

Multiple Access Schemes in Mobile Communication

Multiple Access Techniques:

- Wireless communication systems use E&M waves to transmit signals through the air. When subscribers share the same frequency they will create interference.
- The amount of interference depends on what technique is used to reduce the interference.
- **The resource** : frequency
- **The problem** : interference
- **The solutions** : multiple access techniques

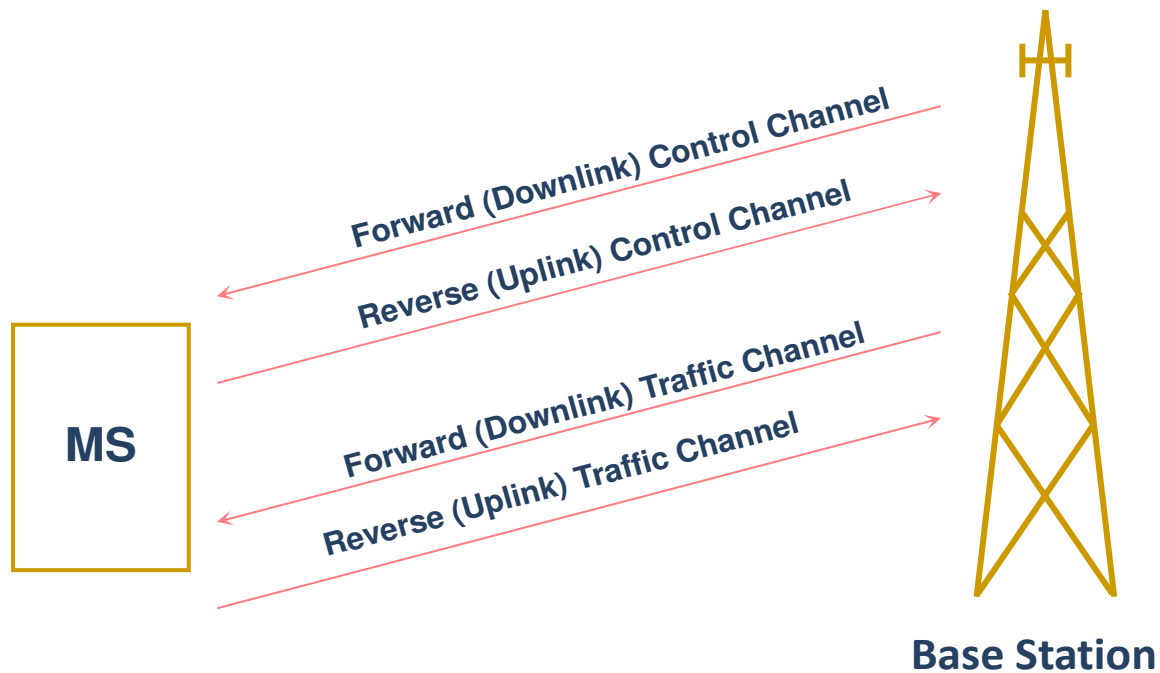
Selection of Radio Techniques:

- The early years of the GSM were devoted mainly to the selection of the radio techniques for air interface.
- In 1986 field trials of different system proposed for the GSM air interface were conducted in Paris.
- The committee established a rank-ordered set of criteria to assess these systems. Some of the criteria to be met by the system included:
 - Spectral efficiency
 - Voice quality
 - Mobile cost

Selection of Radio Techniques:

- Hand portable feasibility
- Cost of base station
- Ability to support the new services
- Coexistence with existing system.

Uplink and Downlink Channel:



Mobile Phone Access Technologies:

- The existing wireless standards use TDMA, FDMA, CDMA and combinations of these.
- In addition to improvements in these multiplexing systems, improved modulation techniques are being used.
- Multiple access schemes are used to allow many mobile users to share finite amount of radio spectrum to achieve high capacity .

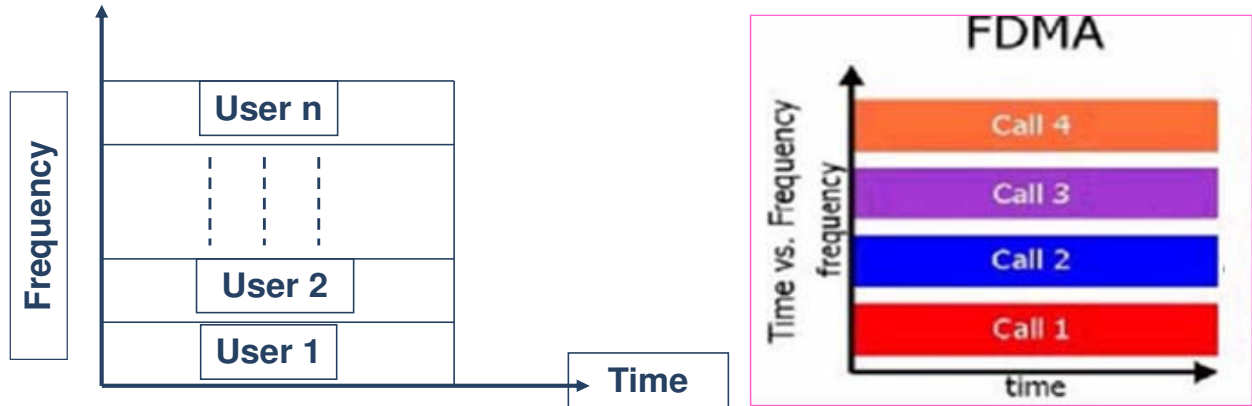
Frequency Division Multiple Access:

