

COURSE OUTLINE

Introduction to Evolved Packet System (EPS)

- Evolution steps of the 3GPP systems, the goals for LTE
- LTE bandwidths, bit rates and UE categories
- Summary of radio access techniques

EPS Network Architecture and Interfaces

- E-UTRA and Evolved Packet Core network architecture
- Nodes: UE, eNB, SGW, MME, PGW, PCRF
- Interfaces: Uu, X2, S1, S11, S5, Gx, S6a, SGi, Rx
- IP connectivity, user plane and control plane
- Access Stratum signaling and Non-Access Stratum signaling

OFDMA, SC-FDMA and MIMO

- Fundamentals of multipath propagation (selectivity in time, frequency and space)
- Serial vs. parallel transmission, multicarrier transmission
- OFDM subcarriers and subcarrier separation, cyclic prefix, IFFT/FFT processing
- OFDM transceiver processing
- Multiuser diversity and OFDMA
- SC-FDMA as a subclass of OFDMA, comparison between SC-FDMA and OFDMA
- Multiple access with OFDMA and SC-FDMA
- Multiple antenna concept
- Open and closed loop spatial multiplexing
- Multi-user MIMO

E-UTRA and E-UTRAN

- E-UTRAN protocol stack and channel architecture
- Downlink FDD frame structure and its elements (sub-frames, slots, resource elements, physical resource blocks, PHY channels and signals)
- Adaptive Modulation and Coding, QPSK, 16-QAM, 64-QAM
- Use of MIMO in 3GPP-LTE Release 8
- Uplink FDD frame structure and its elements (sub-frames, slots, resource elements, physical resource blocks, PHY channels and signals)
- E-UTRAN L3 and L2 protocols: RRC, PDCP, RLC, MAC

Quality of Service in LTE

- Bearer architecture including EPS bearer and end-to-end service
- Guaranteed and Non-Guaranteed Bit Rate Bearer
- QoS Classes and QoS Class Identifier
- Allocation and Retention Priority
- Bit Rate limitations
- Bearer setup, service data flows and traffic flow templates

Evolved Packet Core

- Overview of EPS protocols: PDCP, RRC, GTP, X2AP, S1-AP, S1-MME, GTP, Diameter
- NAS protocols (EMM and ESM)
- UE states (LTE-idle, LTE-active, LTE-detached)
- Subscriber identities and their relations (IMEI, IMSI, GUTI, S-TMSI, RNTIs)
- Security and keys' derivation
- IMS network and nodes (CSCF, AAA, DNS, AS, HSS)
- Call establishment via IMS
- Voice in LTE (CS Fallback, Voice Call Continuity, VoLGA)

LTE Cross-system Procedures

- Network Attach and Detach
- Call setup (Dedicated bearer establishment)
- Tracking Area Update
- Paging
- Handover over X2
- Handover over S1

LTE Features Roadmap (Rel. 8-10)

- Overview of features in the 3GPP E-UTRAN Release 8
- Enhancements expected in 3GPP E-UTRAN release 9 including MBMS
- Features in 3GPP E-UTRAN Release 10 i.e., LTE Advanced: spectrum aggregation, relay concept, MIMO improvements

LTE Interworking Considerations

- Roaming
- Inter-working with 3GPP and non-3GPP networks

Note: the course content is subject to minor changes and adaptations to the customer needs.