

# 2 G ARCHITECTURE– GSM, GPRS AND OTHERS

## Lesson 09 Handover

# HANDOVER (HANDOFF) FROM ONE TO ANOTHER NEIGHBOURING CELL

- Process of transferring a call (or data transfer) in progress from one cell or channel to another
- The core network performs handovers at various levels of the system architecture or
- May handover the call to another network altogether

# MAIN REASONS FOR HANDOVER IN CELLULAR NETWORKS

- If the mobile device moves out of the range of one cell (base station) and a different base station can provide it with a stronger signal
- If all channels of one base station are busy then a nearby base station can provide service to the device

# HANDOVER PROCESS

- Important one in any cellular network
- Must be completed efficiently and without inconvenience to the user
- Different networks use different types of handover techniques

# TWO MAIN TYPES OF HANDOVER

- Hard handover— GSM systems
- Soft handover — CDMA systems

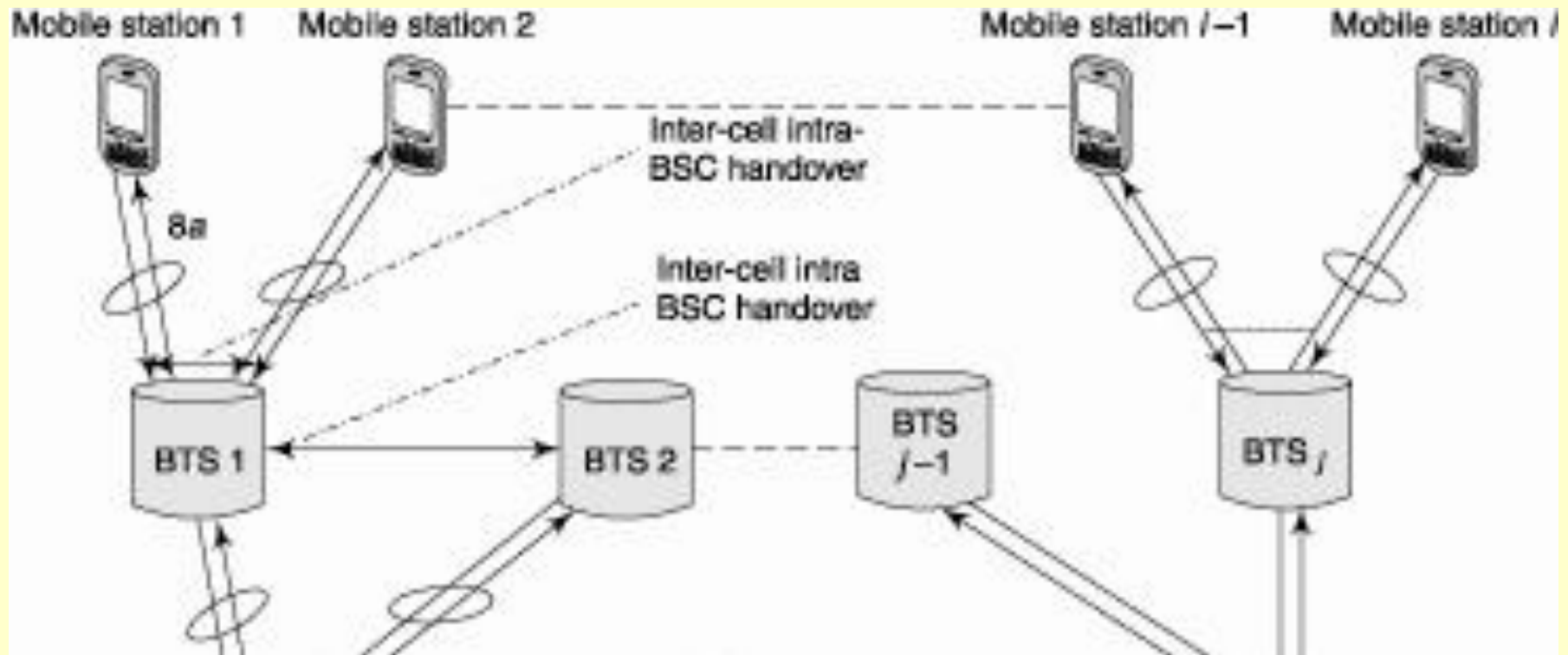
# HARD HANDOVER

- Existing radio link must be dropped for a small period of time
- Then taken over by another base station
- A call in progress redirected not only from a base station to another base station but also from its current transmit–receive frequency pair to another frequency pair
- An ongoing call can not exchange data or voice for this duration

