

# LTE - EVOLVED PACKET CORE

## - WITH FOCUS ON EPC FEATURES, PROTOCOLS, QoS, CHARGING RULES AND VoLTE SUPPORT

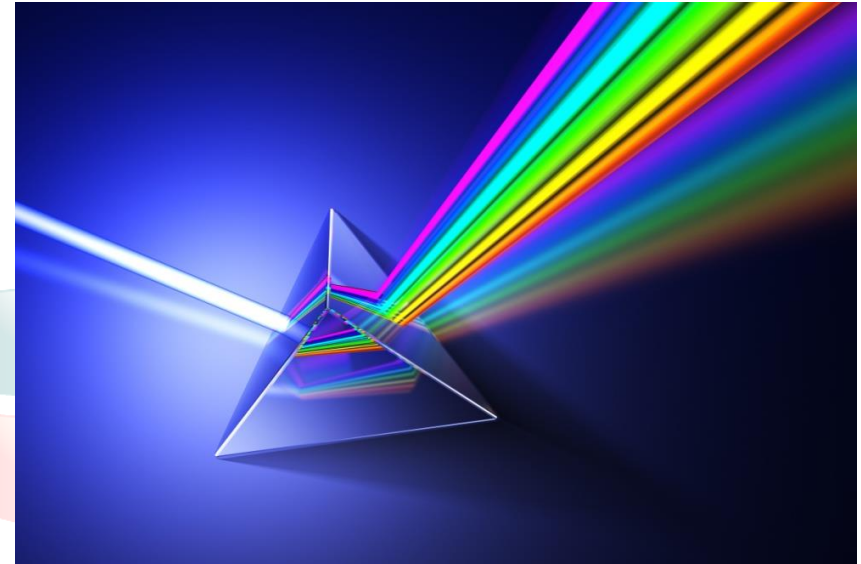
### Course Description

The course “LTE Evolved Packet System with focus on EPC features, protocols, QoS, charging rules and VoLTE support” is intended for telecom professionals with the task of implementing the mobile system standards based on 3GPP LTE and more specifically, the Core Network parts. Therefore the focus is set on understanding the LTE system from a mobile operator’s perspective, addressing the implementation issues and challenges for the Core Network Engineers.

A thorough system overview of the LTE/EPS is featured along with all the details on the Network functions, interfaces and network capabilities. The EPC systems and their features and signaling protocols are analyzed in detail. The role of Diameter/SIP and architectural options are explained. The role of new policy and charging rules principles is clarified.

The VoLTE implementations for IP telephony and Messaging services, based on IMS core systems, are presented. Key principles for interwork interconnect and roaming for VoLTE services as well as the alternative CS fallback options for CS voice and SMS are also presented and discussed. Moreover, the interworking between classical VAS (CAMEL) services and SIP based LTE services are presented together with their evolution options.

Furthermore, a number of traffic cases are studied and several comparisons are made to the existing UMTS technology and the interworking with the UMTS and GSM systems.



### Content

#### THE OVERALL EPS, EVOLVED PACKET SYSTEM (LTE)

- EPS overall architecture and the major differences compared to UMTS
- LTE Radio and Core nodes and their relation to 3G systems
- LTE Service portfolio and compatibility to existing services
- IMS core functionality for operator centric end-user services
- The fundamental TCP/IP functions in LTE
- Mobility and compatibility between 2G/3G and EPS networks
- Migration vs. replacement of 3G systems
- LTE-Advanced: 3GPP R9 and 10 highlights

## LTE RADIO NETWORK ASPECTS ON EPC SERVICES

- Basic principles on LTE OFDMA radio
- S1 control plane and NAS protocol features
- Radio support for traffic prioritization and capacity allocations
- Radio bearers matching with subscription based QoS
- Seamless intra-LTE handover support
- PS-to-PS/CS Interworking with 2G/3G radio
- Fallback for CS services to 2G/3G radio
- SON, Self Optimized/Organizing Networks

## EPC, EVOLVED PACKET CORE FEATURES AND PROTOCOLS

- MME, S/P-GW, HSS and PCRF system functions
- S1-AP and GTP-C v2 context and procedures in LTE
- Policy, charging and bearer control procedures in LTE
- APN, Default bearer vs. dedicated bearers
- UE vs. Network initiated bearer setup
- QCI (QoS Class Indicators) definition and recommendations
- SRVCC, SR Voice Call Continuity and CS fallback support
- QCI mapping into 3G QoS classes and IP DSCP values
- Authentication and security in EPC
- USIM/ISIM and service provisioning issues

