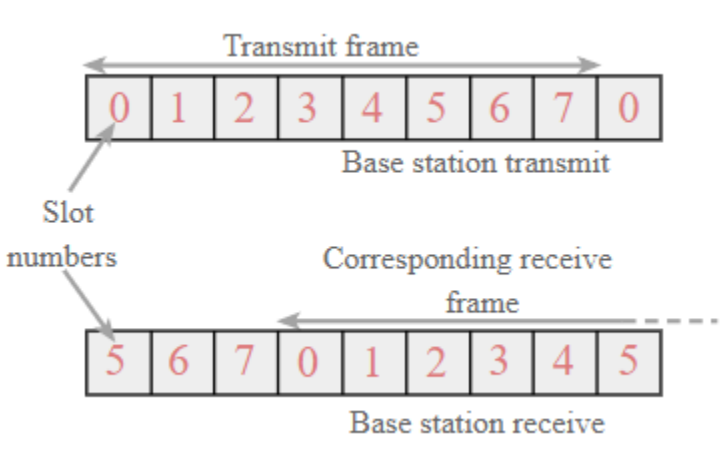
## GSM frame structure:

The basic element in the GSM frame structure is the frame itself. This comprises the eight slots, each used for different users within the TDMA system. As mentioned in another page of the tutorial, the slots for transmission and reception for a given mobile are offset in time so that the mobile does not transmit and receive at the same time.

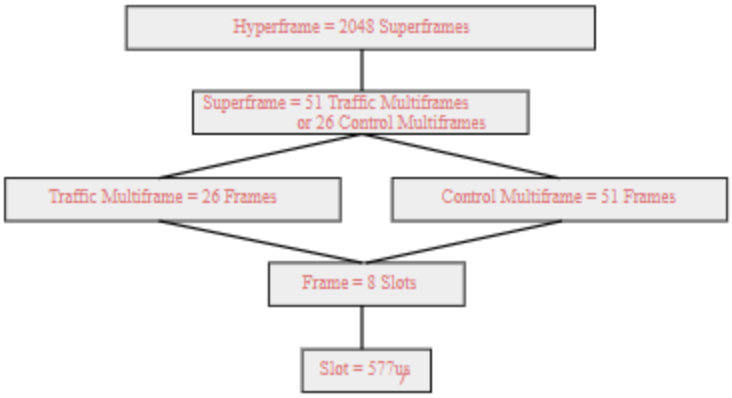



The basic GSM frame defines the structure upon which all the timing and structure of the GSM messaging and signalling is based. The fundamental unit of time is called a burst period and it lasts for approximately 0.577 ms (15/26 ms). Eight of these burst periods are grouped into what is known as a TDMA frame. This lasts for approximately 4.615 ms (i.e.120/26 ms) and it forms the basic unit for the definition of logical channels. One physical channel is one burst period allocated in each TDMA frame.

In simplified terms the base station transmits two types of channel, namely traffic and control. Accordingly the channel structure is organised into two different types of frame, one for the traffic on the main traffic carrier frequency, and the other for the control on the beacon frequency.

## GSM multiframe:

The GSM frames are grouped together to form multiframes and in this way it is possible to establish a time schedule for their operation and the network can be synchronised.




GSM Frame Structure

*showing the relationship between slots, frames, multiframes, superframes & hyperframes*

There are several GSM multiframe structures:

- ***Traffic multiframe:*** The Traffic Channel frames are organised into multiframes consisting of 26 bursts and taking 120 ms. In a traffic multiframe, 24 bursts are used for traffic. These are numbered 0 to 11 and 13 to 24. One of the remaining bursts is then used to accommodate the SACCH, the remaining frame remaining free. The actual position used alternates between position 12 and 25.
- ***Control multiframe:*** the Control Channel multiframe that comprises 51 bursts and occupies 235.4 ms. This always occurs on the beacon frequency in time slot zero and it may also occur within slots 2, 4 and 6 of the beacon frequency as well. This multiframe is subdivided into logical channels which are time-scheduled. These logical channels and functions include the following:
    - Frequency correction burst
    - Synchronisation burst
    - Broadcast channel (BCH)
    - Paging and Access Grant Channel (PACCH)
    - Stand Alone Dedicated Control Channel (SDCCH)

## GSM Superframe:

Multiframes are then constructed into superframes taking 6.12 seconds. These consist of 51 traffic multiframes or 26 control multiframes. As the traffic multiframes are 26 bursts long and the control multiframes are 51 bursts long, the different number of traffic and control multiframes within the superframe, brings them back into line again taking exactly the same interval.

## GSM Hyperframe:

Above this 2048 superframes (i.e. 2 to the power 11) are grouped to form one hyperframe which repeats every 3 hours 28 minutes 53.76 seconds. It is the largest time interval within the GSM frame structure.

Within the GSM hyperframe there is a counter and every time slot has a unique sequential number comprising the frame number and time slot number. This is used to maintain synchronisation of the different scheduled operations with the GSM frame structure. These include functions such as:

- ***Frequency hopping:*** Frequency hopping is a feature that is optional within the GSM system. It can help reduce interference and fading issues, but for it to work, the transmitter and receiver must be synchronised so they hop to the same frequencies at the same time.
- ***Encryption:*** The encryption process is synchronised over the GSM hyperframe period where a counter is used and the encryption process will repeat with each hyperframe. However, it is unlikely that the cellphone conversation will be over 3 hours and accordingly it is unlikely that security will be compromised as a result.

The slots and frames are handled in a very logical manner to enable the system to expect and accept the data that needs to be sent. Organising it in this logical fashion enables it to be handled in the most efficient manner.