Mobile Communication Dependencies

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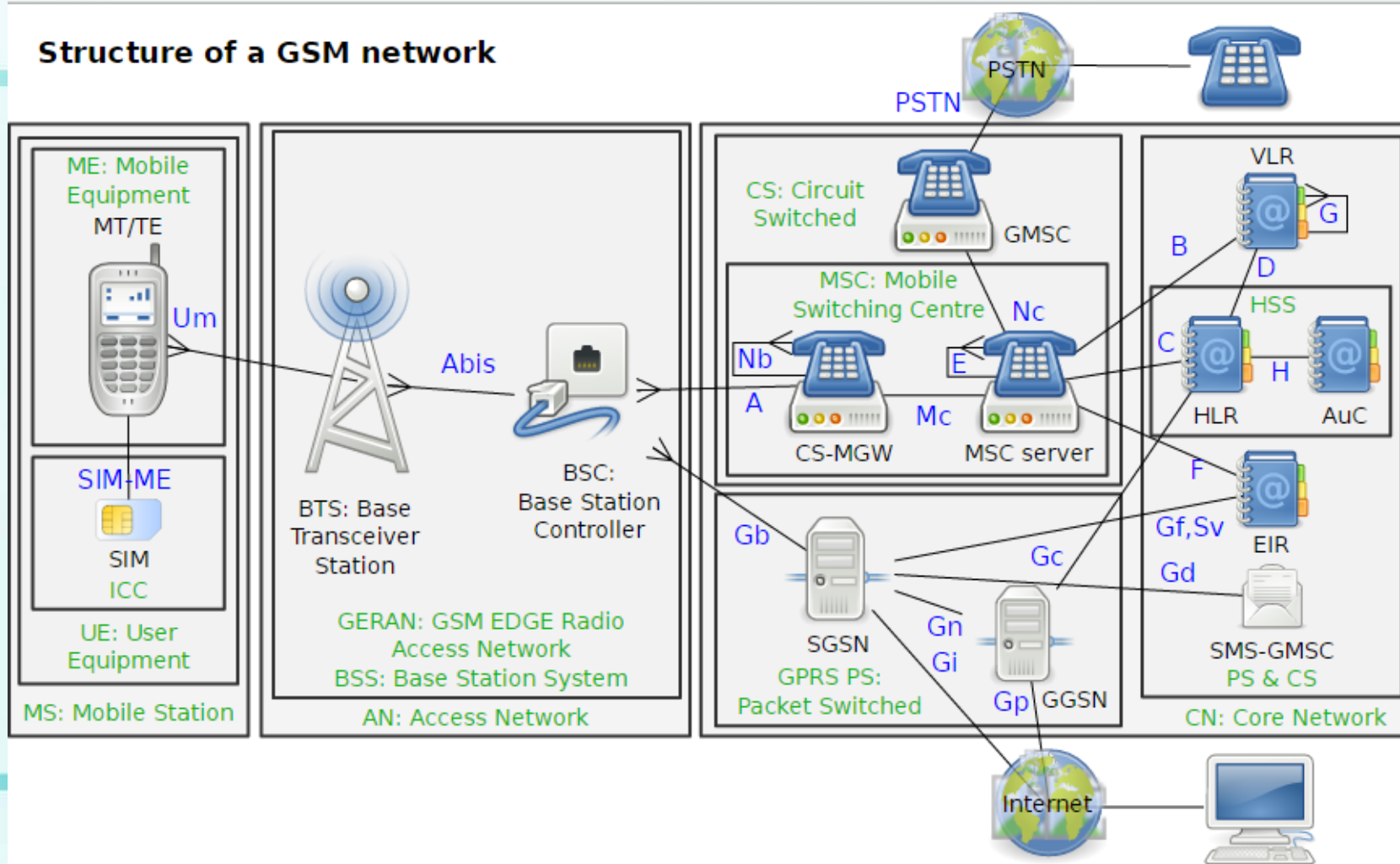
Agenda

- ➢ **Network architecture**
- ➢ **Air Interface**
- ➢ **System capacity**

Network architecture

- Main components of mobile network architecture are:
  - User Equipment (UE)
    - User interface handling radio functions
  - Access Network (AN)
    - Communicates with UE and handles all radio related functionality
  - Core Network (CN)
   - Communication between AC and external networks handles switching and routing services.

