

# LTE - EVOLVED PACKET CORE

“The EPC training came at the right moment for us. While already working with the 4G network, it allowed us to go deeper into our questions and Widermind’s instructor really made us understand the complete picture.”

**Kees Duivenvoorden, Senior Network Performance Engineer,  
BASE Company, Belgium**

## 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 and the new policy and charging rules principles are clarified.

Furthermore, a number of traffic cases are studied and several comparisons are made to the existing UMTS technology and the inter-working with the legacy systems. In the end, the important issue of Security is discussed.

## Content

### 3GPP RELEASES

- Introduction
- Releases
- 3GPP, Standardization Timeline and ITU



- Core Network Evolution - R99, – R4, – LTE
- Terminology

### LTE RADIO NETWORK ASPECTS ON EPC SERVICES

- E-UTRAN Properties
- Modulation
- OFDM
- MIMO
- SC-FDMA

### EPC, EVOLVED PACKET CORE FEATURES AND PROTOCOLS

- EPC Functions and Entities
- Interfaces and Reference Points
- WM-Map1: GSM/GPRS/UMTS/EPS Nodes
- Bearers and Connections
- Traffic Case: Network Attach including Default Bearer Activation

- IDs, Contexts and Tunnels
- Inter eNB Handover
- Traffic Case: Inter-eNB HO
- Location Area, Routing Area, Tracking Area
- WM-Map2: EPS Bearers and QoS
- Logical and physical nodes
- Voice in LTE/EPS (options)

### **EPC INTERFACES, PROTOCOLS & CONTEXTS**

- Protocol Stack for EPS
- EPC Protocols
- Encapsulation & Tunneling
- The S1 Application Protocol
- The SCTP Protocol
- The NAS Protocols (EMM and ESM)
- HSS data – Before Attach
- The GTP Protocol & TEID
- The SGs interface
- Allocated Resources
- Dedicated Bearer Activation (GTP-C)
- GERAN/UTRAN/E-UTRAN Coverage
- Idle & Connected Mode
- Contexts
- WM-Map 3: EPC Interfaces

### **DNS AND EPC**

- Introduction Domain Name System
- Specific Domain Names and FQDNs
- Records used in EPC

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- DNS on IPX/GRX
- NAPTR
- SRV – Service Record
- Address Record

### **DIAMETER AND EPC**

- Introduction
- Diameter Interfaces
- Diameter Specification Structure
- Diameter Message Format
- S13 procedures
- S6a Location Management procedures
- Attribute Value Pairs
- 3GPP Specific Application IDs

### **MOBILITY**

- GUTI
- Areas and Identities
- WM-Map 4: Mobility in Idle mode
- Mobility in Connected mode
- Tracking Area List

### **THE QOS ARCHITECTURE**

- QoS Parameters
- Bearer & QoS Concepts
- Bearer QoS Characteristics
- Traffic Flow
- TFT – Example

## INTERWORKING

- WM-Map 5: Interworking with other RATs
- Dual registration and ISR
- Mapping coverage
- 3GPP access: CS Fallback
- Traffic Cases
- Non-3GPP Access, Wi-Fi Offloading
- Trusted/Untrusted Access
- S2a, S2b & S2c
- New functions ANDSF, ANQP
- Interworking Scenarios
- Mobile IP (v4)
- Traffic case: non-3GPP access

## POLICY AND CHARGING CONTROL PCC

- WM-MAP 9: PCC
- The Service Data Flow
- PCRF & PCEF
- Policy and Flow Based Charging in R6
- PCC – Policy and Charging Control in R7
- PCC – Architecture
- The PCC Rule
- Rx, Gx and S9 Procedures

## SECURITY IN EPC

- Introduction
- Security Architecture
- Key hierarchy
- The Key Derivation Function (KDF)

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- NAS AKA and Security Mode Control
- Security Gateways
- Transport mode & Tunnel mode

## 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

The course length is 3 days. Indicated session lengths may change according to customer wishes.

*Widermind* communicates the knowledge you need to develop and implement new technologies for current and future network operations. Our clients are telecom operators, system integrators, system suppliers and consultancy firms.

Based in Stockholm, Sweden, we develop courses backed by a comprehensive network of associates. Our instructors employ technical and pedagogical skills that have made Widermind training well known and appreciated as one of the best services in the field.

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