- Individual channel to individual users.
- Assignment of channel on users demand.
- During the period of call no other user can share the same channel.
- Channel assigned as a pair of frequencies : forward channel, reverse channel.

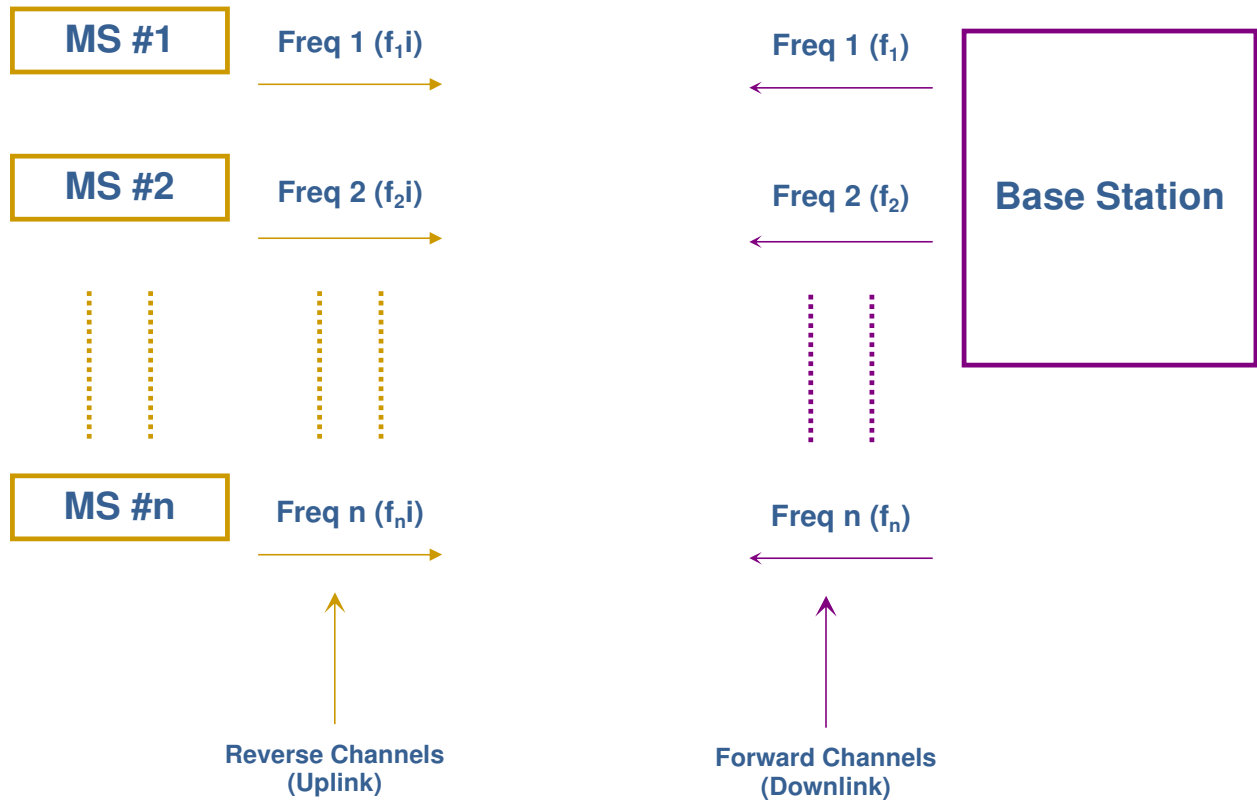
Features:

