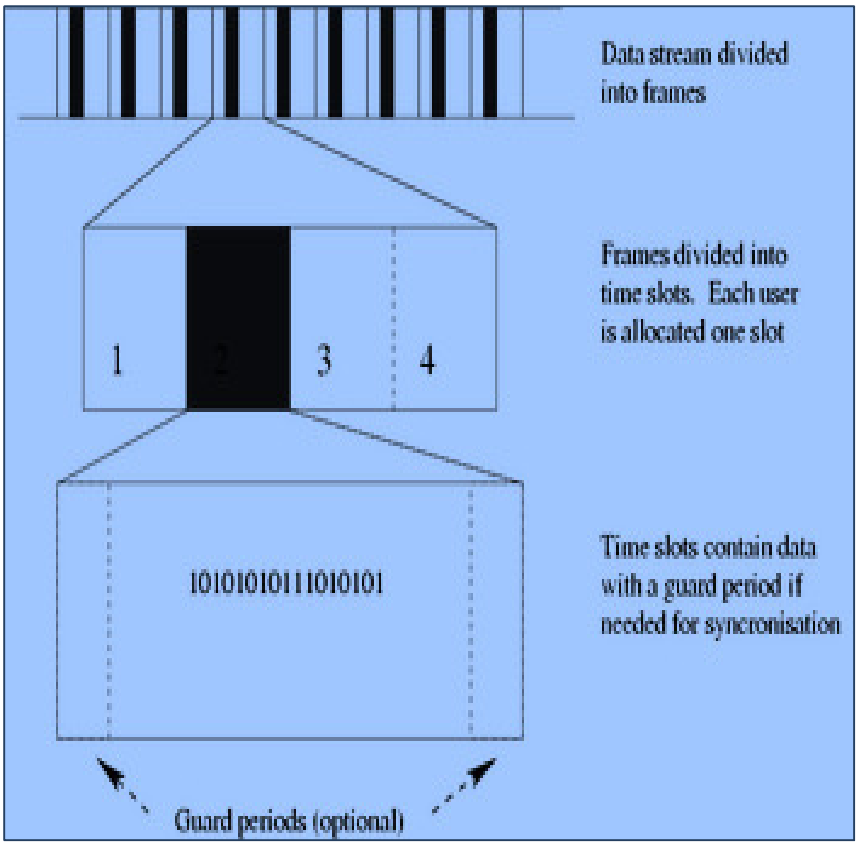
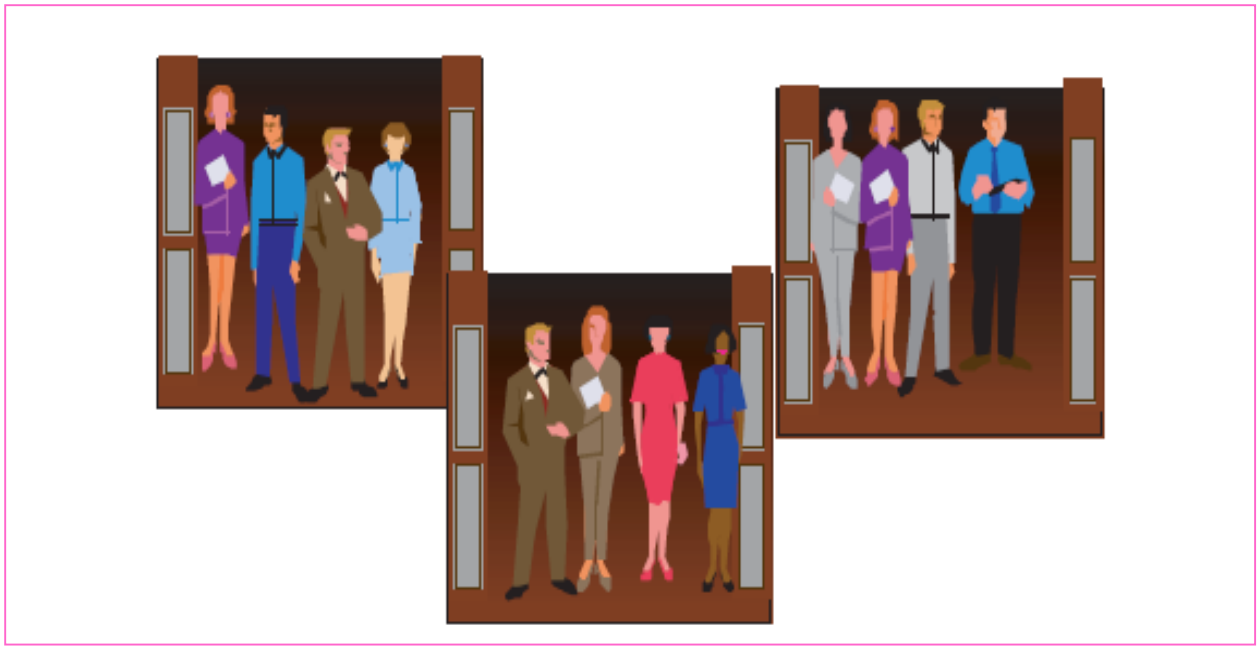
