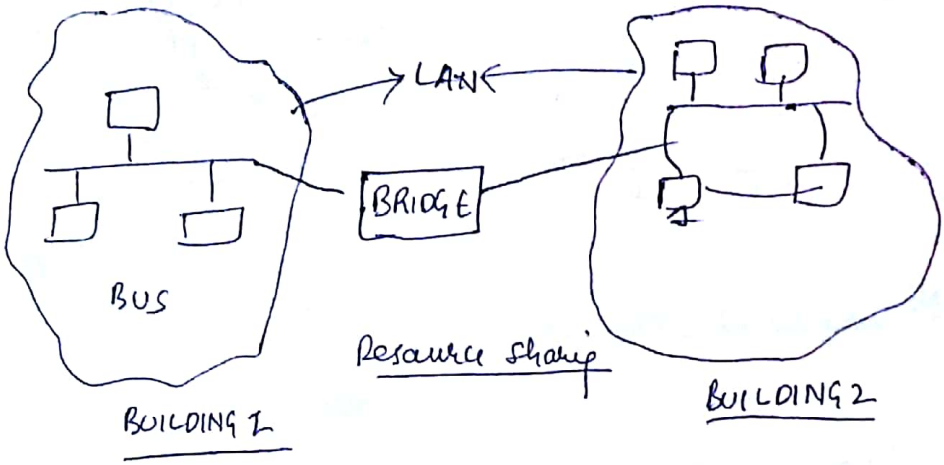
TYPES OF NETWORKS

① LOCAL AREA NETWORKS (LAN)

- OPERATES over small physical area such as office / society etc
- Easy to design & troubleshoot
- BUS, RING TOPOLOGY Are Generally used.

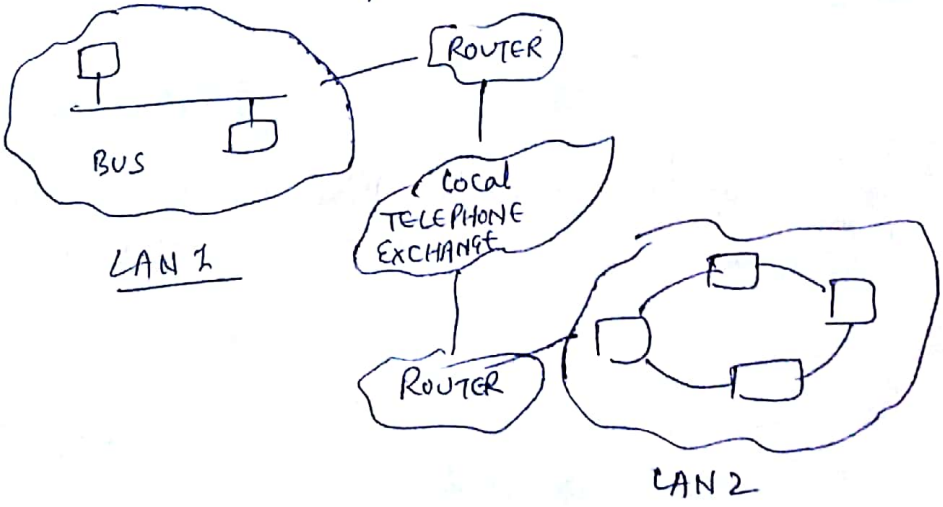
Advantage . used to share the resources such as harddisk, Printers etc



- HIGH SPEED
- NO AUTHORITY (ie no regulatory body)
- Communication Media — Co-axial cables.

