

Review of Generation of Mobile services

- 1G Technology: → First generation of wireless mobile communication where analog signals were used to transmit data.
- Introduced in 1980
 - Design exclusively for voice communication

Radio signal = Analog

Characteristics

- | | |
|--------------------------------|--|
| → uses circuit switching | → No data security |
| → Data service not provided | → speed up to 2.4 Kbps |
| → Channelization protocol FDMA | → poor voice quality |
| | → large phones with limited battery life |

2G

used digital signal for the first time. Launched in Finland in 1991 and used GSM Technology. Implemented GSM, CDMA.

characteristics

- | | |
|--|---|
| → Data speed upto 64 Kbps | → Voice signal is digital |
| → Text and Multimedia message possible | → provide data service except complex data (videos) |
| → Better quality than 1G | → channelization protocol TDMA and CDMA |
| → When GPRS technology introduced, it enabled web browsing, email service, & fast upload and download speed. | |
- General packet for Radio service (GPRS)

$$2G + GPRS = 2.5G$$

Enhanced Data Rates for GSM Evolution (EDGE)

3G

Introduced Smartphone technology. Introduced in 2001 to provide greater voice and data capacity, wide range of application and increase data transmission at a low cost.

Characteristics:

- Data Speed 144 Kbps to 2mbps
- High speed web browsing, web based application video-conf.
- fast and easy transfer of audio and video files
- 3D gaming
- use Universal mobile Telecommunication System (UMTS) as its core network architecture.
- Drawback/challenges: expensive mobile phones, high infrastructure cost like licensing fees and mobile towers, trained person for infrastructure setup.

4G

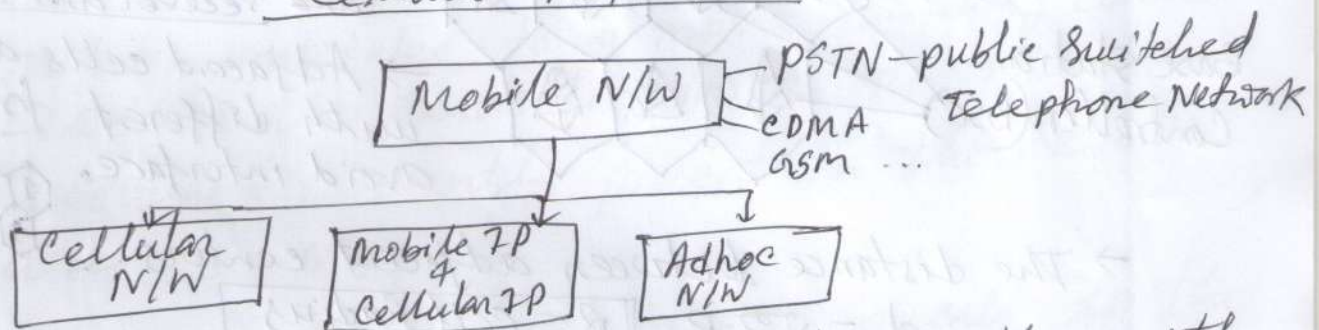
High speed, high quality and high capacity to users while improving security and lower cost of voice and data services, multimedia and internet over IP. Introduced in 2011.

characteristics

- Speed of 100mbps to 1Gbps
 - HD mobile TV
 - Cloud computing
 - IP telephony
 - Two important standards: WiMAX, LTE
 - Multiple Input Multiple Output (MIMO), Orthogonal FDM = OFDM
- Basic term used to describe 4G is 'MAGIC'
- M = mobile multimedia
 - A = Anytime Any where
 - G = Global Mobility Support
 - I = Integrated wireless solution
 - C = Customised personal services.

5G

- Started from late 2020
- complete wireless communication with almost no limitations.
- Highly supportable to WWW (Wireless WWW)
- high speed, high capacity
- providing large broadcasting of data in Gbps
- Support interactive multimedia, voice, streaming video, and others
- More effective and more attractive
- Device-to-device communication, better battery consumption
- will support large area Synchronized-CDMA, ultra Wideband, Network-LMDS (Local Multipoint Distribution Service), IPVC, BDMA (Beam Division Multiple Access)

Cellular Networks

→ cellular concept replace large transmitter with smaller transmitter neighbouring Base Stations (BS) are assigned different sets of channels. Capacity can be increased by additional partitions.

→ Factors for determining cell size.

→ No. of users to be supported

→ Multiplexing and transmission technology

→ Cellular N/W offers a no. of advantages:

→ Increased capacity

→ Reduced power used

→ large coverage area

→ Reduce interference from other signals. (Frequency Reuse).

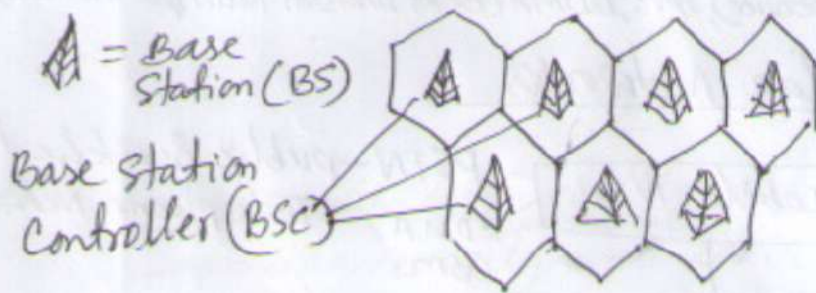
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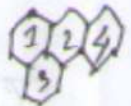
- Communication is always between mobile and base station.
- Neighbouring cells are assigned different channel groups.

Components and Terminology used in Cellular N/W:

Cell: Basic geographic unit of cellular system. These are hexagonal structures that formed a shaped N/W. Cell size varies depending upon the landscape. The cell is designed as a radius of circle that covers the particular area. The cell size is 100m in cities and 35 km on countryside.



- Each cell has its own antenna, having a collection of transmitter and receiver and control unit
- Adjacent cells are assigned with different frequencies to avoid interface.



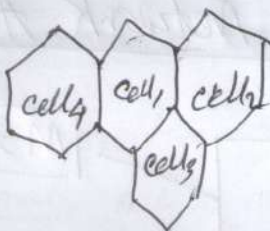
- The distance between adjacent centers
 $d = \sqrt{3} R$ $R = \text{cell Radius}$

Base station:

- The covered area of a cellular N/W is divided into smaller area called cells.
- Each cell has a base station provides direct communication with the mobile phones.
- There may be a number of base stations that linked to a Base station controller (BSC). It acts a small centre to route cells to required BS and also decides ~~in~~ with cells ^{suits} to which BS.

$$\text{Channel per BTS} = \frac{\text{Available Bandwidth}}{\text{number of station} \times \text{per channel capacity}}$$

→ ... Terminology...



→ Coverage area of base station is also known as cell

Home Location Register (HLR): It is a database that records the current location of each mobile that belongs to the Mobile Switching Centre (MSC). [You buy a sim from delhi then data saved in delhi HLR]

- Info like services, mobile number, whether the number have been ported to another network
- Store data permanently

Visitor Location Register (VLR): It is also a database

that records the visiting location of each mobile associated to a mobile switching centre.

- contains the exact location of all mobile subscribers currently present in the service area of MSC

→ This records help to route a call to the right base station.

→ Database entry is deleted when the subscriber leaves the service area.

Cellular Network Architecture

