Cellular network evolution

First Generation:

- **Launched in the mid 1980s.**
- **Analog systems.**
- **Analog modulation, mostly FM.**
- **Voice traffic only.**
- **FDMA/FDD multiple access.**
- **Confined to national boundaries. Ex: - AMPS**

In US, AMPS (Advanced Mobile Phone Services)

2G:

- **Developed for voice communication.**
- **Digital system, digital modulation.**
- **TDMA/FDD and CDMA/FDD multiple access.**
- **Provides data rates of the order of ~9.6 kbps.**
- **GSM uses GMSK (Gaussian Minimum Shift Keying)**
- **In 2002, 66% of mobile users were GSM based.**

Example of 2G:

- **GSM**
  - **TDMA / FDMA**
  - **900 Mhz and 1800Mhz.**
- **Personal Digital Communication (PDC)**
  - **Popular in Japan**
- **IS-95**
  - **CDMA.**
  - **US / South Korea**

- **900 MHz (890 – 915 , 935 – 960) & 1800 MHz signal can move fastest without attenuation.**
- **In most of the phones dual channels like 900 mhz & 1800 Mhz are used.**

Limitation of 2G:

- **Unsuitable for data traffic**
- **Average rate 10 kbps**
-
- **Not suitable for internet (packet switched service).**
- **Multiple standards (no true global coverage)**

2.5 G:

- **Digital System**
- **Voice + Low data rate.**
- **Internet access through GPRS (General Packet Radio Services)**
- **Enhanced Data rates for Global Evolution (EDGE): Uses better modulation techniques.**

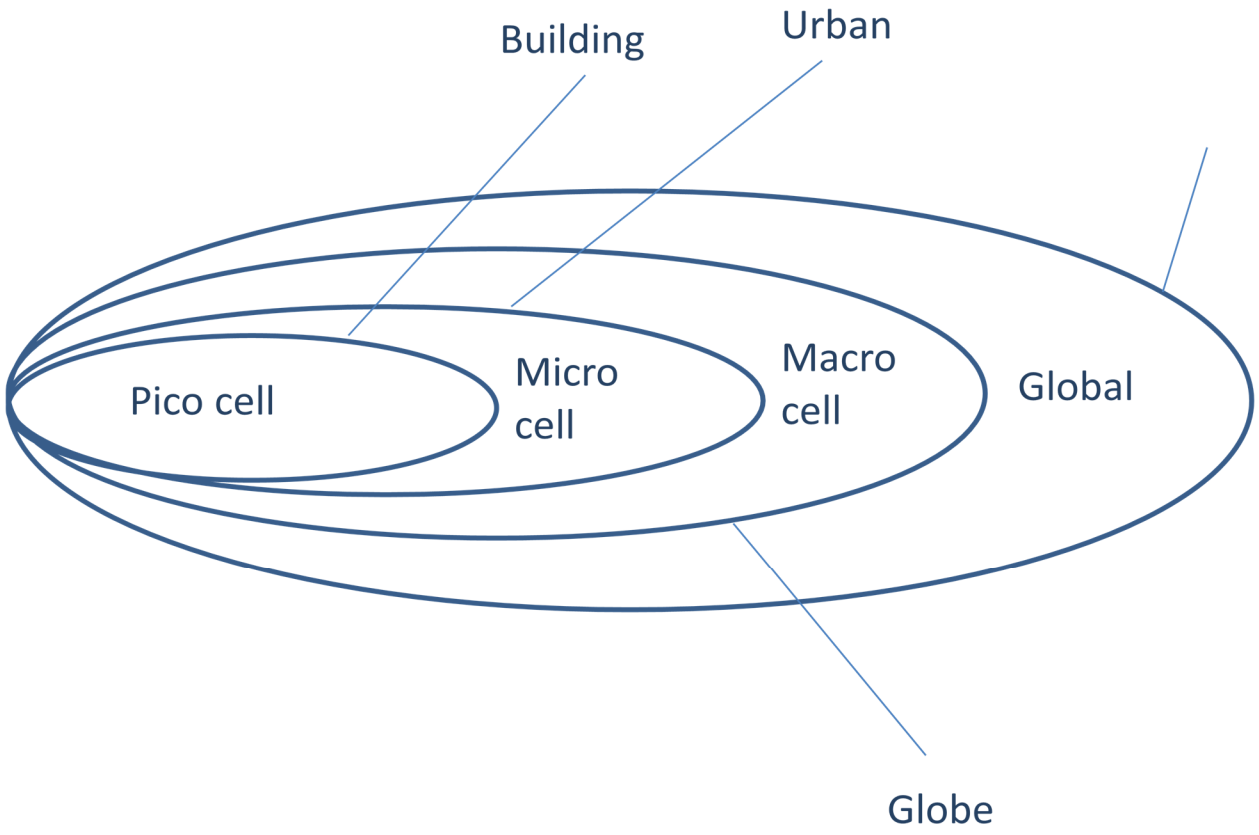
3 G:

