2021 - 2022

5. (a) One of the upgrades of the air interface for the Long-Term Evolution (**LTE**) 4th generation wireless systems is the provision of Evolved Universal Terrestrial Radio Access (E-UTRA). Describe the four key features of E-UTRA designed for the LTE wireless networks.

Answer: 5 (a) Scalable bandwidth: LTE supports scalable bandwidth from 1.4 MHz to 20 MHz for a physical channel.

High data rate: The peak data rate in the downlink can reach up to 300 Mbps when 4 by 4 MIMO is used.

The uplink peak data rate can be as high as 86 Mbps.

High mobility: LTE is designed to optimize for low mobile speed up to 15 km/h

It supports up to 350 or even 500 km/h

Scalable Coverage: The radio coverage ranges from femtocells to 100 km cells.

(b) For terrestrial cellular systems there are two types of handovers. Describe the basic mechanisms of these two handovers and identify the type of cellular systems that deploys this mechanism.

Answer (b) There are two types of handover: Hard Handover and Soft Handover.

Hard Handover: Break the the connection from previous base station before establish a new connection to a new base station. It is used in GSM and early 3G systems.

Soft Handover: Establish the connection to a new base station before break the connection from the previous base station. This type of handover is common in CDMA-based systems such as UMTS and CDMA2000.

(c) In a satellite system with Medium Earth Orbit (MEO) or Low Earth Orbit (LEO) satellites, there could also be handovers in the system if the satellite acts as a base station. Briefly describe the different types of handovers that can happen for this type of satellite system.

Answer (c) Intra-Satellite Handover: The UE moves from one service area to another service area within a satellite coverage zone.

Inter-Satellite Handover: The UE moves from one satellite coverage zone to another.

Gateway Handover: The satellite moves out of the range of ground station.

Intra-satellite handovers: caused by the movement of mobile users within the coverage zone of a satellite over different sectors.
Inter-satellite handovers: caused by the movements of mobile users between the coverage zones of 2 satellites or satellite moves away.
Gateway handovers: the satellite moves away from the current gateway.
Inter-system handovers: handovers between a satellite system and a wireless system. Due to the signal strength and QoS performance.