2. METROPOLITIAN AREA NETWORK (MAN) (50 km radius)

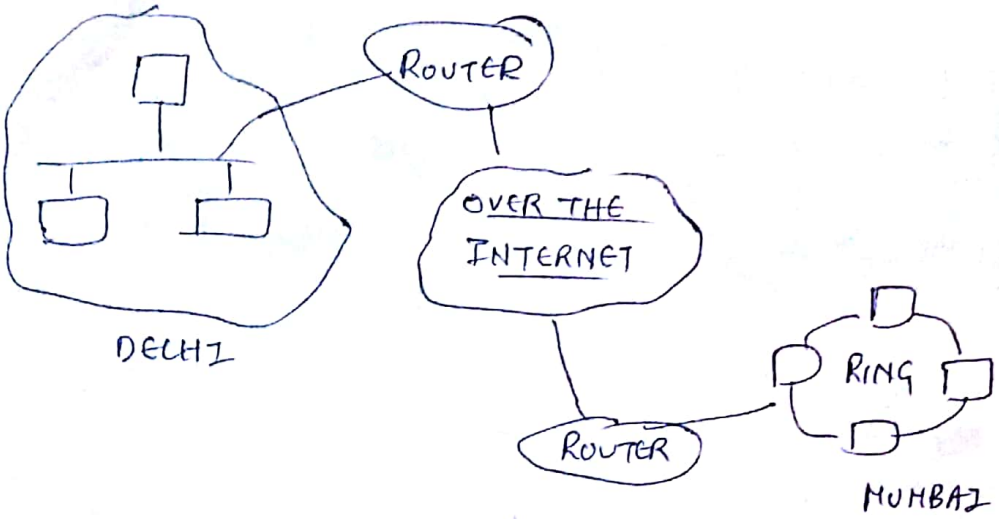
- Extended over Entire city
- Covers city .. Data rate is less compared to LAN.



- Communication media is with the help of optical fibres or cables

3. WIDE AREA NETWORK (WAN)

- Large distance such as Country / States.



COMPARISON B/W LAN & WAN

LAN	WAN
1. Owned by a Person ie Privately owned	1) Can be Private or Public] ownership
2. operate over Small area	2. large distance, across countries
3. Easy to design & implement	3. Not Easy
4. Co-axial Cables	4. Satellite links
5. Minimum Propagation delay	5. Excessive Propagation delay
6. High data rate	6. Low data rate
7. Concept of Broadcasting	7. Concept of Switching

CELLULAR TELEPHONE SYSTEM

TOPICS TO COVER

- CELLULAR CONCEPT
- MOBILE PHONE SYSTEM
- FEATURES OF CELLULAR CONCEPTS :
  1) FREQUENCY REUSE
  2) CELL SPLITTING
- HAND OFF PROCEDURE
- GSM STRUCTURE

- **CONVENTIONAL METHOD**
  - used single high Powered Transmitter with Antenna
  - Covered large area.

  Drawback — Frequency reuse not possible due to interference

- **CELLULAR CONCEPT** –
  - Solved spectral conjestion (Frequency) & user capacity
  - Replaced Single high Power Transmitter → with → Large no, of low power transmitters

Primary Goal of Cellular telephone n/w

- To Provide wireless communication b/w two moving devices called Mobile stations or b/w one Mobile Unit & a stationary unit called Land line unit.

How CTS WORKS

- To Provide / accomodate large no, of users over a large geographical area, CTS uses

a) · Multiple low Power transmitters ($\leq 100W$)

b) Area divided into cells, each one served by its own Antenna

c) Each cell allocated a band of frequencies & is served by a base station.

d) Adjacent cells are assigned different frequencies to avoid interference or cross talk.

e) cells sufficiently distant from each other can use the same frequency band.

