Mobilitás menedzsment alapok (angolul)

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Cellular network basics

- mobile phone is physically connected to a base station, through the transceiver that covers a cell
- radio cells:
  - no fixed and strict borders, not regular shapes
  - rather probabilities of having a given signal quality in certain locations
    - due to the random nature of the radio channel
- in every cell a certain amount of frequency channels can be used -> a given capacity, according to Shannon
- cells using the same frequency channels cause interference to each others
- why cells? why not a single big cell over a big area?
  - propagation loss issues, power is not enough to reach very big distances
  - protocol issues: radio signal formats may limit the maximum cell size (see later)
  - but the main reason is: to **provide more capacity**
    - the idea of frequency –reuse
  - more smaller cells in an area -> higher capacity over the area -> higher number of customers and higher total traffic over the area
  - doe not increase, or even decrease the maximum bitrate of a single user!
Mobility management

- mobile phone is physically connected to a base station, through the transceiver that covers a cell (-> mobile is in a cell)
  - the mobile has an active connection or data flow
  - while moving, the mobile may arrive to a place where the serving signal quality becomes bad (-> the mobile reaches the cell edge, mobile is going out of the cell)
  - the call/flow has to be switched to another cell, whose signal quality is better
  - without interrupting the call
  - this process is *handover*

- handover
  - handover at radio level: the call to be switched to another transceiver
  - handover in the network: the data flow to be routed to the new cell or new base station
  - handover is handled in the network
  - HOW?
    - mobile constantly measures the quality of serving cell and neighboring cells (yes, meanwhile having a conversation)
    - reports the measurements
    - the network decides and order the mobile to attach to another cell
    - the network handles the re-routing of the data flow to the new place
Mobility management

- Location management
  - when a mobile is turned on, but there’s no connection
  - a mobile terminated call/data arrives to the network
  - the data should be routed to the mobile
    - to the base station, to the cell where the mobile currently is

- How does the system know it?
  - option 0: mobile reports its position using e.g. GPS
    - wrong, due to multiple reasons, I’ll ask in the exam
  - option 1: the mobile constantly measures the qualities of all cells, selects the best one and reports the Id. of this cell to the network very often. The network keeps a database containing the Id. of best cell for all mobiles. Problems:
    - this reporting needs network capacity and signalling, setting up of signalling communication
    - too often, too much signalling especially for fast mobiles in small-cell area
    - due to the random nature of radio channel, best cell can change very often -> reporting should be done very often
  - option 2: don’t report and don’t store mobile positions at all, but operate a broadcast channel (paging channel) in the network. This should be listened to by all mobiles. In case of incoming data, send a notification to the paging broadcast channel in the whole network -> mobile will answer through its best cell. Problem:
    - paging channel should be so huge, to contain all the incoming notifications of all mobiles
Location management

- solution: Location Areas (later: Routing Areas, Tracking Areas)
- a group of cells (say 20-30)
- has a unique Id. as well LAC Location Area Code
- the mobile constantly reads the LAC of its best cell
- if there is a new LAC -> then sends the new LAC to the network
- the network stores the current LAC for the mobile
- upon arrival of a call the notification is sent to the paging channel of all the cells within the location area