

## EPC Architecture – 3 days

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### CONTENTS

The course describes the Evolved Packet Core (EPC) as standardized by 3GPP in technical specifications. The course accounts for the network architecture, important procedures, logical functions (nodes), interfaces and protocols in EPC, primarily with E-UTRAN access. Message-level traffic cases (signalling flows) are used to illustrate the functionality and procedures of EPC.

The course also describes procedures for Mobility Management, Security and Policy and Charging Control, as well as interworking with legacy 3GPP (GERAN/UTRAN) and non-3GPP networks.

### PREREQUISITES

General knowledge about the architecture, terminology and operation of 3GPP Mobile Networks is recommended. Basic knowledge of the Internet Protocol (IP) family is useful. For required background IP knowledge, the Apis courses *3GPP Mobile Systems Overview* and *TCP/IP in a Day* (or equivalent) is recommended.

### LTE/EPS Introduction

- 3GPP Core Network evolution
- Nodes and interfaces introduced for the Evolved UTRAN and Evolved Packet Core (EPC)
- MME, SGW, PGW, HSS and PCRF
- Basic Concepts: EPS Bearers, PDN Connections
- Network Function Virtualization

### NAS (Non-Access Stratum) Protocols – EMM and ESM

- EPS Mobility Management (EMM) Procedures
- ESM Session Management (ESM) Procedures
- Network Attach and PDN Connection Setup
- Default and Dedicated EPS Bearers

### S1AP – the S1 Application Protocol

- The S1-MME Interface
- S1-MME Connections and S1 Connections
- Selected S1AP procedures and use cases

### GTP – the GPRS Tunnelling Protocol

- GTP-C and GTP-U
- GTP Tunnels and TEIDs
- GTP at PDN Connection (Data Session) and EPS Bearer setup
- GTP at UE Mobility scenarios

### UE Mobility in LTE/EPS

- Pool concept for MME and SGW
- Various UE identities
- Idle mode mobility – TA Updates
- Connected mode mobility – PS Handovers
- Context storage in EPS nodes

## LTE Interworking with 2G/3G

- Inter-RAT Mobility for UE in Idle and Connected state
- Interworking for SRVCC and CS Fallback

## Control and User Plane Separation - CUPS

- Reasons for separation of control and user planes | EPC nodes
- Roles of CP function and UP function
- Sx interfaces and PFCP (Packet Forwarding Control Protocol)

## DIAMETER on EPC Interfaces

- Introduction to Diameter
- Main Diameter procedures in EPC

## Policy and Charging Control - PCC

- Purpose of Policy and Charging Control
- QoS handling in LTE/EPS
- The PCRF (Policy and Charging Rules Function) and PCEF (Policy and Charging Enforcement Function)
- Service Data Flows (SDFs) and PCC Rules

## DNS in EPS

- Introduction to DNS
- DNS procedures for node selection in EPS
- Selected Traffic Cases – SGW and PGW selection

## IoT in 4G

- Differences between human voice and data communication and IoT / Machine-type Communication (MTC)
- Additional features and options in for IoT/MTC
- Dedicated Core Networks (DCNs)

## Non-3GPP Access Architecture

- Additional features and options for Non-3GPP Access to EPC
- Trusted and non-trusted non-3GPP access networks
- PDN Connection using WiFi and fixed broadband

## 5G System Overview

- An introduction to 5G
- Non-Standalone New Radio with EPC
- Standalone New Radio with 5G Core