

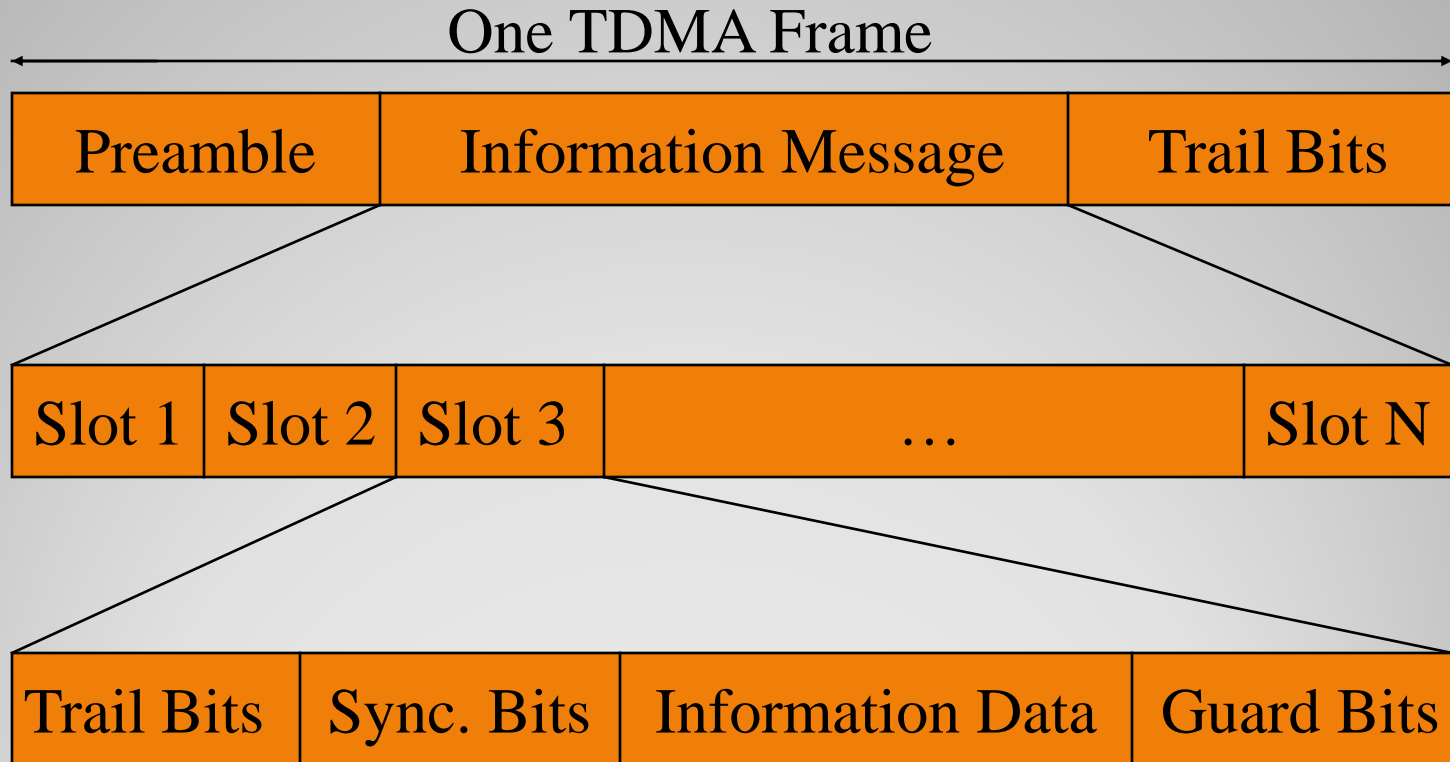
Multiple Access Techniques for Wireless Communication

FDMA
TDMA
SDMA
PDMA

Time Division Multiple Access

- time slots
- one user per slot
- buffer and burst method
- noncontinuous transmission
- digital data
- digital modulation

Repeating Frame Structure



The frame is cyclically repeated over time.

Features of TDMA

- a single carrier frequency for several users
- transmission in bursts
- low battery consumption
- handoff process much simpler
- FDD : switch instead of duplexer
- very high transmission rate
- high synchronization overhead
- guard slots necessary

Number of channels in a TDMA system

$$N = \frac{m * (B_{\text{tot}} - 2 * B_{\text{guard}})}{B_c}$$

- N ... number of channels
- m ... number of TDMA users per radio channel
- B_{tot} ... total spectrum allocation
- B_{guard} ... Guard Band
- B_c ... channel bandwidth

Example: Global System for Mobile (GSM)

