of 5G technology based on Policy to avoid error.
- Remote management environment is presented in 5G. Through remote management offered by 5G technology a user can get a better and faster solution.

### CONCLUSION AND FUTURE ENHANCEMENT

Mobiles have become very important part of our day to day life. In this paper we have also discussed the existing mobile wireless technologies. There are lots of improvements from 1G,2G,3G and 4G to 5G in the world of communication. 5G will bring people in a new level of mobile technology. Fifth generation technologies have brought tremendous data capabilities, high peak future and much reliability than its preceding technologies.The fifth generation evolution will be based on 4G. The 5G network technology will open a new era for technologies. 5G will offer high resolution for passionate mobile users. We will be able to watch an HD TV channels in our mobiles without any disturbance. Many mobile embedded technologies will develop.

**REFERENCES**

- [1] C.-X. Wang et al., "Cellular architecture and key technologies for 5G wireless communication networks," IEEE Commun. Mag., vol. 52, no. 2, pp. 122–130, Feb. 2014
- [2] www.ijcsmc.com ISSN 2320–088X IJCSMC, Vol. 3, Issue. 10, October 2014, pg.203 – 207
- [3] Y. Kishiyama, "Future Steps of LTE-A: Evolution toward Integration of Local Area and Wide Area Systems," IEEE Wireless Commun., vol. 20, no. 1, 2013, pp. 12–18.
- [4] <https://en.m.wikipedia.org/wiki/4G>
- [5] [http://whatsag.com/g/understanding\\_4g.php](http://whatsag.com/g/understanding_4g.php)
- [6] M. Hata, "Fourth Generation Mobile Communication Systems Beyond IMT-2000 Communications," Proc 5th Asia Pacific Conf. Commun. 4th Optoelect. Commun. Conf., vol. 1, 1999, pp. 765–67.
- [7] 5G mobile Technology Abstract Available:[http://www.seminaronly.com/Labels/5g-Mobile-Technology\\*Abstract.php](http://www.seminaronly.com/Labels/5g-Mobile-Technology*Abstract.php)
- [8] [www.rfwirelessworld.com/Terminology/Advantages-and-Disadvantages-of-5g.html](http://www.rfwirelessworld.com/Terminology/Advantages-and-Disadvantages-of-5g.html)
- [9] S. Hossain, "5G Wireless Communication Systems," no. 10, pp. 344–353, 2013.
- [10] S. Singh and P. Singh, "Key concepts and Network Architecture for 5G mobile technology," vol. 1, no. 5, pp. 165–170, 2012.
- [11] A. K. Pachauri and O. Singh, "5G technology – Redefining wireless Communication in upcoming years," vol. 1, no. 1, pp. 12–19, 2012.
- [12] 5G technology Available :<http://freewimaxinfo.com/5g-technology.html>


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