# CALL DROP IN HARD HANDOVER

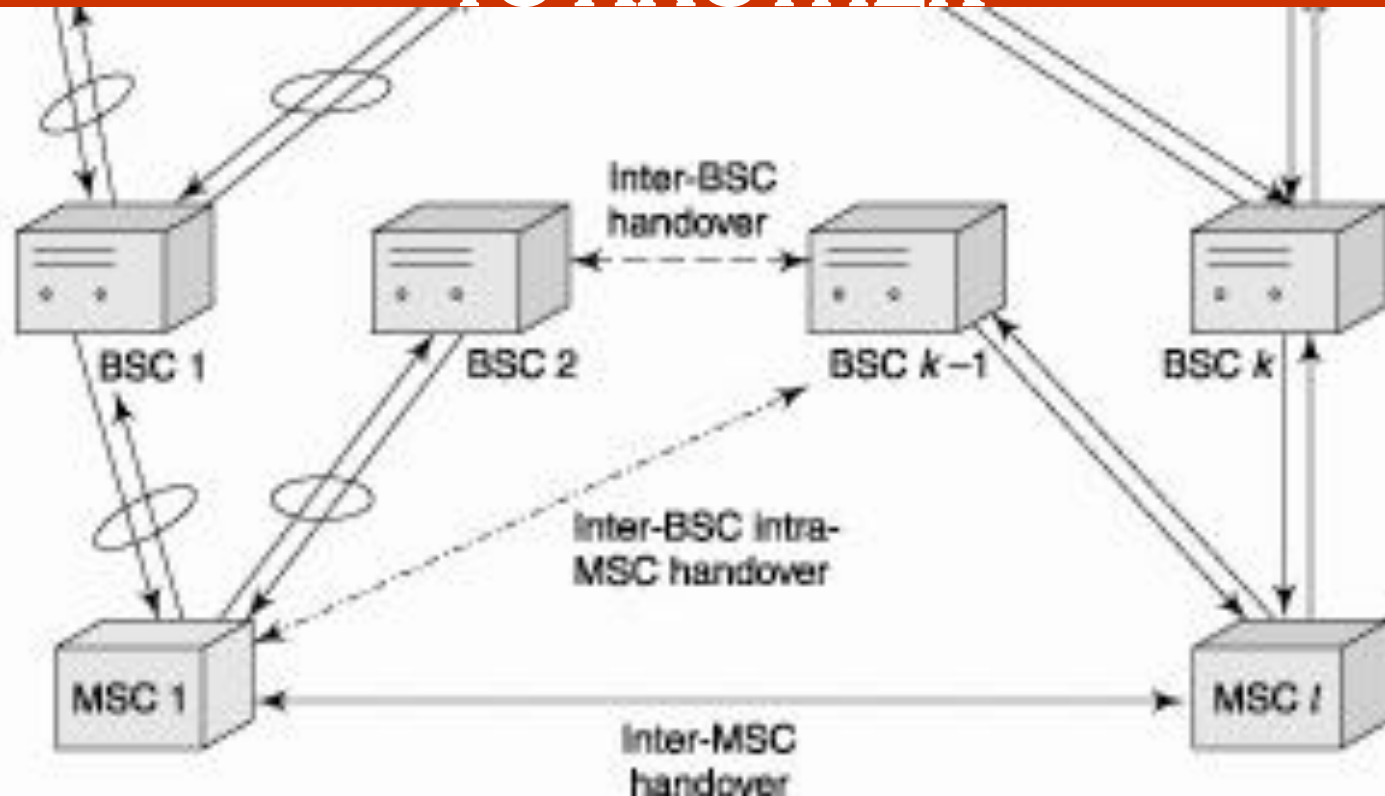
- Break in call transmission
- Handover takes place in a few ms (at best in 60 ms)
- Interruption is hardly discernible by the user
- Handover to another cell is required when the signal strength is low and error rate is high. GSM systems perform hard handovers

