

## WIRELESS COMMUNICATION SYSTEMS ARE TRANSFORMING OUR LIVES

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### **Abstract**

*As a subscriber becomes more aware of the mobile phone technology, he/she will search for a suitable package all together, including all the advanced features of a cellular phone can have. Hence, the search for new technology is always the main target of the prime cell phone giants to out innovate their competitors. In addition, the main purpose of the future generation wireless networks (6G & 7G) is planned to design the best wireless world that is free from limitations and barrier of the previous generations (1G to 5G). The journey of development in mobile wireless communication is spread over few decades. This advancement in mobile communication consists of few generations and is still going on. In this paper we will present the study of several generations which are being used 1G, 2G, 3G, 4G and 5G and try to find some future generations which are under research like 6G, and 7G. So this paper represents to find the future picture of mobile communication.*

**Keywords:** 1G, 2G, 3G, 4G, 5G, 6G, 7G, TDMA, CDMA, GSM, All IP Network

### **Introduction**

We are living in modern science. We cannot think a single moment without science. Science makes our life easy and comfortable. Modern world is being compressed due to the development of science and its technologies. During the last few decades, the world has seen phenomenal changes in the telecommunications industry due to science and technology. The growth in telecommunication industry is very sharp during last little decades. The main contribution in this growth of industry is wireless mobile communication industry. We have different mobile and wireless communication technologies, which are mass deployed, such as WiMAX , Wi-Fi, LTE (Long Term Evolution), 3G mobile networks and 4G as well as accompanying networks, such as personal area networks (e.g., Bluetooth, ZigBee) or sensor networks. The growth of this industry has experienced several generations. These generations are 1G, 2G, 3G, 4G, and 5G. Each generation have some standards, capacities, techniques and new features which differentiate it from previous generations. Due to these new features, the number of mobile phone subscribers is increasing day by day.

### **Evolution of Wireless Technologies**

#### **1G - First Generation Mobile Communication System**

The 1st generation was open up for voice service in early 1980's, where almost all of them were analog systems using the frequency modulation technique for radio transmission using frequency division multiple access (FDMA) with channel capacity of 30 KHz and frequency band was 824-894 MHz, which was based on a technology known as Advance Mobile Phone Service (AMPS).The first generation has some specification which are a following.

Generation	1G
Starts From	1970 - 1984
Data Capacity	2kbps
Technology	Analog Wireless
Stander	AMPS
Multiplexing	FDMA
Switching	Circuit
Service	Voice Only
Main Network	PSTN
Hand off	Horizontal
Frequency	800 - 900 MHz

### 2G - Second Generation Mobile Communication System

The 2nd generation was achieved in later 1990's. The 2G mobile communication system is a digital system; this system is still mostly used in different parts of the world. This generation mainly used for voice communication also offered additional services such as SMS and e-mail. In this generation two digital modulation schemes are used; one is time division multiple access (TDMA) and the 2nd is code division multiple access (CDMA) and frequency band is 850-1900 MHz. In 2G, GSM technology uses eight channels per carrier with a gross data rate of 22.8 kbps (a net rate of 13 kbps) in the full rate channel and a frame of 4.6 milliseconds (ms) duration. The family of this generation includes of 2G, 2.5G and 2.75G. The specifications of this family are shown in the table below.

Generation	2G	2.5G	2.75G
Starts From	1990	2000	2003
Data Capacity	10kbps	200kbps	473kbps
Technology	Digital Wireless	GPRS	EDGE
Stander	CDMA, TDMA, GSM	Supported TDMA/GSM	GSM, CDMA
Multiplexing	TDMA, CDMA	TDMA, CDMA	TDMA, CDMA
Switching	Circuit packet	Packet Switch	Packet Switch
Service	Voice Data	MMS internet	
Main Network	PSTN	GSM, TDMA	WCD, MA
Hand off	Horizontal		
Frequency	850-1900 MHz(GSM) 825-849MHz(CDMA)	850-1900 MHz	850-1900 MHz

