

## Question 4

UMTS system uses W-CDMA as its multiple access technique. Answer the following questions in the UMTS system.

- What kind of power control is used in UMTS, in particular in the uplink, to tackle the near-far problem?

Fast power control

- In what kind of power control, the BS performs frequent estimates of the received Signal-to-Interference Ratio (SIR) in the uplink and compares it to a target SIR?

Closed Loop Power Control

- What will BS do if the measured SIR is different from the target SIR?

If the measured SIR is higher than the target SIR, the BS will command the MS to **lower** (8) the power; if it is too low it will command the MS to **increase** (9) its power.

- What kind of power control adjusts the target SIR in the BS according to the needs of the individual radio link.

**Outer** **Loop** (10) power control adjusts the target SIR in the BS according to the needs of the individual radio link.

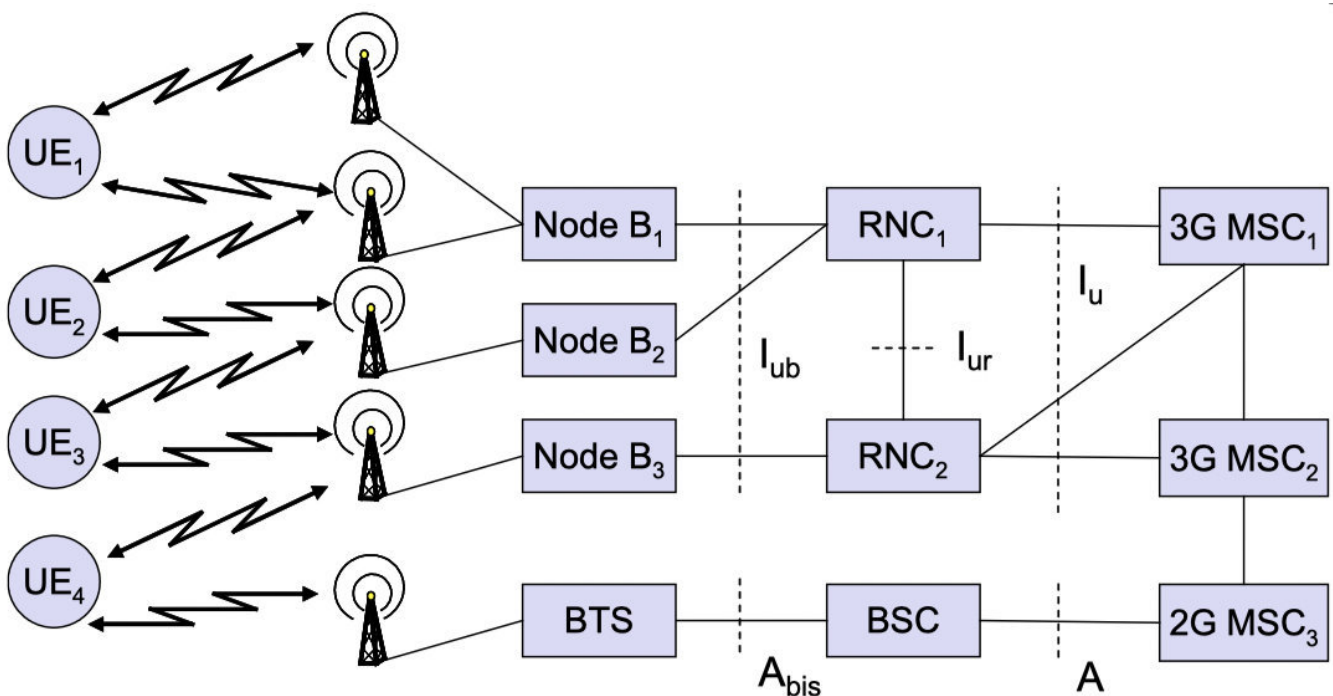


Figure 1: Handovers in UMTS/GSM Network

**Figure 1 gives an overview of several types of handover in a combined UMTS/GSM network. Indicate what handover UE 2 is performing and describe this type of handover.**

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Inter-node B, intra-RNC, In this case, RNC1 supports the soft handover by combining and splitting data.

**Describe the general functionality of HSUPA.**

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The technologies applied with HSUPA improve uplink packet data performance by means of fast physical layer (L1) retransmission and transmission combining, as well as fast Node B scheduling.

General Functionality:

- The Node B estimates the data rate transmission needs of each active HSUPA user based on the device-specific feedback;
- The scheduler in Node B then provides instruction to devices on the uplink data rate to be used at a fast pace depending on the feedback received, the scheduling algorithm, and the user prioritization scheme;
- The retransmissions are initiated by the Node B feedback;

**With the help of diagrams, explain how the OFDMA works in LTE downlinks.**

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OFDMA distributes subcarriers to different users at the same time, so that multiple users can be scheduled to receive data simultaneously.

In addition to the time domain, the scheduler can, for each frequency region, select the user with the best channel conditions. In other words, scheduling in LTE can take channel variations into account both in the time domain and in the frequency domain

For LTE, scheduling decisions can be taken as often as once every 1 ms and the granularity in the frequency domain is 180kHz.