



Very impressed with the material and methods. Looking forward to more Mpirical training in the future.



Watch our course intro video.

LTE System Engineering

Course Description

With LTE now the cornerstone of global 4G services, this course provides an end to end view of a typical LTE deployment. As such, the architecture required for LTE, including the air interface and all of the key interfaces and protocols, is examined. The course then takes a “day in the life” approach to the LTE handset, detailing all of the typical activity an LTE handset undertakes as it interacts with the network; procedures such as Initial Attach, Bearer Establishment, Mobility and 5G Interworking are all considered. In conclusion, the course focuses on voice services, with emphasis on both CSFB and VoLTE.

Prerequisites: None

3

day
(LiveOnsite,
LiveOnline)

18

hours
learning
(OnlineAnytime)

18

CPD Learning
Credits



Level: 2
(Intermediate)

This course will contain the following sections:

1. Defining LTE

Topic areas covered include:

- LTE Roadmap and Drivers:
 - 3GPP Roadmap.
 - LTE Advanced and LTE Advanced Pro.
 - LTE Releases and Versions.
- 4G Mobile Data:
 - Growth of Mobile Data.
 - LTE Drivers.
 - 4G Fixed Wireless Access.
 - Private LTE Networks.
 - LTE Market Update.

2. LTE Architecture

Topic areas covered include:

- The LTE System:
 - Evolved Packet System.
 - Mobile Equipment.
 - Subscriber Identity Module.
 - SIM and Device Identities.
- LTE RAN:
 - 4G Radio Access.
 - Evolved Node B.
 - eNB Protocol Stacks.
- Evolved Packet Core Network:
 - Evolved Packet Core.
 - Control and User Plane Separation.
 - Evolved Packet Core Protocols.

LTE Architecture (cont.)

- Evolving RAN Architectures:
 - 5G Non Standalone.
 - NSA Reference Point and Protocols.
 - 4G in the NG-RAN.
 - ng-eNB Protocols.

3. LTE Air Interface

Topic areas covered include:

- LTE Radio Spectrum:
 - LTE Radio Bands.
 - LTE Carrier.
 - FDD vs TDD.
 - LTE Channel Number.
 - Spectrum Refarming.
- Multiple Access:
 - Orthogonal Frequency Division Multiple Access.
 - Subcarriers and Reference Signals.
 - LTE Frame Structure.
 - Multiple Access.
- Enhancing LTE Performance:
 - Modulation and Coding.
 - MIMO Technology.
 - Carrier Aggregation.
 - Shared Spectrum Options.

3 day
(LiveOnsite,
LiveOnline)

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(OnlineAnytime)

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4. LTE Initial Procedures

Topic areas covered include:

- LTE Identities:
 - Device and User Identities.
 - E-UTRAN Identities.
 - EPC Identities.
- Tracking Areas:
 - Tracking Areas Identity.
 - MME Pool, S-GW Service and Tracking Areas.
- Signalling in LTE:
 - Stratums.
 - EPS Mobility Management.
- EPS Session Management:
 - Default EPS Bearers.
 - Radio Resource Control.
- Initial Attach:
 - PLMN and Network Selection.
 - Cell Selection.
 - Attach Procedure.
 - Combined Attach.
- Attaching without PDN:
 - 4G Attach without PDN Connectivity.

5. LTE Security

Topic areas covered include:

- Security in 4G Networks:
 - Authentication and Key Agreement.
 - Security in 4G Networks.
 - 4G Authentication and Key Agreement.
- 4G Security Procedures:
 - 4G Mutual Authentication.
 - 4G NAS Key Distribution.
 - 4G RRC Key Distribution.
- 4G Encryption and Integrity Protection:
 - 4G Algorithms.
 - 4G Encryption.
 - 4G Integrity Protection.
- Securing the E-UTRAN:
 - Transport Security.
 - IPSec Management.

6. Defining EPS Bearers

Topic areas covered include:

- 4G Sessions:
 - PDN Connection.
 - IP Address Allocation.
- 4G Quality of Service:
 - Default and Dedicated EPS Bearers.
 - EPS Bearer QoS Attributes Overview.
- QoS Characteristics – Part 1:
 - QoS Class Identifier.
 - Allocation and Retention Priority.
- QoS Characteristics – Part 2:
 - Aggregate Maximum Bit Rates.
 - Traffic Flow Templates.
 - GTP Tunnels and Tunnel Endpoint Identifiers.
- 4G PDN Connectivity Establishment:
 - End-to-End Tunnels.
 - 4G Attach and Default EPS Bearer Establishment.
 - LTE Tunnel Creation.
- Dedicated EPS Bearer Establishment:
 - 4G Dedicated EPS Bearer Establishment Procedure.
 - End to End Tunnels.