Structure of a GSM network

MS: Mobile Station
- ME: Mobile Equipment
  - MT/TE
  - Um
- SIM-ME
  - SIM
  - ICC
- UE: User Equipment

AN: Access Network
- BTS: Base Transceiver Station
- Abis
- BSC: Base Station Controller
- GERAN: GSM EDGE Radio Access Network
- BSS: Base Station System

CS: Circuit Switched
- GMSC
- MSC: Mobile Switching Centre
  - Nb
  - Nc
  - E
  - A
  - Mc
  - CS-MGW
  - MSC server

GPRS PS: Packet Switched
- Gb
- Gc
- SGSN
- Gn
- Gi
- Gp
- GGSN

CN: Core Network
- VLR
- B
- D
- G
- HSS
- C
- H
- HLR
- AuC
- F
- Gf,Sv
- Gd
- EIR
- SMS-GMSC
- PS & CS

PSTN

Internet

Basic elements in mobile communication systems

- **SIM** – A smart card stores identification (IMSI) of a subscriber, holds Auth. Key that identifies SIM on the mobile network
- **ME/MU/MS** – the mobile device
- **BTS** – Facilitate wireless communication between UE/ME and the network
- **BSC** – Allocates radio channel to ME, several BTS under the control of one BSC
- **MSC** – carries out call switching and routing
- **VLR** – linked to MSC, temporary DB of subscriber who roamed into a specific MSC
- **HLR** – a central DB of ME
- **AuC** – to authenticate each SIM
- **EIR** – keeps lists of ME which are to be banned or monitored