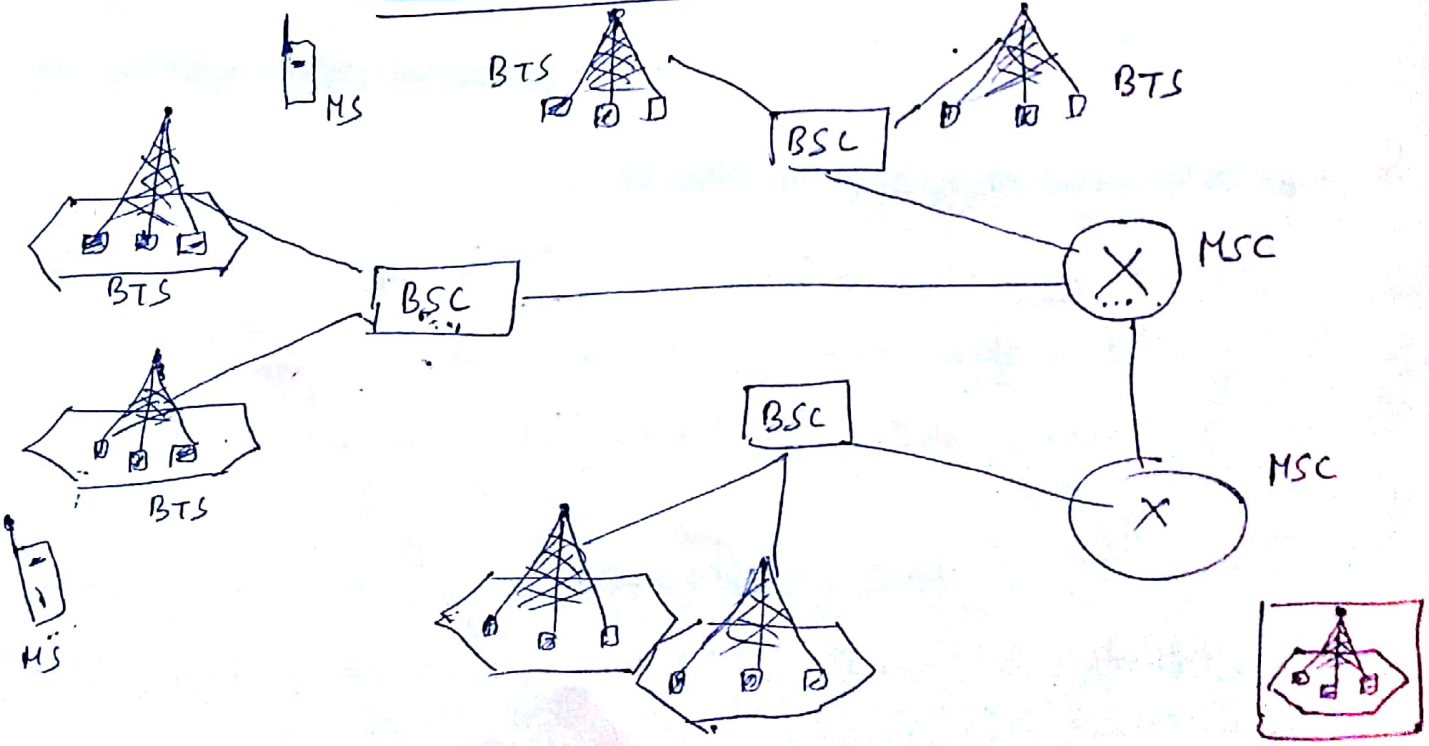
CELL - A Basic Geographical unit of a cellular communication System

- All cells must be Symmetrical in shape.
- Area (Hexagon) > Area(Square) > Area (Equilateral triangle)

CLUSTER - A Group of cells is called as a CLUSTER

- Size is not fixed
- depends on the requirements of the area

WORKING OF MOBILE PHONE SYSTEM



① Mobile Station (MS) : Mobile handsets used by user to communicate with another user

② BASE STATION CONTROLLER (BSC) - Each cell contains an Antenna which is controlled by small office called Base Transceiver Station (BTS)

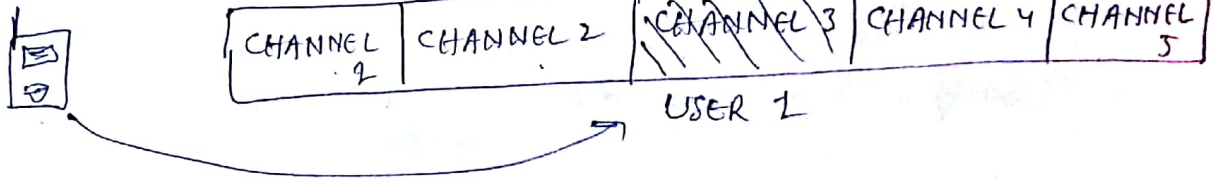
③ MSC (Mobile Switching Centre) - Each base station is controlled by a Switching office called MSC.

MSC — Master controller of the entire system.

