

# A Comparative Study of Mobile Wireless Communication Network: 1G to 5G

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**Abstract:** Mobile communication system providing the way to which people communicate, sharing messages and data to each other. These facilities are provided to the user within a very short time period with the latest technologies. The technologies of mobile communication is started from first generation (1G) and reached to the fifth generation (5G). First generation start from providing basic services mobile voice, second generation support mobile voice as well as low bit rate data services, 3G started high volume movement of data was possible which will further expanded to high speed technologies and high mobility and then 5G mobile communication system with high bandwidth with wide coverage area. This paper provides a comparison overview of all mobile communication generation from 1G to 5G.

**Keywords:** 1G, 2G, 3G, 4G, 5G, Mobile communication

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## I. INTRODUCTION

Today, present the era of the communication among people, companies through the mobile wireless communication network. In the last decades mobile communication industry growing very fast and rapidly. The wireless generation generally define as what changes are made in transmission technology time to time and to its frequency bands and these changes are further classified as 1G,2G,3G,4G,5G.each generation having its own features, techniques, capabilities and differentiating each other.

## II. FIRST GENERATION (1G)

The first generation mobile communication system was introduced in the beginning of 1980 and using the analog transmission for speech services. In 1979, the first cellular system in the world became operational by Nippon Telephone and Telegraph (NTT) in Tokyo, Japan. Two years later, the cellular epoch reached Europe. The two most popular analogue systems were Nordic Mobile Telephones (NMT) and Total Access Communication Systems (TACS)[1]. 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 [6], which was based on a technology known as Advance Mobile Phone Service (AMPS).[2]

## III. SECOND GENERATION (2G)

After first generation analog mobile communication system 2G mobile system was introduced around 1991.concept of 2G based on multiple base stations where each station distributed uniformly over the world to communicating with the users. to communicate more and more users multiple access techniques are used i.e. FDMA,TDMA,CDMA[3].2G technology make uses of compression decompression algorithm (codec) and family members of this generation are 2G(GSM), 2.5G(GPRS) ,2.75G(EDGE)[4].

#### IV. THIRD GENERATION (3G)

3G is the advanced generations for the mobile communication services and these services based on the technical standards of IMT-2000 including the reliability and speed (data transfer rates) i.e. at least 200kbit/s [5]. Beyond mobile telephony, the higher speeds allowed 3G connections in PCs, gaming consoles, tablets and any other portable device that could benefit from a faster and higher quality internet connection. 3G also provides users with better security through user authentication capabilities when communicating with other wireless devices.[6]. 3G comprised of three basic technologies i.e. **CDMA2000**, **TD-SCDMA** - Time-division Synchronous Code-division Multiple Access, **W-CDMA (UMTS)** Wideband Code Division Multiple Access.

#### V. FOURTH GENERATION (4G)

4G is the successor generation of 3G and 2G. 4G communication allow users to access network on the concept of “connect anytime, anywhere, anyhow”. The main features of 4G communication system is seamless access, personalization, quality of service and IP based system and it is characterized by high data rates i.e. 20 Mb/s per customer, high mobility, end-to-end IP transmission & QoS management. The word “MAGIC” also refers to 4G wireless technology which stands for Mobile multimedia, Any-where, Global mobility solutions over, integrated wireless and Customized services.

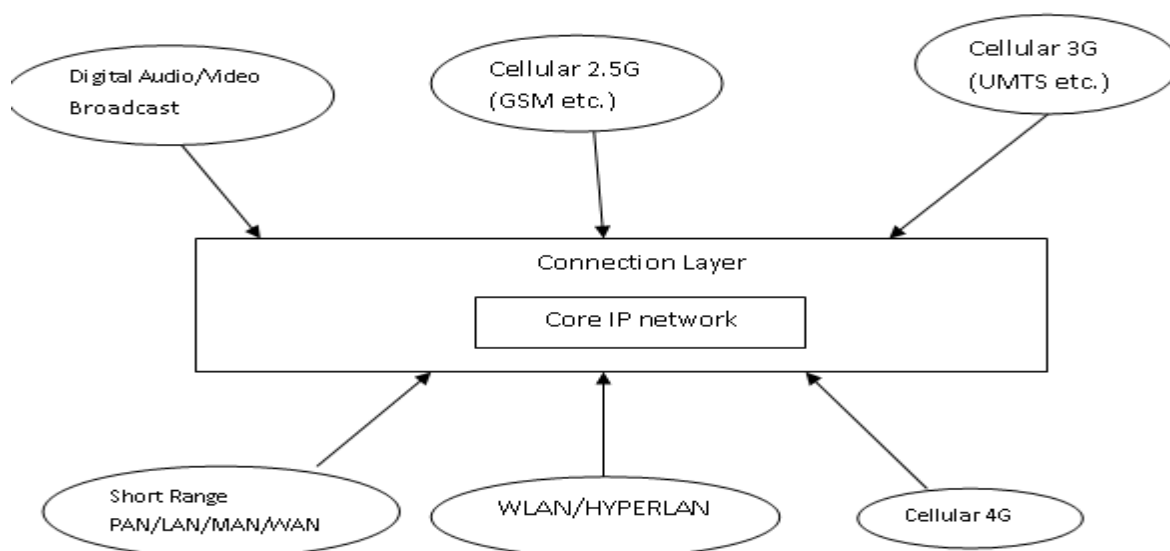


Fig 1: Seamless Connection of networks in 4G [1]

#### VI. FIFTH GENERATION (5G)

Fourth generation LTE started to deployed widely around the world. fifth generation mobile and technologies emerging in the field of research, new services, application that will enhance the system quality and capacity within the limited bandwidth spectrum whose frequency band and Data Bandwidth will be 3-300GHz and 1Gbps & higher (as demand) successively. Fifth generation communication will be deploy on the concept of WISDOM (Wireless Innovative System for Dynamic Operating Mega communications concept).