### 3G - Third Generation Mobile Communication System

The evolution of GSM to 3G is about gradually adding more functionality, possibilities and value to the existing GSM network and business. In search of high speed, fast data rate capacity and good QoS, the evolution of mobile generation reached to 3rd generation mobile communication system. This system was adopted by Japan and South Korea in 2001 for the first time. 3G UMTS (universal mobile telephone service) is developed by ETSI with in ITU's IMT-2000 framework. 3G mobile system is equally available with all cellular standards like CDMA, GSM, and TDMA under one umbrella. The

main features of 3G technology include wireless web base access, multimedia services, email, and video conferencing. The specifications of this family are shown in the table below.

Generation	3G	3.5G	3.75G
Starts From	2001	2003	2003
Data Capacity	384Kbps	2Mbps	30Mbps
Technology	Broad band / IP technology FDD, TDD	GSM/ 3GPP	
Stander	CDMA/WCDMA/ UMTS/CDMA 2000	HSDPA/HSUPA	1xEVDO
Multiplexing	CDMA	CDMA	CDMA
Switching	Packet& circuit	Packet	Packet
Service	High speed voice / data / video	High speed voice / data / video	High speed internet / multimedia
Main Network	Packet network	GSM , TDMA	
Hand off	Horizontal	Horizontal	Horizontal
Frequency	1.6-2.5GHz	1.6-2.5GHz	1.6-2.5GHz

#### 4G - Fourth Generation Mobile Communication System

A huge increment in the mobile subscription has made the attention of researchers and industries to move the next generation of mobile wireless technology. The main aim of 4G technology is to provide high speed, high quality, high capacity and low cost services for example voice, multimedia and internet over IP. 4G is totally IP based technology with the capability of 100Mbps and 1Gbps speed for both indoor and outdoor. This generation is in the under development stage. A term MAGIC is used to explain the 4G technology.

- M = mobile multimedia
- A = any time any where
- G = global mobility support
- I = integrated wireless solution
- C = customized personal service

The technologies under the 4G umbrella are; one is LTE (Long term evolution) and second is Wi-MAX (Worldwide Interoperability for Microwave Access). One common characteristic of the new services to be provided by 4G is their demanding requirements in terms of QoS. Applications such as wireless broadband access, Multimedia Messaging Service (MMS), video chat, mobile TV, HDTV content and Digital Video Broadcasting (DVB) are being developed to use a 4G network.

Generation	4G
Starts From	2010
Data Capacity	200Mbps to 1Gbps
Technology	LTE, Wi-MAX
Stander	IP-broadband LAN/WAN/PAN
Multiplexing	MC-CDMA, OFAM
Switching	Packet
Main Network	Internet
Hand off	Horizontal & Vertical
Frequency	2-8GHz

### 5G - Fifth Generation Mobile Communication System

5G Wireless Communication System is not deployed yet. The big challenge for the design and deployment of 5G wireless system can be faced easily as proposed features and architecture (mentioned below) that will increase system capacity and quality within the limited available frequency spectrum, whose frequency band and Data Bandwidth will be '3-300GHz' and '1Gbps & higher (as demand)' successively. The remarkable issue, there don't have any limitation in 5G as respect to user demands in the next 200 years. The 5G also implies the whole wireless world interconnection (WISDOM–Wireless Innovative System for Dynamic Operating Mega communications concept), together with very high data rates of the Quality of Service (QoS) applications.

5G is to be a new technology that will provide all the possible applications, by using only one universal device, and interconnecting most of the already existing communication infrastructures. The 5G terminals will be an upgradable multimode and cognitive radio-enabled. It will have software defined radio modulation schemes. All the required upgradable software should be downloaded from the Internet on the run. The 5G mobile networks will focus on the development of the user terminals where the terminals will have access to different wireless technologies at the same time and will consolidate various flows from various technologies. Besides, the terminal will make the ultimate choice among different wireless/mobile access network providers for a given service.