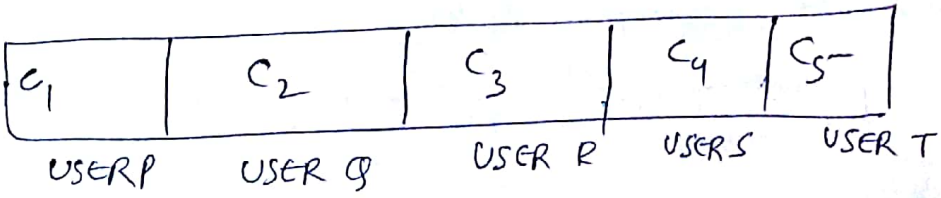
MSC are different for different areas

CHANNEL ALLOCATION SCENARIO

SCENARIO 1



SCENARIO 2 - when all channels are occupied



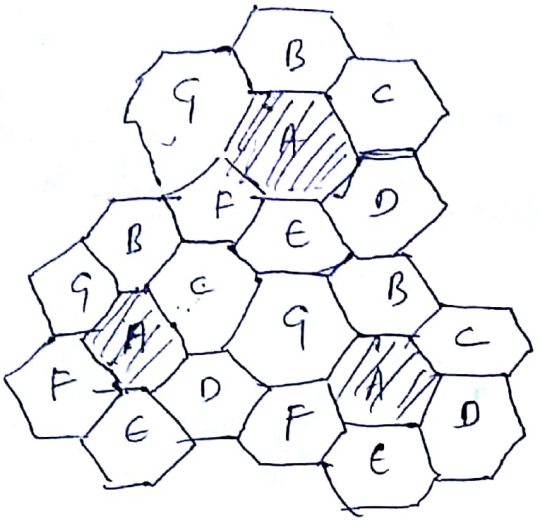
All channel occupied

- Then USER 1 has to wait & gets a notification like

✓ Call cannot be completed OR NETWORK ERROR

FEATURES OF CELLULAR CONCEPT

1. **FREQUENCY REUSE** — Same set of Frequencies are used for radio channels for different areas.



- Here Every cell named A uses same set of frequencies

Advantages of Frequency Reuse

- Many transmitters of small output Power operating at the same frequency can be used
- reduces minimum height of Transmitting antenna.

Disadvantage

- Co-Channel interference can occur if System is not Properly designed.

diff. It is the Phenomenon in which two frequency signals of adjacent channels interfere with each other

(2) **Cell Splitting** — Each cell is further divided into small cells called Microcells.

$$R(\text{Small cell}) = \frac{1}{2} * R(\text{Original cell})$$

Advantage

- when traffic increases beyond the limit of a regular cell.

HANDOFF PROCEDURE

- During a conversation, the mobile station moves from one cell to another. when it does, the signal may become weak. To solve this problem, MSC monitors level of signal every few seconds.
- If the strength of the signal diminishes, the MSC seeks a new cell that can better accomodate the communication. This procedure is called Hand off procedure

Hard Hand off

- MS only communicates with one BS. when MS moves from one cell to another communication must first be broken with previous BS before communication

Soft hand off

- In this case, MS can communicate with two BS at the same time. This means that breaking off from old one, MS can contain with new one also.

ROAMING

- Feature of cellular telephony
- A service Provider has a limited coverage. Here neighbouring service Providers can Provide extended coverage through a roaming contract.

FIRST GENERATION CELLULAR TELEPHONE

- First generation was designed for voice communication using analog signals.
  - uses 800MHz BAND
  - Each band divided into 832 channels

Example - AMPS (Advanced Mobile Phone System) is analog cellular system used in North America. It uses FDMA.

2. SECOND GENERATION

- Mainly designed for digitized voice.
- First generation was designed for analog voice communication
- Three major systems evolved in 2G.

D-AMPS IS-136

- uses digital system for voice communication
- D-AMPS is compatible with AMPS
- D-AMPS uses same band & channels as AMPS
- It is digital cellular phone system using TDMA & FDMA

GSM

- Global System For mobile communication
- GSM uses two bands for duplex communication
- Each band is divided into 24 channels
- uses TDMA & FDMA

IS-95 CDMA

- uses two bands for duplex communication
- Each band is divided into 20 channels

NOTE

① GSM – 2G
GPRS – 2.5G
② WCDMA – 3G (wideband) CDMA
③ LTE – 4G. (10 Times speed of 3G)
Long Term Evolution

3.6 to 21 mbps
- 05 m/
0 - 2.5 mbps

3. THIRD GENERATION

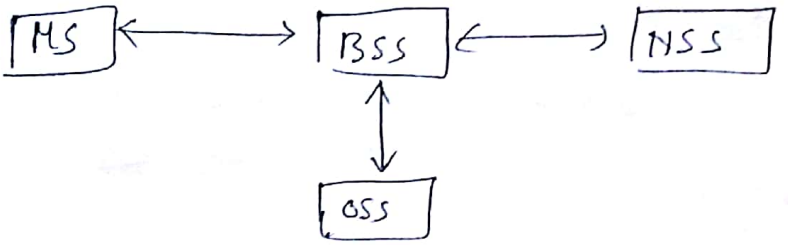
- Provides both digital data & voice communication
- Characteristic of 3G – Portable device is always connected to the internet
- Concept started in 1992 with a blue print called International mobile communication 2000 (IMT-2000)
  - Voice Quality Comparable to PSTN
  - Data rate of 144 kbps to access in a moving vehicle & 2 mbps for stationary
  - ~~A band of 2 GHz~~
  - Bandwidth of 2 MHz
  - Interface to Internet