- **Digital modulation.**
- **Simultaneous Voice plus High Speed data.**
- **Multimegabit Internet access.**
- **Voice activated calls.**
- **Multimedia transmission.**
- **Eg. WCDMA & CDMA2000**

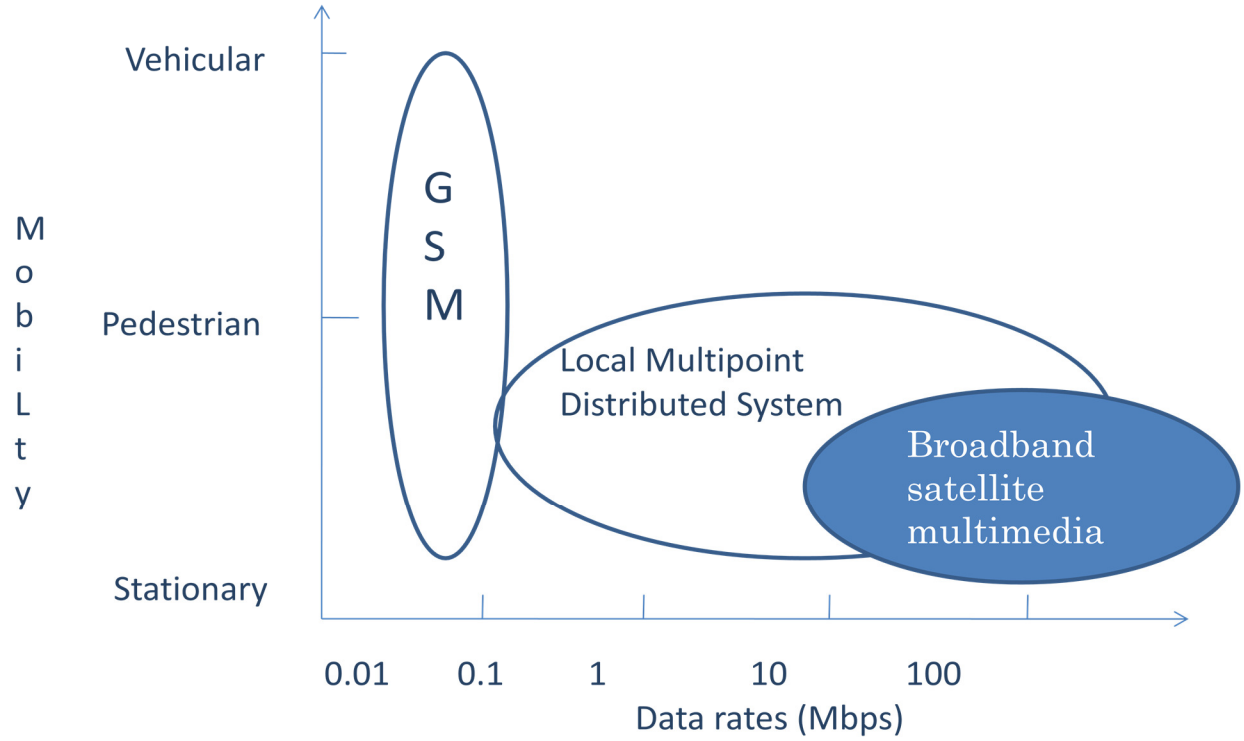
Need for 4G:

- **It will integrate various networks, functions and application.**
- **It will create the "Global information multimedia village".**
- **It will support a variety of data rates from 2G to 3G to3G+ , WLAN system to pico and small microcellular connectivity and fixed line systems.**

Coverage Aspect of Next Generation Mobile Communication System:



Transmission Capacity:



Terminology:

- **Control Channel:**

For call setup , call request and call initiation.

- **Page:**

A brief message that is broadcast over the entire service area by many base stations at the same time.

- **FDD / TDD** is used in between mobile and base station within the cell while multiple access is used to divide a channel among users.
- In CDMA / TDD.

FDD:

- Both base station and the user unit transmit and receive signals simultaneously.
- At the base station two separate transmit and receive antennas are used.

- At the subscriber unit only a single antenna is used both for transmission and reception . A device called duplexer is used to enable the same antenna for transmission and reception simultaneously.

TDD:

- Uses the fact that it is possible to share a single radio channel in time.
- A portion of time is used to transmit from the base station (BS) to mobile station (MS) and the remaining time is used to transmit from the MS to the BS.
- Only possible with digital transmission formats and digital modulation (very sensitive to time) .
- Used only for indoor or small area applications where the propagation delays are small.