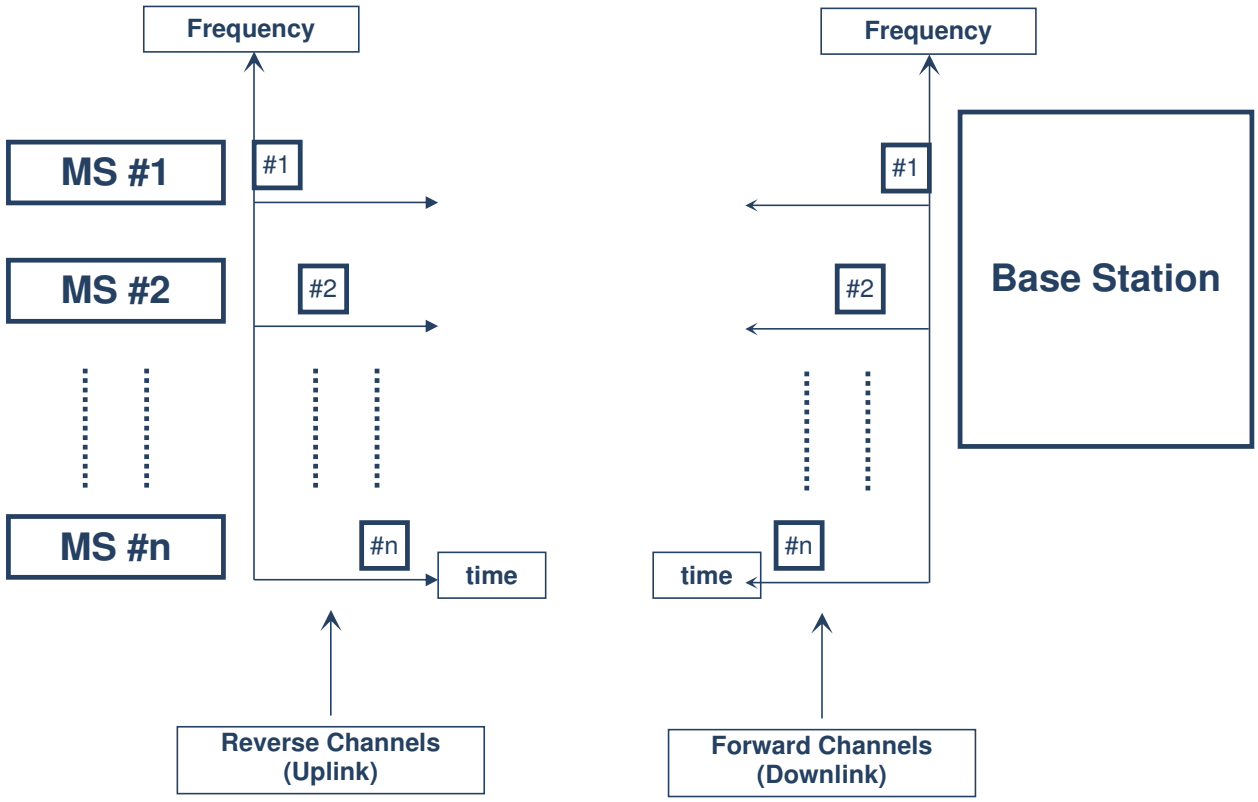
Time Division Multiple Access:

- TDMA system divide the radio spectrum into time slots ,and in each time slot only one user is allowed to either transmit or receive.
- Transmission from different users is interlaced into repeating frame structure.
- Frame is made up of preamble, information message and tail bits. It consists of number of slots.
- In TDMA frame , preamble contains the address & synchronization information that both the base station & the subscribers use to identify each other.



- TDMA shares single frequency with several users.
- Data transmission is in bursts, thus low battery consumption.
- TDMA uses different timeslots for transmission & reception ,thus duplexers are not required.
- High synchronization is required because of bursts transmission.
- Bandwidth can be supplied on demand to different users.




Frequency
MS #1
#1
MS #2
#2
MS #n
#n
time
Reverse Channels
(Uplink)
Frequency
#1
#2
#n
time
Base Station
Forward Channels
(Downlink)

- **Efficiency of TDMA** : measure of percentage of transmitted data.
- Frame efficiency , η_f : Percentage of bits per frame which contains transmitted data.
- Thus , η_f can be calculated as : No. of overhead bits per frame is

$b_{oH} = N_r b_r + N_t b_p + N_t b_g + N_r b_g$ ----------(1)

- N_r ,No. of reference bursts per frame
- N_t ,no. of traffic bursts per frame
- b_r ,no. of overhead bits per reference bursts,
- b_p , no. of overhead bits per preamble in each time slot and b_g ,no. of equivalent bits in each guard time interval.
- The total number of bits per frame , b_T , is

$b_T = T_f R$ ----------(2)

- T_f ,Frame duration & R is channel bit rate. Thus η_f is given by

$\eta_f = \{1-(b_{oH} / b_T)\}*100\%$ --------(3)

- Number of channels in TDMA system :

$N = \{m (B_{tot} – 2B_{guard})\}/B_c$ ----------(4)

- Where m is maximum number of TDMA users supported on each radio channel.

Example:

GSM System uses a TDMA / FDD system.

The GSM System uses a frame structure where each frame consist of 8 time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel. Find: ……

1. Time duration of a bit
2. Time duration of a slot
3. Time duration of a frame and
4. How long must a user occupying a single slot must wait between two simultaneous transmissions?

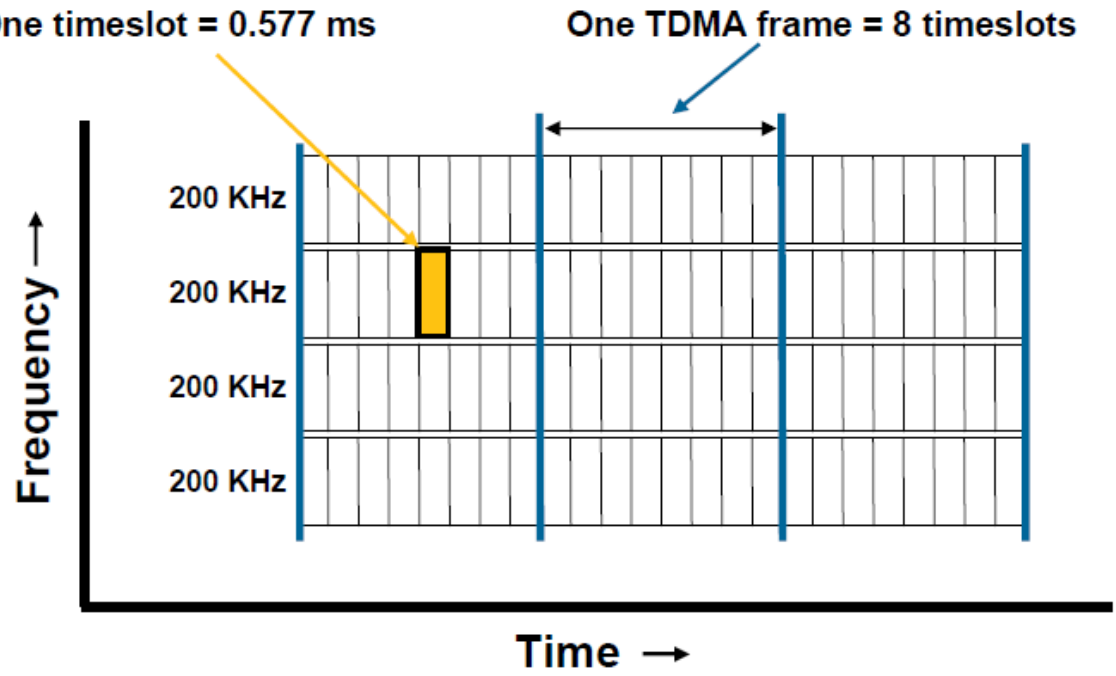
Solution:

- Time duration of a bit = 3.962 micro sec

- Time duration of a slot

  = T_{slot} =156.25 x T_b =0.577ms

- Time duration of a frame = 4.615 msec
- A user has to wait 4.615 ms before next transmissionission



Example:

If a normal GSM timeslot consists of 6 trailing bits, 8.25 guard bits, 26 training bits, and 2 traffic bursts of 58 bits of data, find the frame efficiency

Solution

- Time slots have 6 + 8.25 + 26 + 2/58 = 156.25 bits.
- A frame has 8 * 156.25 = 1250 bits / frame.

Example: The number of overhead bits per frame is given by

- b_{OH} = 8(6) + 8(8.25) + 8(26) = 322 bits
- Frame efficiency = (1250 – 322) / 1250 = 74.24 %