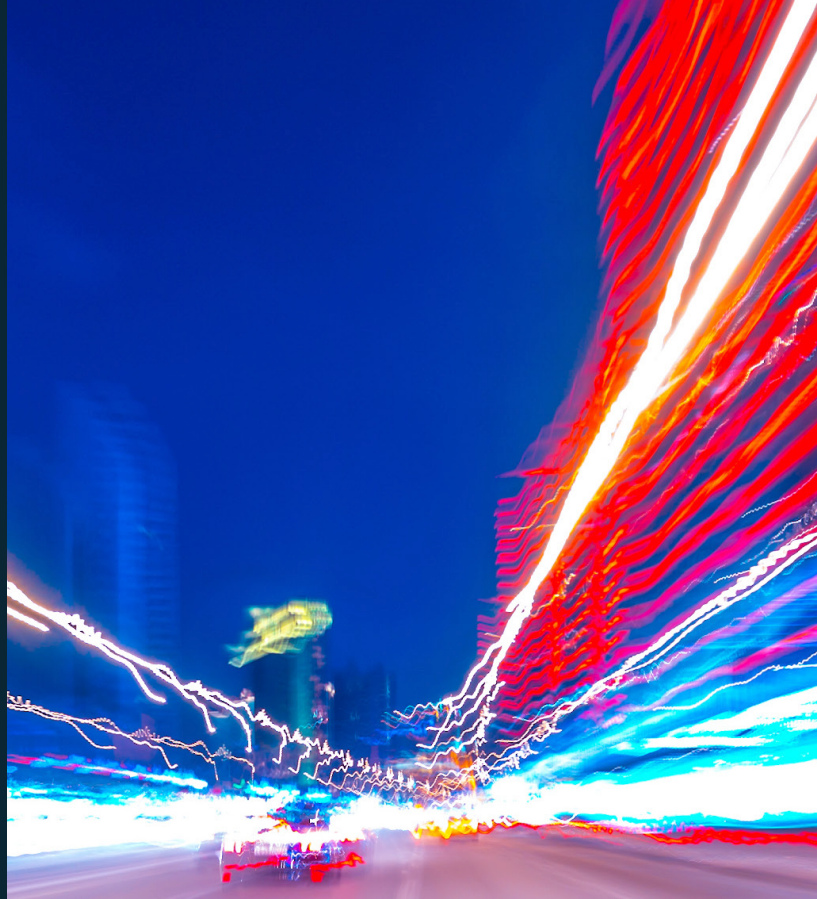




Very good material and pleased that we had access beforehand.



Watch our course intro video.



Analyzing the EPC

Course Description

Building on the foundation of LTE System Engineering, this course provides a detailed examination of the LTE Evolved Packet Core. Key emphasis is placed on the network architecture, as well as the main network procedures that occur during a mobile's typical interactivity with the LTE network. Analysis of the LTE Attach, EPS bearer establishment, EPS bearer usage, Policy Control, Mobility and Interworking will be provided as part of this process. In conclusion, the course will cover the key aspects of voice services across the EPC, including discussion on CSFB and also VoLTE.

Prerequisites: LTE System Engineering or equivalent knowledge.

3

Days
(LiveOnsite, LiveOnline)

18

CPD Learning
Credits



Level: 3
(Advanced)

This course will contain the following sections:

1. EPC Concepts

Topic areas covered include:

- What is the EPC?
 - Market Drivers for EPC.
- Defining EPC and LTE - 3GPP Standardization.
- Positioning EPC within LTE:
 - E-UTRA, E-UTRAN and EPC.
- LTE Principles of Operation.

2. EPC Functional Architecture

Topic areas covered include:

- EPC Functional Architecture:
 - MME, S-GW, PDN-GW, PCC, HSS and AAA.
- EPC Interfaces:
 - E-UTRAN and EPC Interfaces.
 - Interaction with GPRS.
 - EPC Interacting with Trusted and Untrusted Non 3GPP Access.
 - EPC Interfaces for Roaming.
 - S1-MME, S1-U, S2a, S2b, S3, S4, S5, S6a, S8, S10, S11, Gx, Rx.
- LTE Protocols:
 - S1AP - functions and procedures.
 - GTP - GTPv1-U header and procedures, GTPv2-C message format.
 - Diameter - Base Protocol, AVPs and Routing.
- DECOR.
- CUPS.

3. EPC Protocols

Topic areas covered include:

- S1 Application Protocol:
 - S1 Functions and Procedures.
 - Example S1 Procedure - NAS Transport.
 - Example S1 Procedure - Initial Context Setup.
 - E-RAB Establishment.
- GPRS Tunnelling Protocol:
 - GTPv1-U.
 - GTPv2-C.
- Non Access Stratum:
 - EMM Messages.
 - ESM Messages.
- Diameter:
 - Diameter Base Protocol & AVPs.
 - Diameter Routing.

4. EPC Transport Network Architecture

Topic areas covered include:

- Carrier Grade IP Transport:
 - IP Overview, Routing and IPv6.
- Multi Protocol Label Switching:
 - Overview, Architecture, Label Format, Traffic Engineering, FRR, PWE3.
- Carrier Ethernet:
 - CE in LTE, CE Layered Model, CE Transport.
- Timing and Synchronization:
 - Timing over Packet Options, PTP, SyncE.