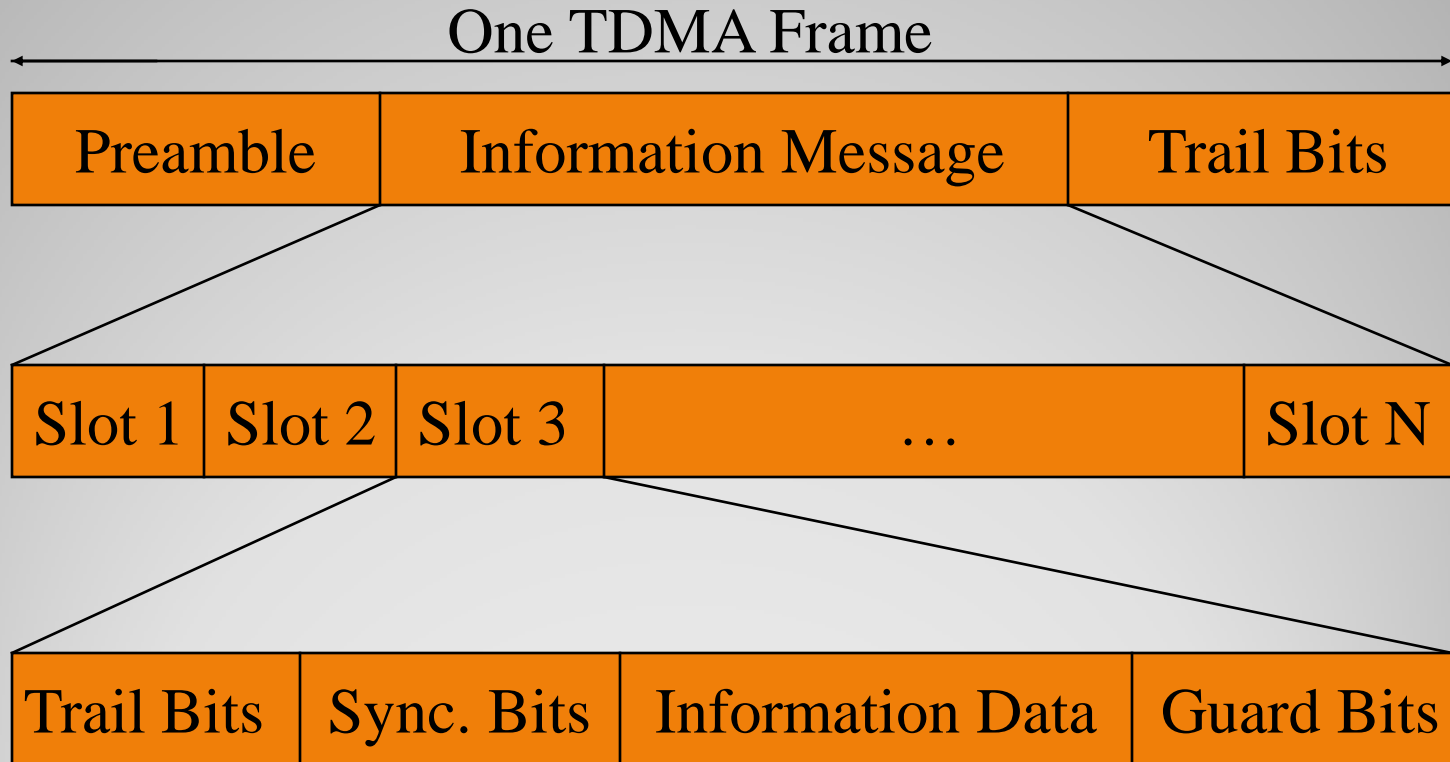
- TDMA/FDD
- forward link at $B_{\text{tot}} = 25 \text{ MHz}$
- radio channels of $B_c = 200 \text{ kHz}$
- if $m = 8$ speech channels supported, and
- if no guard band is assumed :

$$N = \frac{8 * 25\text{E}6}{200\text{E}3} = 1000 \text{ simultaneous users}$$

Efficiency of TDMA

- percentage of transmitted data that contain information
- frame efficiency η_f
- usually end user efficiency $< \eta_f$,
- because of source and channel coding
- How get η_f ?

Repeating Frame Structure



The frame is cyclically repeated over time.

Efficiency of TDMA

$$bOH = N_r * b_r + N_t * b_p + N_t * b_g + N_r * b_g$$

- bOH ... number of overhead bits
- N_r ... number of reference bursts per frame
- b_r ... reference bits per reference burst
- N_t ... number of traffic bursts per frame
- b_p ... overhead bits per preamble in each slot
- b_g ... equivalent bits in each guard time intervall

Efficiency of TDMA

$$b_T = T_f * R$$

- b_T ... total number of bits per frame
- T_f ... frame duration
- R ... channel bit rate

Efficiency of TDMA

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

- η_f ... frame efficiency
- b_{OH} ... number of overhead bits per frame
- b_T ... total number of bits per frame