Air Interface
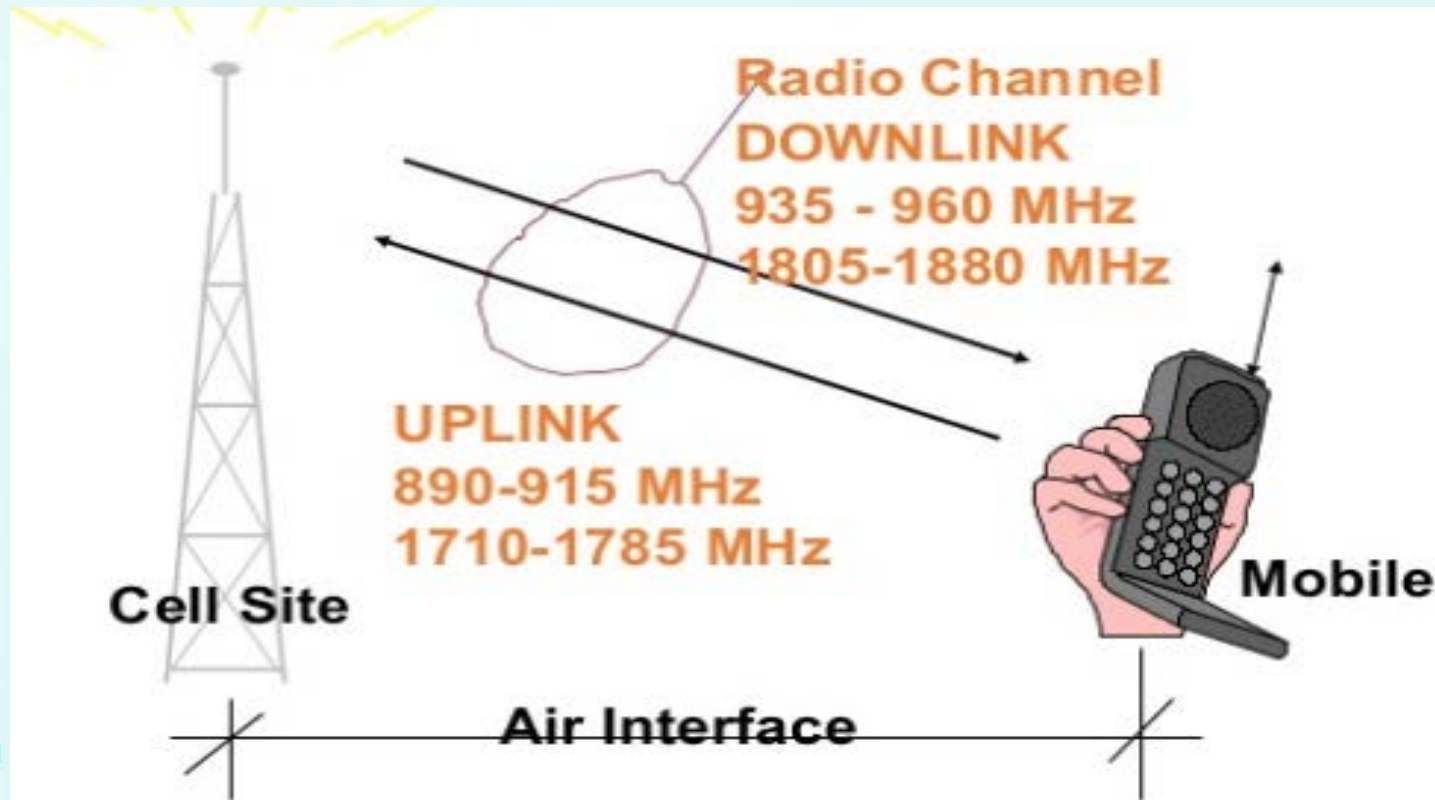
GSM frequency allocation

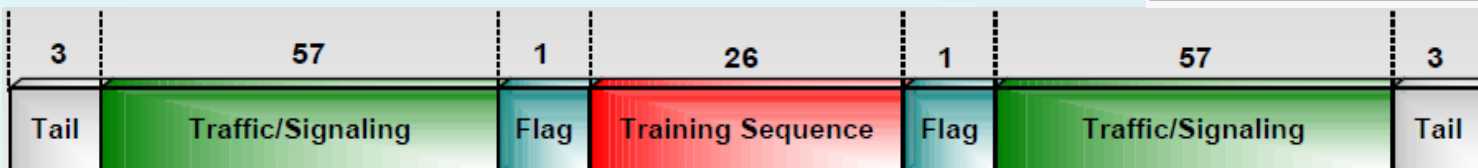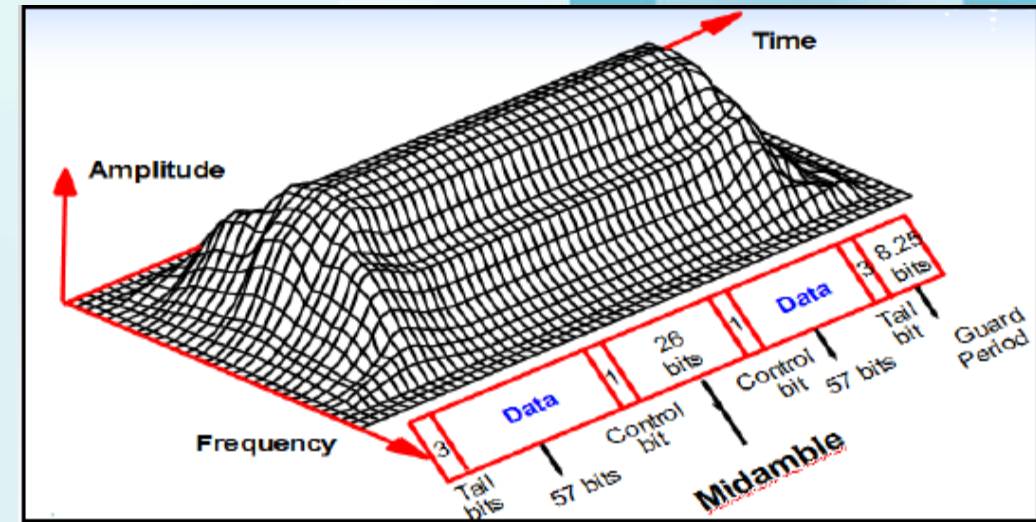| System	P-GSM 900	E-GSM 900	GSM(DCS) 1800	GSM(PCS) 1900
Uplink (MS → BS) Downlink(BS→ MS)	890 - 915 MHz 935 - 960 MHz	880 - 915 MHz 925 - 960 MHz	1710 - 1785 MHz 1805 - 1880 MHz	1850 - 1910 MHz 1930 - 1990 MHz
Wavelength	≅ 33 cm	≅ 33 cm	≅ 17 cm	≅ 16 cm
Bandwidth	25 MHz	35 MHz	75 MHz	60 MHz
Duplex distance	45 MHz	45 MHz	95 MHz	80 MHz
Carrier separation	200 kHz	200 kHz	200 kHz	200 kHz
No. of carriers	124	174	374	299
Channel rate	270.8 kbps	270.8 kbps	270.8 kbps	270.8 kbps

Air Interface

▸ GSM is a combination of TDMA (Time division multiple access)and FDMA

▸ One or more carrier frequencies are assigned to each base station and each of these carrier frequencies is then divided in time using TDMA scheme.