3

Days
(LiveOnsite, LiveOnline)

18

CPD Learning Credits



**LiveOnsite,
LiveOnline**

5. Registration Procedures

Topic areas covered include:

- Transferring Signalling in the E-UTRAN and EPC:
 - LTE Stratum and NAS Messages.
- LTE States:
 - EMM and ECM.
- LTE Identities:
 - UE Identities, eNB Identities and EPC Identities.
 - IMSI, GUTI, eNB ID, GUMMEI, S-TMSI.
- Detailed Registration Process.
- Deregistration.

Activity: detailed analysis of the Registration procedure using Mpirical's NetX.

6. Security in the EPC

Topic areas covered include:

- EPS Authentication and Key Agreement:
 - AKA Principles, AKA in the Attach, AIR and AIA, NAS Authentication Request.
 - EEA and EIA – Null, SNOW, AES, ZUC.
 - RAND, AUTN, XRES, KASME.
- Key Distribution and Security Contexts:
 - LTE Key Architecture, Security Context Initiation, S1-MME and S1-U Security.
- IPSec and IKEv2:
 - AH and ESP, SPD, SAD, SPI and SA Establishment with IKEv2.
- Transport Layer Security:
 - TLS Operation, Handshaking, Cipher Suites, PKI and X.509.

Activity: detailed analysis of security elements of the Registration procedure using Mpirical's NetX.

7. QoS, Policy and Charging

Topic areas covered include:

- Supporting QoS - Significant Protocols:
 - SCTP and DiffServ.
- Policy and Charging Control:
 - CC Architecture, Principles, PCC and EPC.

QoS, Policy and Charging (cont.)

- PCC Binding Mechanism:
 - Session Binding, Rule Authorization, Bearer Binding.
- EPC Charging Architecture:
 - CTF, CGF, OCS, OFCS, GTP', Diameter Charging Interfaces.

Activity: detailed analysis of Diameter based PCC procedures using Mpirical's NetX.

8. End to End Session Procedures

Topic areas covered include:

- Dedicated EPS Bearers:
 - TFTs and QCI.
- Dedicated Bearer Establishment:
 - Network and UE Initiated Procedures.
- Utilizing EPS Bearers:
 - UE Triggered Service Request, Paging.
- Bearer Resource Modification Procedures.
- EPS Bearer Deactivation.

Activity: detailed analysis of Network Initiated Dedicated Bearer Establishment and Modification procedures using Mpirical's NetX.

9. EPC Mobility and Roaming

Topic areas covered include:

- Tracking Area Update Detailed Analysis.
- Handover Procedure.
- EPC Relocation Procedures:
 - MME and S-GW Relocation, S1 Based Handover.
- LTE Roaming Considerations:
 - Roaming Scenarios, IPX Architecture, DRA, IPX Proxy and Diameter Routing.

Activity: detailed analysis of TAU and Handover procedures using Mpirical NetX.

10. Circuit Switched Fallback

Topic areas covered include:

- Supporting CSFB - Network Considerations:
 - UE, MME, MSC-S, SGs, SGsAP, S3 (Packet Data).
- CSFB Preparation Phase.
- CSFB MO Call:
 - Key Stages, Handover and Redirection, SIB Skipping/Tunnelling.
- CSFB MT Call.
- Handover vs Redirection.
- Other CSFB Procedures:
 - MO/MT SMS, Packet Switched Handover, Network Detach.

11. Interworking with the PS Domain

Topic areas covered include:

- Interworking Concepts and Architecture.
- Registration and Bearer Establishment:
 - Establishing the PDP Context and EPS Bearer, Secondary PDP Contexts.
- E-UTRAN to GERAN/UTRAN RAU.
- E-UTRAN to GERAN/UTRAN Handover:
 - Preparation and Execution.

12. Exploring VoLTE

Topic areas covered include:

- Deploying VoLTE:
 - VoLTE High Level Network Architecture.
 - VoLTE Standardization.
- IMS Call Control Network:
 - IMS Requirements.
 - IMS Architecture.
 - Call Session Control Functions.
 - P-CSCF, I-CSCF, S-CSCF.
 - Additional IMS Network Elements.
 - ATCF, ATGW, A-SBC, I-SBC, HSS, TAS, SCC-AS.
 - IMS Deployment Options.
- VoLTE Initial Procedures:
 - Subscriber Provisioning.
 - Establishing IMS Connectivity.
 - IMS Registration.
 - Post Registration.
- VoLTE Call Procedures:
 - VoLTE Media – Codecs.
 - SIP Signalling Exchange.
 - Establishing Dedicated Bearers.
 - Tearing Down the Call.
- Interworking:
 - Interworking with Legacy Voice Networks.
- IMS Service Centralization and Continuity:
 - Wi-Fi Calling.
- End to End VoLTE Architecture.

The NetX logo is displayed in a large, stylized font. The background of the entire page is a detailed, isometric network diagram showing various telecom components like MSC, HSS, CSCF, and MME interconnected by lines representing network paths.

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