MOBILE SYSTEMS

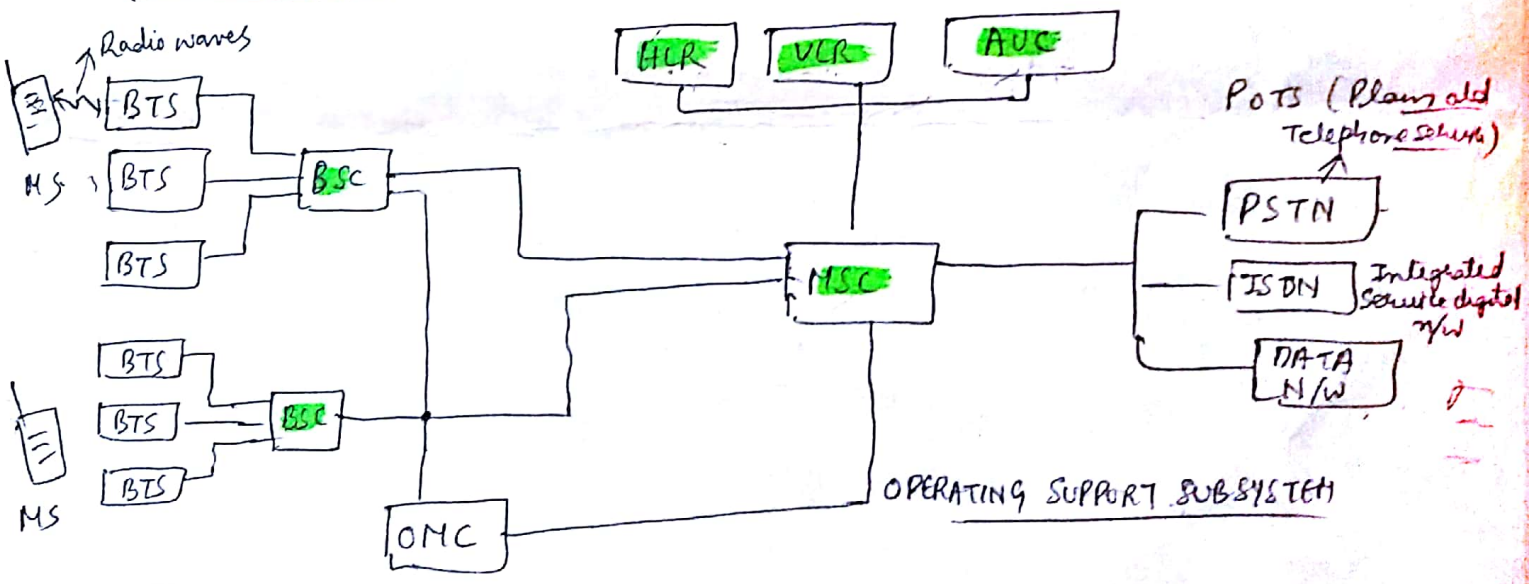
- GSM
- CDMA

GSM - GLOBAL SYSTEM FOR MOBILE

- A BIG system made up of small sub systems such as
  - MOBILE station (MS)
  - BASE station subsystem (BSS)
  - Network & Switching Sub system (NSS)
  - OPerating subsystem (OSS)



ARCHITECTURE



BSS = BTS + BSC

MSC = Backbone of the entire n/w operations

- Setting up a Call
- Handoff Procedure

NSS = MSC + HLR + VLR + AUC

NSS = MSC + HLR + VLR + AUC

HLR – keeps the database of all the users who reside in the same geographical area. (HOME LOCATION REGISTER)

VLR – visitor's location register – keeps the track of all the users who are visitors of particular geographic area. mainly roaming customers.

AUC – Authentication Center – Authentication of the users (by checking their SIM nos etc)
• Sends required inform to the MSC

OMC – operation & Maintenance Center – manages the GSM functional blocks < MSC / BSC

DIFFERENCE B/W GSM & GPRS

GSM	GPRS
• Global System for Mobile	• General Packet radio Service (GPRS)
• GSM is the n/w which can connect mobile Phones globally Based on TDMA	• GPRS – is one of the Service Provided over GSM for data on Mobile Phone.
• WCS 2G Cellular Telephony	• uses digital radio link to carry data at low rates
• Supports voice & SMS (Text)	– First Mobile internet (2.5G)