▸ TDMA scheme

  ▸ Frequencies are divided into frame

  ▸ Each frame is divided into eight time slots

  ▸ Each mobile call is assigned a time slot

  ▸ Information transmitted in one time slot is a burst

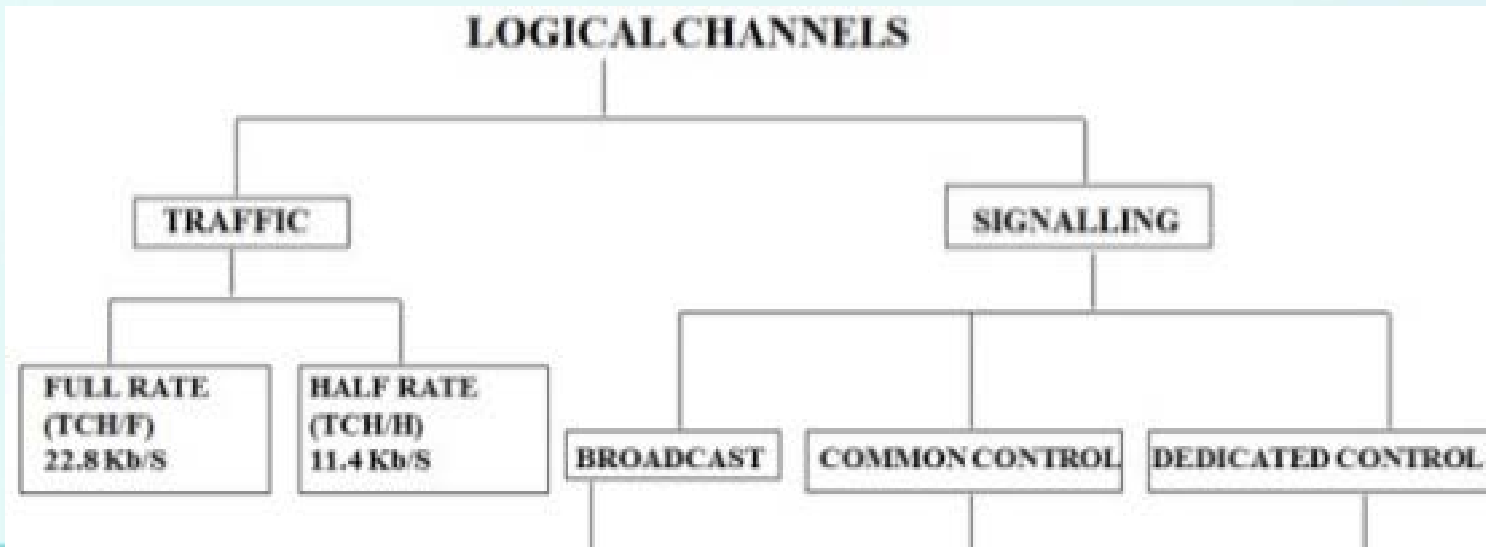 ▸ Each burst periods are grouped into TDMA frame of approx. 4.615 ms
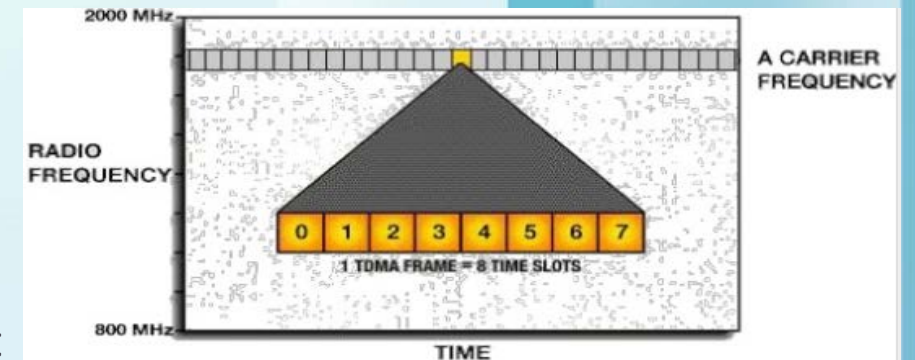
TDMA frame structure

- Bit rate of the radio carrier is 270.833 Kbps

- Bit duration = 1/270.833 = 3.69 μsec

- One time slot = 148 bits + 8.25 guard bits = 156.25 bits

- Time slot duration = 156.25 x 3.69 μsec = 0.577 ms

- Frame duration = 0.577 x 8 = 4.615 msec

| 3	57	1	26	1	57	3
Tail	Traffic/Signaling	Flag	Training Sequence	Flag	Traffic/Signaling	Tail

Type of channels

- Physical channels
- Logic channels

System Capacity

- Sectoring
    - Use directional antennas
        - Omni
        - Sector
        - Panel

- Frequency reuse of channels

- Cell splitting increases the number of BS deployed which allows orderly growth of the cellular system

- Limit the coverage area of each BS to small geographical area called cell.
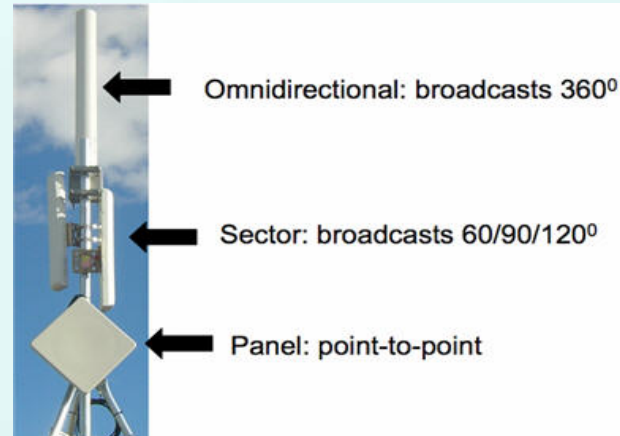
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Thank you!