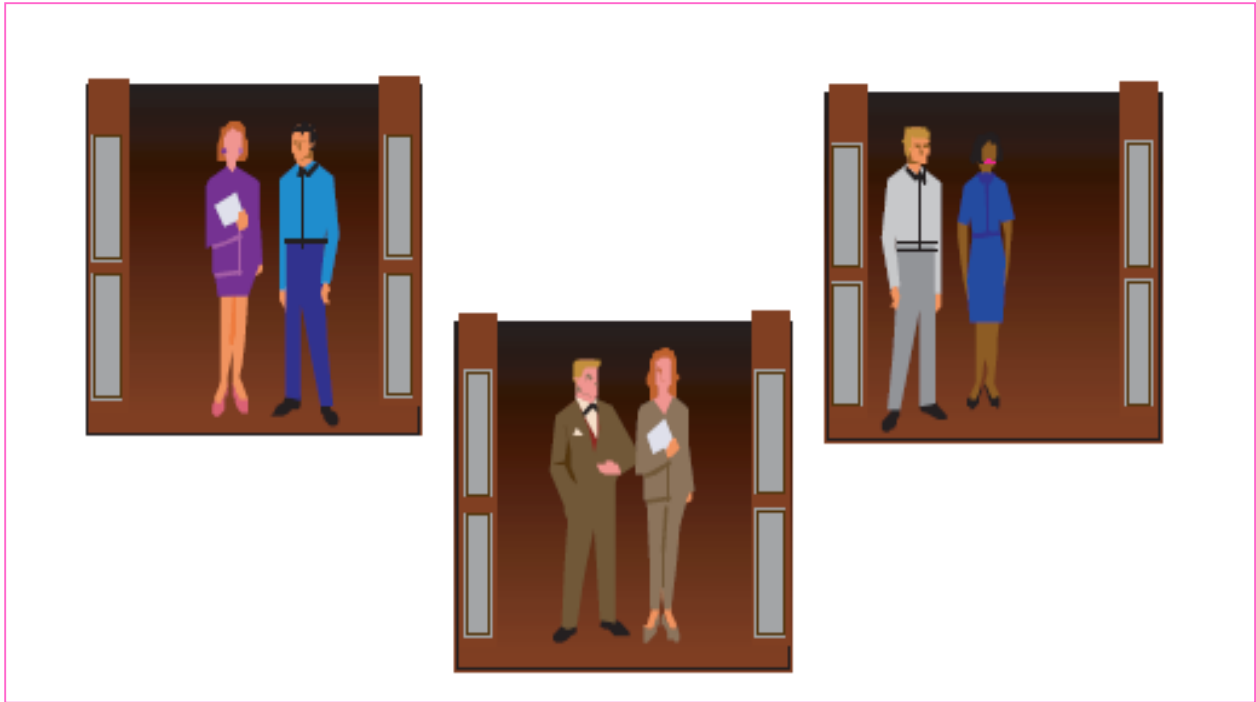
- The FDMA channel carries only one phone circuit at a time.
- FDMA channel not in use, then sits idle and can not be used by other users to increase or share capacity.

- Bandwidth of FDMA channel is narrow .It is usually implemented in narrow band systems.
- FDMA system is a continuous transmission scheme ,fewer bits are needed for overhead purposes.
- FDMA systems have higher cell site system costs as compared to TDMA system



FDMA Structure:



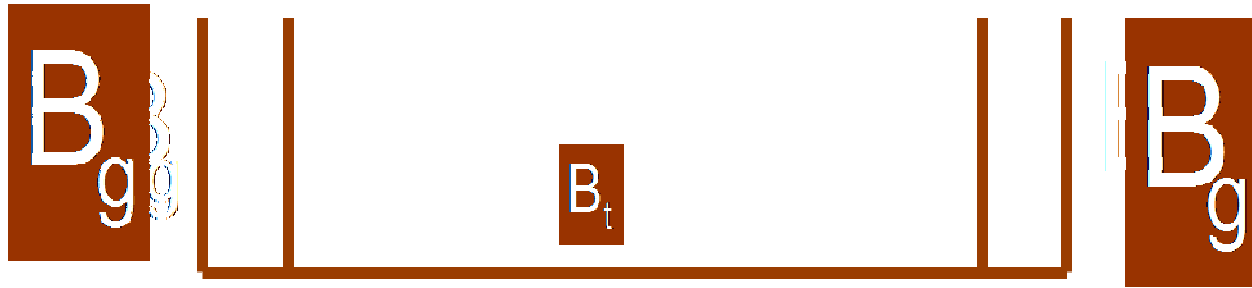


- The number of channels in FDMA system is given by :

$$N = \left\{ \frac{B_t - 2B_{\text{guard}}}{B_c} \right\} \text{ -----(1)}$$

- B_t , Total spectrum allocation , B_{guard} ,Guard band , B_c , Channel bandwidth.

Number Of Channel Supported By FDMA System:



$$N = \frac{B_t - 2B_g}{B_c}$$

$B_g \rightarrow$ Guard Band
 $B_c \rightarrow$ Channel Bandwidth

Example:

In the US, each cellular carrier is allocated 416 channels,

$$B_t = 12.5\text{MHz}$$
$$B_g = 10\text{KHz}$$
$$B_c = 30\text{KHz}$$
$$N = \frac{[(12.5 \times 10^6) - 2(10 \times 10^3)]}{30 \times 10^3} = 416$$