Assignment Three: LTE

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**How can the LTE core network be interconnected with legacy core networks?**

The LTE core network, known as the Evolved Packet Core (EPC), can connect with legacy networks such as GSM and UMTS through standardized interfaces like S3, S4, and S5/S8. These interfaces enable LTE to support seamless handovers and data continuity between modern and older networks, maintaining consistent service for users (From GSM to LTE-Advanced Pro and 5G, 2021, p. 287).

**Why should this be done?**

Connecting LTE with legacy networks ensures backward compatibility, allowing devices to maintain connections when moving between LTE and older systems. This approach maximizes network coverage and service availability, especially in areas with mixed technology deployment (From GSM to LTE-Advanced Pro and 5G, 2021, p. 287).

**Describe different options for the backhaul connection of the eNB.**

Backhaul connections for eNodeB (eNB) can include fiber optics, microwave links, and Ethernet. Fiber optics provide high capacity and low latency but are expensive to deploy. Microwave links offer flexibility and ease of installation but can be impacted by environmental factors. Ethernet is a cost-effective option but may require dedicated lines for higher capacities (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 289-290).

**Describe the differences between the tasks for the MME and the tasks of the S-GW.**

The Mobility Management Entity (MME) is responsible for handling signaling, authentication, and mobility management tasks such as tracking users in idle mode. The Serving Gateway (S-GW) focuses on routing and forwarding user data packets and acts as a local anchor for mobility within LTE, especially during handovers (From GSM to LTE-Advanced Pro and 5G, 2021, p. 304).

**How does a mobile device get access to the PUSCH?**

A mobile device accesses the Physical Uplink Shared Channel (PUSCH) after receiving an uplink grant from the eNodeB. This grant specifies the frequency and time slots the device can use, allowing it to transmit data efficiently within the network (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 230-231).

**How is mobility controlled in RRC idle state?**

In the RRC idle state, mobility is controlled through cell reselection, which allows the device to autonomously switch to cells with stronger signals or better service quality. This process helps the device maintain optimal connectivity without network assistance (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 263-265).

**How many subcarriers are used for a 10MHz FDD-LTE channel?**

A 10 MHz FDD-LTE channel utilizes 600 subcarriers, each spaced 15 kHz apart, supporting high data rates and efficient frequency usage (From GSM to LTE-Advanced Pro and 5G, 2021, p. 226)

**What are the differences between ARQ and HARQ?**

Automatic Repeat Request (ARQ) requests retransmission of faulty packets to correct errors, whereas Hybrid Automatic Repeat Request (HARQ) combines error correction and retransmission, allowing partial error correction with fewer retransmissions, thus enhancing data throughput (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 228-230).

**What is an RB?**

A Resource Block (RB) in LTE consists of 12 subcarriers over a time slot of 0.5 ms. It is the smallest unit of resource allocation used for scheduling and managing radio resources for data transmission (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 225-226).

**What is CS-fallback?**

Circuit Switched Fallback (CS-fallback) allows LTE devices to switch to legacy GSM or UMTS networks for voice calls, as LTE primarily handles data over packet-switched networks and lacks native circuit-switched voice support (From GSM to LTE-Advanced Pro and 5G, 2021, p. 285).

**What is the big disadvantage of Internet-based voice services compared to network operator-based voice services?**

Internet-based voice services, such as VoIP, often experience variable call quality due to factors like latency, jitter, and packet loss, unlike operator-based voice services, which are designed to maintain consistent quality with dedicated network resources (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 243-246).

**What is the difference between a cell change order and a handover?**

A cell change order is used when the device is in idle mode, directing it to switch to another cell. A handover occurs during an active connection, transferring the ongoing session to a new cell without service interruption (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 211-213).

**What is the difference between a default and a dedicated bearer?**

A default bearer provides basic, best-effort connectivity when a device first connects to the network. A dedicated bearer offers enhanced service quality for specific applications, such as video calls or streaming, with better QoS parameters (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 242-245).

**What is the difference between an S1 and an X2 handover?**

An S1 handover routes through the core network (EPC), involving MMEs and S-GWs, usually when X2 interfaces are not available. In contrast, an X2 handover occurs directly between neighboring eNodeBs, offering a faster and more direct transfer method (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 254-257).

**What is the purpose of DRX in RRC connected state?**

Discontinuous Reception (DRX) in the RRC connected state helps save battery life by allowing the device to periodically power down its receiver, balancing energy consumption with data transfer needs while remaining connected (From GSM to LTE-Advanced Pro and 5G, 2021, pp. 262-263).

# References

From GSM to LTE-Advanced Pro and 5G. (2021). In M. Sauter, *And Introduction to Mobile Networks and Mobile Broadband* (pp. 15 - 100). Hoboken, New Jersey: John Wiley and Sons Ltd.