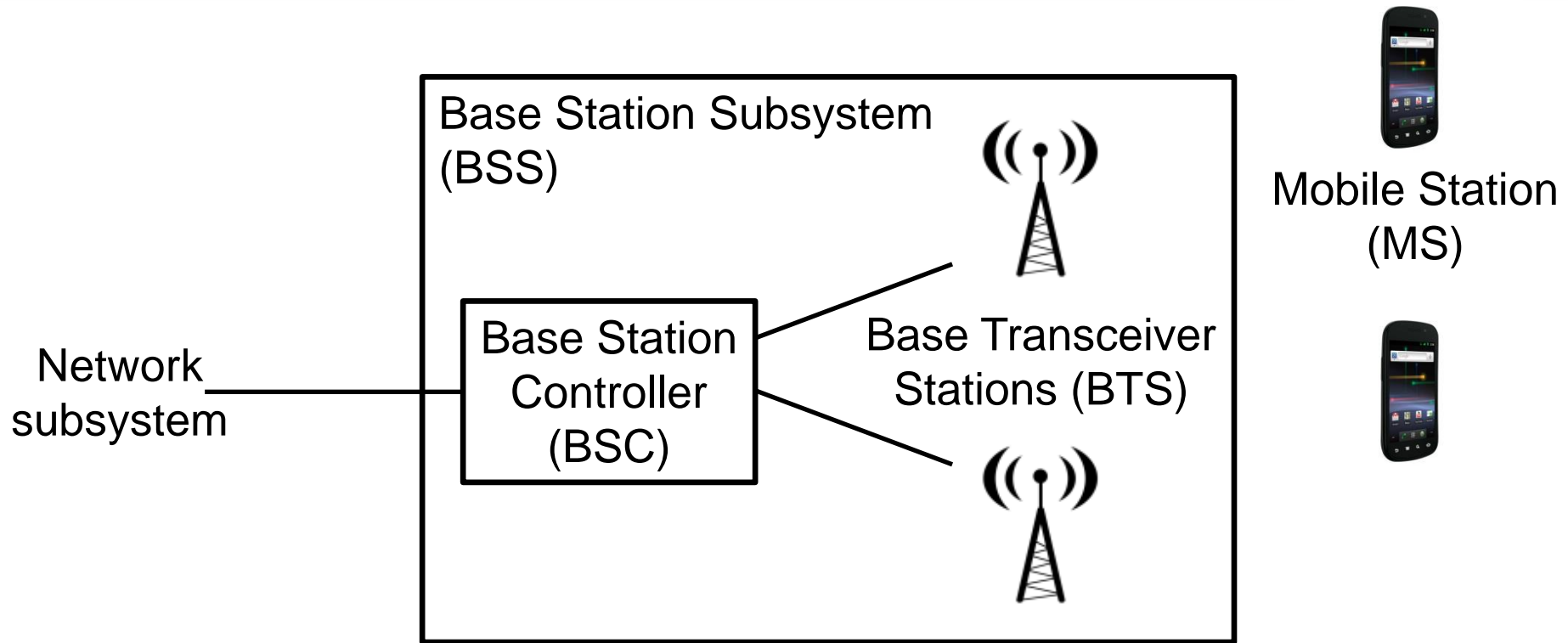


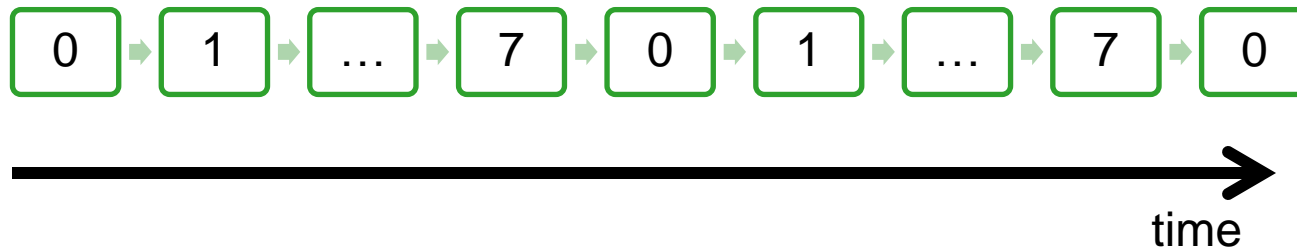
GSM Channels

(Repeat) Base Station Subsystem



(Repeat) Timeslots

- Each carrier frequency is divided into 8 repeating timeslots (“bursts”) of 0.577ms -> TDMA