The innovation of fifth generation is based on the three objectives:

1. Implementation of large scale capacity and large connectivity
2. Supporting all diverse set of services, applications and users : all with extremely diverging requirements
3. Flexible and efficient use of all available non-contiguous spectrum for: wildly different network deployment scenarios[5g tech.vision]

## VII. COMPARATIVE STUDY OF 1G TO 5G

Here we summarize the comparison among the generations of mobile communication in terms of requirements, Data bandwidth, core network, service, standards, multiple access, switching, and frequency.

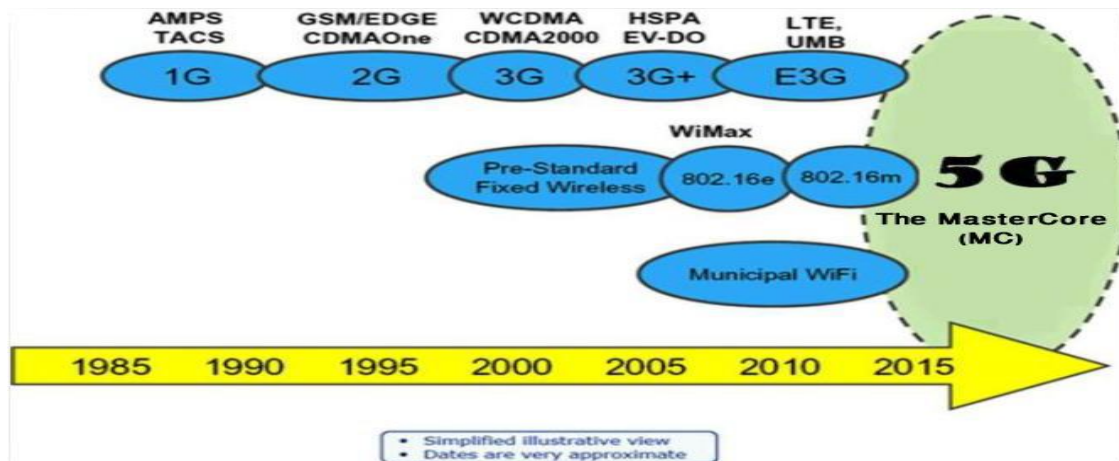


Figure 2: Series of mobile generations and their features [2]

TABLE 1: COMPARISON OF MOBILE TECHNOLOGIES

Technology	1G	2G	3G	4G	5G
<b>Requirements</b>	No official Requirements Analog technology	No official Requirements Digital Technology	ITU's IMT-2000 required 144 kbps mobile, 384 kbps pedestrian, 2 Mbps indoors	ITU's IMT Advanced requirements include ability to operate in up to 40 MHz radio channels and with very high spectral Efficiency.	at least 1 GB/s or more data rates to support ultra-high definition video and virtual reality, applications, 10 GB/s data rates to support mobile cloud service
<b>Data Bandwidth</b>	1.9 kbps	14.4 kbps to 384 kbps	2 Mbps	2 Mbps to 1 Gbps	1Gbps & Higher (as demand )
<b>Core network</b>	PSTN	PSTN Packet Network	Packet network	All IP Network	Flatter IP Network & 5G Network Interfacing(5G-NI)
<b>Service</b>	Analog voice	Digital voice Higher capacity, packetized data	Integrated high quality audio, video and data	Dynamic information access, wear-able devices, HD streaming; global roaming;	Dynamic information access, wear-able devices, HD streaming; any demand of users; upcoming all technologies; global roaming smoothly;
<b>Standards</b>	NMT, AMPS, Hicap, CDPD, TACS, ETACS	GSM,GPRS, EDGE ETC.	WCDMA, CDMA 2000.	All access convergence including: OFMDA,MC-CDMA Network-LMPS	CDMA & BDMA
<b>Multiple access</b>	FDMA	TDMA CDMA	CDMA	CDMA	CDMA & BDMA
<b>Starts from</b>	1970-84	1990	2001	2010	2015
<b>Switching</b>	Circuit	Circuit Packet	Circuit Packet	Packet	All Packet
<b>Frequency</b>	800-900 Reference Mhz	850-1900MHZ	1.6-2.5GHZ	2-8GHZ	

## VIII. CONCLUSION

Increasing demand of people or users encourages the industries and the researchers to develop new technology and the result is mobile communication industry reaches to 5G (fifth generation).

Fifth generation communication allow users to communicate at very high speed with higher bandwidth and high data rate.

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