

# **Detailed comparative analysis of 1G, 2G, 3G, 4G and 5G.**

Name: Sameer Gupta

Roll no.: 252010036

## **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.

## **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). 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).

## **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. 2G technology make uses of compression decompression algorithm (codec) and family members of this generation are 2G(GSM), 2.5G(GPRS) ,2.75G(EDGE).

## **ITHIRD 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. 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. 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.

#### **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 are 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.

#### **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 deployed 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]

| Technology            | 1G   | 2G   | 3G  | 4G  | 5G  |
|-----------------------|--|--|---|---|---|
| <b>Requirements</b>   | No official Requirements Analog technology | No official Requirements Digital Technology    | ITU's IMT2000 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<br>; global<br>roaming<br>smoothly; |
| <b>Standards</b>           | NMT,<br>AMPS,<br>Hicap,<br>CDPD,<br>TACS,<br>ETACS | GSM,<br>GPRS,<br>EDGE ETC. | WCDMA,<br>CDMA<br>2000. | All access<br>convergence<br>including:<br>OFMDA,<br>MC-CDMA<br>Network-LMP<br>S | CDMA &<br>BDMA                                   |
| <b>Multiple<br/>access</b> | FDMA   | TDMA<br>CDMA               | CDMA                    | CDMA   | CDMA &<br>BDMA                                   |
| <b>Starts from</b>         | 1970-84  | 1990                       | 2001                    | 2010   | 2015   |
| <b>Switching</b>           | Circuit  | Circuit<br>Packet          | Circuit<br>Packet       | Packet   | All Packet                                       |
| <b>Frequency</b>           | 800-900<br>Reference<br>MHz                        | 850-<br>1900MHZ            | 1.6-2.5G<br>HZ          | 2-8GHZ   |  |