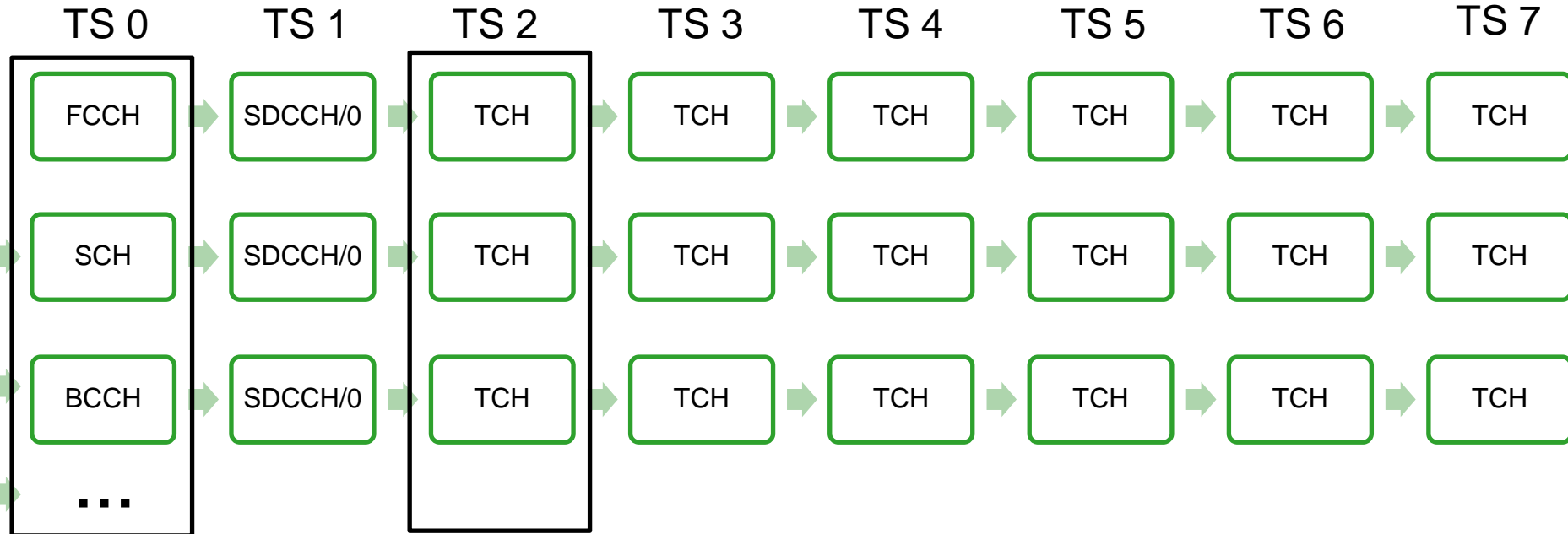


- The 8 timeslots of a carrier frequency are called “*physical channels*”
 - A physical channel is identified by its frequency and timeslot number
- Example: base station with 6 frequencies -> 48 physical channels
 - Number of physical channels determines how many simultaneous active MS the base station can handle

Logical Channels

- How are the user data (voice,...) and signaling data transmitted over the physical channels?
- Logical channels: transmit a specific type of information
 - Common channels: channels used by all MS
 - Dedicated channels: channels assigned to specific MS
- Example:
 - TCH (Traffic Channel): carries the voice and user data from/to a mobile station
 - BCCH (Broadcast Common Control Channel): used by the base station to broadcast status information to all idle mobile stations
 - PCH (Paging Channel): informs mobile stations about incoming calls or SMS
- The logical channels are mapped to the physical channels
 - The base station manages the mapping

Possible mapping (for one frequency)



Physical channel carrying FCCH, SCH, BCCH, ... Pattern repeats after 51 frames ("multiframe")

Physical channel carrying one TCH.

Compared to the traffic channel, most logical signaling channels only carry few information (e.g., one burst every 10th TDMA frame) and therefore can be time-multiplexed on the same physical channel

Example: Setting up a call from the MS

Step 1: MS contacts the base station on RACH

- RACH (Random access channel) is a common up-link channel that can be used by all MS in the cell
- Since MS are not synchronized, collisions are possible on RACH. Lost messages are repeated by the MS with random back-off (like ALOHA).

Example: Setting up a call from the MS

Step 2:

1. MS waits on the common channel AGCH (Access Grant Channel) for an answer from the base station
2. The base station controller (BSC) allocates an available dedicated SDCCH (Standalone Dedicated Control Channel) for the MS and sends a message with the SDCCH number (=frequency+timeslot) to the MS on AGCH
 - SDCCH is a dedicated channel used for signaling between an MS and the base station
 - A base station manages several SDCCH and assigns them to MS when needed (call setup, etc.)

Example: Setting up a call from the MS

Step 3:

1. MS sends a call request message to the BSC on the dedicated SDCCH
2. The BSC forwards the message to the network subsystem
3. The network subsystem sets up the call (if possible) and sends an assignment request for a voice channel to the BSC

Example: Setting up a call from the MS

Step 4:

1. The BSC allocates an available dedicated traffic channel (TCH) for the MS
2. The BSC sends the information about the allocated physical channel (=frequency+timeslot) for the TCH to the MS via SDCCH

Example: Setting up a call from the MS

Step 5:

1. The MS sends a message on the FACCH (Fast Associated Control Channel) to inform the BTS that it has switched to the TDH/FACCH and is not listening anymore on the SDCCH
 - FACCH is a dedicated channel that shares the physical channel with the TCH
 - FACCH does not have dedicated bursts on the physical channel. Instead, it replaces TCH data by its own data and sends the “S” flag (“Stealing flag”).
2. The BTS acknowledges with a message on the FACCH

Example: Setting up a call from the MS

Step 6:

1. MS sends an “assignment complete” message to the BSC on FACCH
2. BSC informs the network subsystem that the voice channel has been successfully established

MS can now use the TCH to send and receive voice data

The Traffic Channel

- A dedicated channel used for voice or user data
 - Full rate: 13 kbit/s
 - Half rate: 6.5 kbit/s, two MS share a burst
- When allocating the TCH for a MS, the BSC chooses timeslots in the down-link frequency and the up-link frequency that are at least 3 timeslot periods apart
 - > MS has enough time to switch from the down-link frequency to the up-link frequency
- There are more channels than discussed in our example: channels for informing MS about incoming calls, for adjusting the timing,...