## LTE/EPC MOBILITY MANAGEMENT PRINCIPLES

- Tracking Area (TA List) based mobility
- Mobility management in IDLE mode
- EPC support for ANR (Automatic Neighbour Relations function)
- Mobility Management in ACTIVE/CONNECTED Mode
- Inter-RAT mobility principles for PS and CS bearers

## Introduction of the new Diameter/SIP standards

- AAA, MAP and Diameter base RFC3588

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- Diameter nodes, agents and Diameter routing functions
- Diameter messages, procedures, AVPs and codes
- Application advertisement support and Peer Discovery
- SIP based call and session control mechanisms
- Replacing USSD with SIP/XCAP
- Subscription profile management

## CC, Credit Control Application overview (RFC4006)

- CC application messages and operation modes
- Important AVPs, codes and timers
- Sessions, sub sessions and multiple services transactions
- Rating Groups, Quotas and Credit pools
- Graceful termination and Redirect
- One time event credit control (DIRECT DEBITING)
- Duplicate detection and tariff changes
- HA/Failure handling AVPs

## 3GPP Diameter applications for Cx/Sh

- User-Authorization-Request/-Answer
- Server-Assignment-Request/-Answer
- Location-Info-Request/-Answer
- Multimedia-Auth-Request/-Answer
- Push-Profile-Request/-Answer
- User-Data-Request/-Answer
- Profile-Update-Request/-Answer
- Subscribe-Notifications-Request/-Answer
- Push-Notification-Request/-Answer

## 3GPP Diameter applications for S6ad/S13/S13'

- Replacing MAP with Diameter
- Update-Location-Request/Answer



- Cancel-Location-Request/Answer
- Authentication- Information -Request/Answer
- Insert Subscriber Data-Request/Answer
- Delete-Subscriber-Data-Request/Answer
- Purge-UE-Request/Answer
- Notify-Request/Answer
- ME-Identity-Check-Request/Answer

#### **EPC SYSTEM DESIGN AND SIGNALLING SCENARIOS**

- The protocols and interfaces in EPC, including S1
- Signaling scenarios on GTP-C v2 control protocol
- Diameter protocol and routing scenarios in EPC
- DRA based architecture in EPC
- EPC Signaling with SIP based traffic
- PCRF Interfaces and dedicated bearer set up
- International Roaming guidelines with EPC signaling

#### **VOICE over LTE implementation in EPC, VoLTE**

- VoLTE service architecture with PCRF support
- VoLTE provisioning and default APN attributes
- VoLTE support for International Roaming (guidelines)
- CS Voice migration options with VoLTE (ICS based)
- Implementation of 112 and Supplementary services in VoLTE
- IM (SIMPLE) implementation and provisioning options in VoLTE
- SIMPLE/SMS service interworking options in LTE
- Legacy CAMEL (VAS) interworking with SIP (IMS)

#### **CS Fall Back implementations in EPC and CS CN**

- CSFB requirements on network and terminals
- Subscription data related to CSFB services
- Dual registration and mobility support for CSFB

- SMS fallback or 'SMS over SGs' solution
- MT- and MO-scenarios covering voice fallback to 2G/3G
- Return to LTE after CSFB completion
- Fallback for CS services to 2G/3G radio

#### **TRAFFIC CASES IN LTE/EPS (*distributed over the course*)**

- Combined 3G/LTE registration and mobility
- Network initiated Bearer setup for MT VoLTE traffic
- LTE Data Session setup procedures
- Mobile phone call set up (VoIP call session initiation)
- IMS application registration and IM message delivery
- SMS-SIMPLE (IM) messaging interworking cases
- Mobility in LTE: Paging and location update procedures
- Voice call continuity between CS voice and VoLTE services
- End2end EPS scenario with policy and charging rules signaling flow



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## Target audience

The course targets Core Network engineers with the task of implementing the mobile system standards based on 3GPP LTE.

## Pre-requisites

The participants should have a good understanding and working experience from WCDMA CN Systems and GSM CN Systems.

## Course Length

3-5 days. Indicated session lengths may change according to customer wishes.

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