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1. What is the relative signal strength with hysteresis handoff strategy? (7%) What problem does it prevent? (3%)

   Handoff occurs only if the new BS is sufficiently stronger (by a margin H) than the current one. (7%) Prevents the ping-pong effect. (3%)

2. List three approaches to increase capacity in the cellular system. (9%)

   Adding new channels
   Frequency borrowing
   Cell splitting
   Cell sectoring
   Microcells (any three of them, 3% each, 9% total)

3. Paging in the cellular system (10%)

   MTSO sends a paging message to certain BSs depending on the called mobile number (5%). Each BS transmits the paging signal on its own assigned setup channel to complete the connection to the called unit. (5%)

4. What are Cell blocking probability (5%) and Call dropping probability (5%)

   Cell blocking probability

   Probability of a new call being blocked, due to the BS heavy traffic load (5%)

   Call dropping probability

   Probability that a call is terminated due to a handoff (5%)

5. Explain the concept of frequency reuse. (5%) What is its objective? (2%) What is the reuse factor? (5%)

   (a) Adjacent cells assigned different frequencies (3%) to avoid interference or crosstalk (2%)

   Objective is to reuse frequency in nearby cells (2%)

   Reuse factor is the number of repetitious pattern (each cell in the pattern uses a unique band of frequencies) (5%)

6. Consider 2 different cellular systems that share the following characteristics. The frequency bands are 825 to 845 MHz for mobile unit communication and 870 to 890 MHz for base station transmission. A duplex circuit consists of one 20-KHz channel in each direction. The system is distinguished by the reuse factor 7. Please find the total number of channels available (5%) and the number of simultaneous communications that can be supported by a single cell and in the system. (5%) If the system has 32 cells, what is the number of concurrent calls that can be handled? (5%) (15% total, 不說明原因扣一半)

   (b) Total number of channels available is K = B_{CL}/b_{ch} = 1000. (5%) For a frequency reuse factor N, each cell can use $k_{CE} = K/N$ channels.

For $N = 7$, k_{CE} = 142 channels (5%)
If a system has 32 cells, the number of concurrent calls is 142×32=4544. (5%)

7. Compare two power control schemes in cellular networks. (14%)

Open-loop power control (2%)

- No feedback from BS (2%)
- The mobile monitors the received power level of the pilot (2%) and sets the transmitted power in the reverse channel (mobile to BS) inversely proportional to it (2%)

Closed-loop power control (2%)

- Adjusts signal strength in reverse channel based on metric of performance in reverse channel (2%)
- BS makes power adjustment decision and communicates a power adjustment command to mobile on control channel (2%)

8. Draw a figure to describe Network Subsystem (NS) and explain each component of this subsystem? (20% total)

Network Subsystem (NS) provides link between cellular network and public switched telecommunications networks

- mobile switching center (MSC) (2%) - Controls handoffs between cells in different BSSs (2%)
- Home location register (HLR) database (2%) - stores permanent and temporary information about each subscriber that belongs to it (2%)
- Visitor location register (VLR) database (2%) - maintains location information about subscribers currently physically in the region covered by the switching center (2%)
- Authentication center database (AuC) (2%) - used for authentication activities, Controls access to user data (2%)
- Equipment identity register database (EIR) (2%) - keeps track of the type of equipment that exists at the mobile station, Security (2%)

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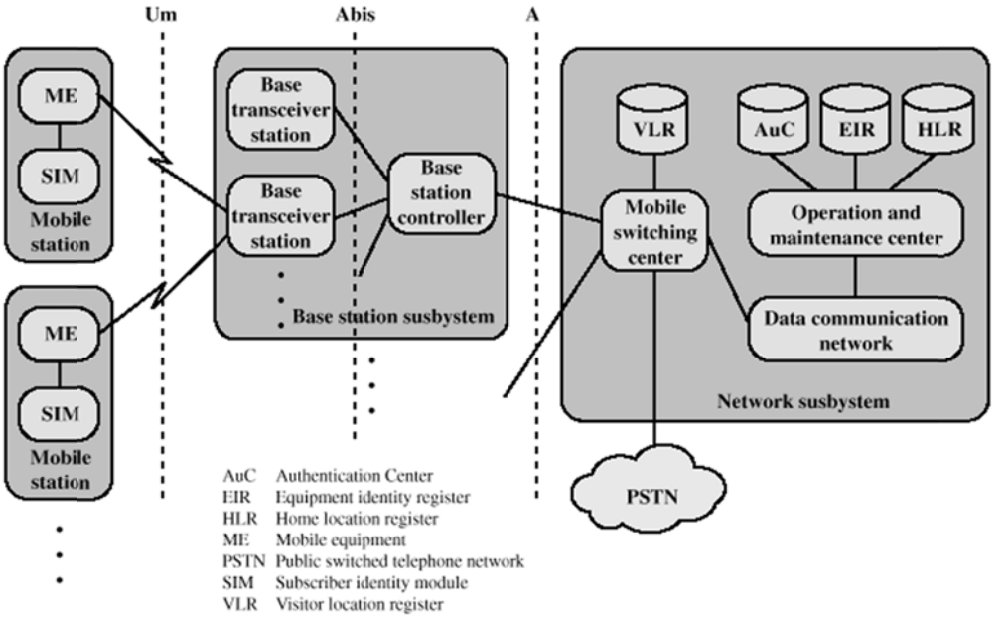

Figure 10.14 Overall GSM Architecture