# INTER-CELL INTRA-BSC HANDOVERS WHEN A MOBILE STATION MOVES FROM ONE CELL TO ANOTHER





# INTER-BSC INTRA-MSC HANDOVERS WHEN A MOBILE STATION MOVES FROM ONE CELL TO ANOTHER



# SIGNAL STRENGTH

- Measurement continuously performed at the RRM (radio resource management) sub layers in the Mobile station, BTS, and BSC
- The RRM responsible for handover management

# INTER CELL HANDOVER

- When the signal strength goes weak due to several reasons (for example, the mobile moving away from the cell in which it is presently localized to the boundary region of another cell), there is handover from a cell to another

# INTER-MSC HANDOVER

- Handover also takes place for load balancing when the traffic from the cells and BSCs high
- An ongoing call, which is being handled by a cell, may be handed over to another MSC
- Since the two MSCs are interfaced through PCM the handover performed over a wired line

# INTER-BSC HANDOVER

- Handover for load balancing when the traffic from the cells and BTSs high
- The BSCs connect to an MSC
- A call, which is ongoing in a cell through a BTS, may be handed over to another BSC connected to the same MSC
- Since the BSCs connect to the MSC interfaces by PCM, the handover is over a wired line

# INTER-BSC, INTER-MSC HANDOVER

- For load balancing when the traffic from the cells and BTSs as well as BSCs high

# INTRA-CELL HANDOVER

- Due to interference at certain frequencies, the signal quality poor
- The BSC can handover the call to another frequency of the cell in such cases

# INTER-CELL, INTRA-BSC HANDOVER

- When an MS moves to a neighbouring cell and suffers poor signal quality, the BSC can handover the call to a different BTS channel of the same BSC



# INTER-CELL, INTRA-MSC HANDOVER

1. The RRM sub layer transmits a signal report from  $MS_i$  to  $BTS_i$  and from  $BTS_i$  to  $BSC_i$ . In case a handover is necessary,  $BSC_i$  signals the handover requirement to  $MSC_i$ .
2.  $MSC_i$  signals the handover requirement to another  $BSC_j$  and  $BSC_j$  allocates radio resources and transmits the activated channel to another  $BTS_k$ .

# INTER-CELL, INTRA-MSC HANDOVER

3.  $BTS_k$  sends acknowledgement of the channel to  $BSC_j$  and  $BSC_j$  acknowledges the handover request grant via message to  $MSC_i$
4.  $MSC_i$  transmits handover command to  $BSC_i$ ,  $BSC_i$  to  $BTS_i$ , and  $BTS_i$  to the  $MS_i$ 's RRM layer

# INTER-CELL, INTRA-MSC HANDOVER

- The RRM directs the MS radio interface to operate at another channel linked to *BTS<sub>k</sub>*

# HANDOFF—HANDOVER PROCESSES

- New handover methods have also evolved and are used in addition to the older techniques
- 3G standards and technology makes it possible for several mobile phones to use the same channel and for neighbouring cells to use the same frequency bands

# SOFT HANDOVER

- Mobile station at the boundary of two adjacent cells— does not suffer call drops due to handover in the boundary region
- Gives seamless connectivity to a Mobile station
- An offset to pseudo noise code— method of soft handover

# SOFT HANDOVER

- Soft handover does not require breaking of the radio link for cell-to-cell transfer of a call. A mobile device can be simultaneously connected to several base stations

# NEW GENERATION (3G) NETWORKS

- Ensure mobility by handover not only among the BTSs, BSCs, or MSCs but also among the in-between LANs
- Ensures seamless (uninterrupted) connectivity to the user

# SUMMARY

- Handover when the mobile device moves out of the range of one cell (base station) and a different base station can provide it with a stronger signal or when present cell traffic high
- Hard handover in GSM
- Call drop for hard handover
- Soft handover in CDMA



# End of Lesson 9 Handover