The important features of 5G technology includes bidirectional larger bandwidth, less traffic, equally availability of network across the world, 25Mbps connectivity speed, data bandwidth higher than 1GB and low-cost.

Generation	5G
Starts From	2015
Data Capacity	Higher then 1Gbps
Technology	IP v6
Stander	IP-broadband LAN/WAN/PAN & wwwww
Multiplexing	CDMA
Switching	All packet
Main Network	Internet
Hand off	Horizontal & Vertical

### Quality of Service (QoS)

Next Generation Networks (NGN) consists of support functionalities for data transport, and control transport, as well as functionalities for support of services and applications. The measurement of traffic is a basic control activity in order to provide Quality of Service. In addition 5G communication system is designed by the finest Quality of Service (QoS). Quality of Service (QoS) refers to a network's ability to achieve maximum bandwidth and deal with other network performance elements like latency, error rate and uptime. Quality of service also involves controlling and managing network resources by setting priorities for specific types of data (video, audio, files) on the network. QoS is exclusively applied to network traffic generated for video on demand, IPTV, VoIP, streaming media, videoconferencing and online gaming. The primary goal of quality of service is to provide priority to networks, including dedicated bandwidth, controlled jitter, low latency and improved loss characteristics. Its technologies supply the elemental building blocks that will be used for future business applications in campus, wide area networks and service provider networks. There are three fundamental components for basic QoS implementation:

- Identification and marking techniques for coordinating QoS from end to end between network elements.
- QoS within a single network element.
- QoS policy, management, and accounting functions to control and administer end-to-end traffic across a network.

### Future Generation of Mobile Communication

#### 6G & 7G Mobile Communication System

The 6G mobile system for the global coverage will join together 5G wireless mobile system and satellite network. These satellite networks consist of telecommunication satellite network, Earth imaging satellite network and navigation satellite network. The telecommunication satellite is used for voice, data, internet, and video broadcasting; the earth imaging satellite networks is for weather and environmental information collection; and the navigational satellite network is for global positional system (GPS). The four different countries which developed these satellite systems are; the GPS by USA, the COMPASS system developed by China. The Galileo system by EU, and the GLONASS system developed by Russia. In 6G handoff and roaming will be the big issue because these satellite systems are different networks and 6G has four different standards. So the handoff and roaming must take place between these 4 networks but how it will occur is still a question.

7G mobile network is like the 6G for global coverage but it will also define the satellite functions for mobile communication. In satellite system, the telecommunication satellite will be for voice and multimedia communication; navigational satellite will be for global positional system (GPS) and earth image satellite for some extra information like weather update. The 6G mobile wireless network will support local voice coverage and

other services. The 7G will be the most advance generation in mobile communication but there will be some research on demanding issues like the use of mobile phone during moving condition from one country to another country, because satellite is also moving in constant speed and in specific orbit, the standards and protocols for cellular to satellite system and for satellite to satellite communication system. The dream of 7G can only be true when all standards and protocols are defined. May be this is possible in next generation after 7G and can be named as 7.5G.

When 7G will complete all its weak points then there will be no issue of data capacity coverage and hand off left behind. At that time there will be only one demand from user which is the cost of mobile phone call and its services. This issue will again start evolutionally change in standard and technology and will also open new horizons for research. This new revolution in technology for cost of mobile phone call and services will be called as 7.5G or 8G.

### Conclusion

In this paper we have discussed the existing and future wireless mobile communication generations. Edge will contribute to a bright future for 3G and onwards generations, a vision shared by major analyst and industry groups. Satellite network will be used from 6G mobile communication systems and onwards. In 6G the cost of mobile call will be relatively high but in 7G this problem will be improved and the cost of call will be reduced and lower level user will benefit from it. Automobile and the television changed our lives but EDGE will change our lives by providing 3G, 4G, 5G, 6G, 7G services for the masses.

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