7. Utilizing EPS Bearers

Topic areas covered include:

- EPS Bearers in Idle State:
 - Idle and Connected States.
 - EPS Bearers in ECM Idle.
 - S1 Release.
- 4G Uplink Data Transfer:
 - Uplink Data Transfer when Idle.
 - Uplink Data Transfer when Connected.
- 4G Downlink Data Transfer:
 - Downlink Data Transfer when Idle.
 - Downlink Data Transfer when Connected.
- Cellular IoT Enhancements:
 - Non IP Data Delivery.
 - Control Plane Cellular IoT EPS Optimization.
 - Uplink and Downlink Data Transfer via SCEF.

8. LTE Mobility

Topic areas covered include:

- Mobility in 4G:
 - LTE Mobility.
 - Mobility with the EPC.
- Idle Mode Mobility:
 - Cell Reselection.
- Tracking Area Update:
 - Tracking Areas.
 - 4G Tracking Area Update.
- 4G Handovers:
 - X2 Handover.
 - S1 Handover.
- LTE Roaming:
 - Home Routed and Local Breakout.
 - GRX and IPX.

9. 3GPP and Non-3GPP Interworking

Topic areas covered include:

- Interworking with 2G / 3G Networks:
 - Inter RAT Mobility.
 - 4G / 3G / 2G Interworking Architecture.
 - 4G to 3G Packet Switched Handover.
 - 4G to 2G Packet Switched Handover.
- 4G and 5G Non Standalone:
 - 5G Non Standalone Architecture.
 - Splitting Bearers.
 - Option 3x.
 - NSA Considerations.
- 5G NSA Secondary Node Procedures:
 - Secondary Node Addition.
 - Change of Secondary Node.
 - Release of Secondary Node.
- Interworking with Non-3GPP Networks:
 - Non-3GPP Network Architecture.
 - ePDG Selection.
 - Non-3GPP Initial Attach.

10. LTE and Voice Services

Topic areas covered include:

- Introducing Circuit Switched Fallback:
 - LTE Voice Options.
 - CSFB Network Requirements.
 - CSFB Options.
- CSFB Procedures:
 - CSFB Initial Procedures.
 - CSFB Mobile Originated Call Setup.
 - CSFB Mobile Terminated Call Setup.
 - CSFB and Text Messaging.
- Introducing VoLTE:
 - VoLTE Key Components.
 - IMS Architecture.
 - IMS Identities.
 - VoLTE Initial Procedures
 - VoLTE Support.
 - VoLTE Registration.
 - Post Registration.
- VoLTE Call Procedures:
 - VoLTE Media – Codecs.
 - SIP Signalling Exchange.
 - Establishing Dedicated EPS Bearers.
 - End to End Call Example.
 - Single Radio – Voice Call Continuity.
 - Wi-Fi Calling.



**Watch a Sample
Video Online**

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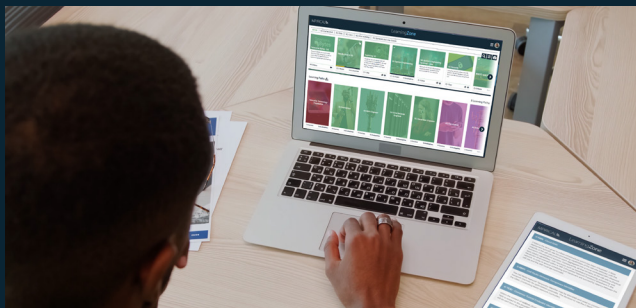
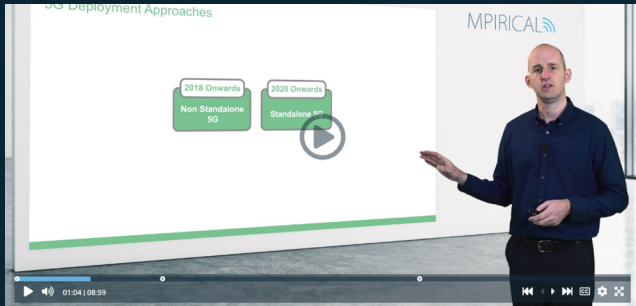
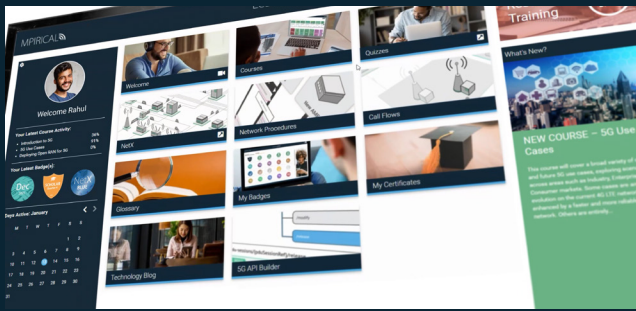
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- Technology and learning blogs
- Virtual network application, NetX

...and so much more!

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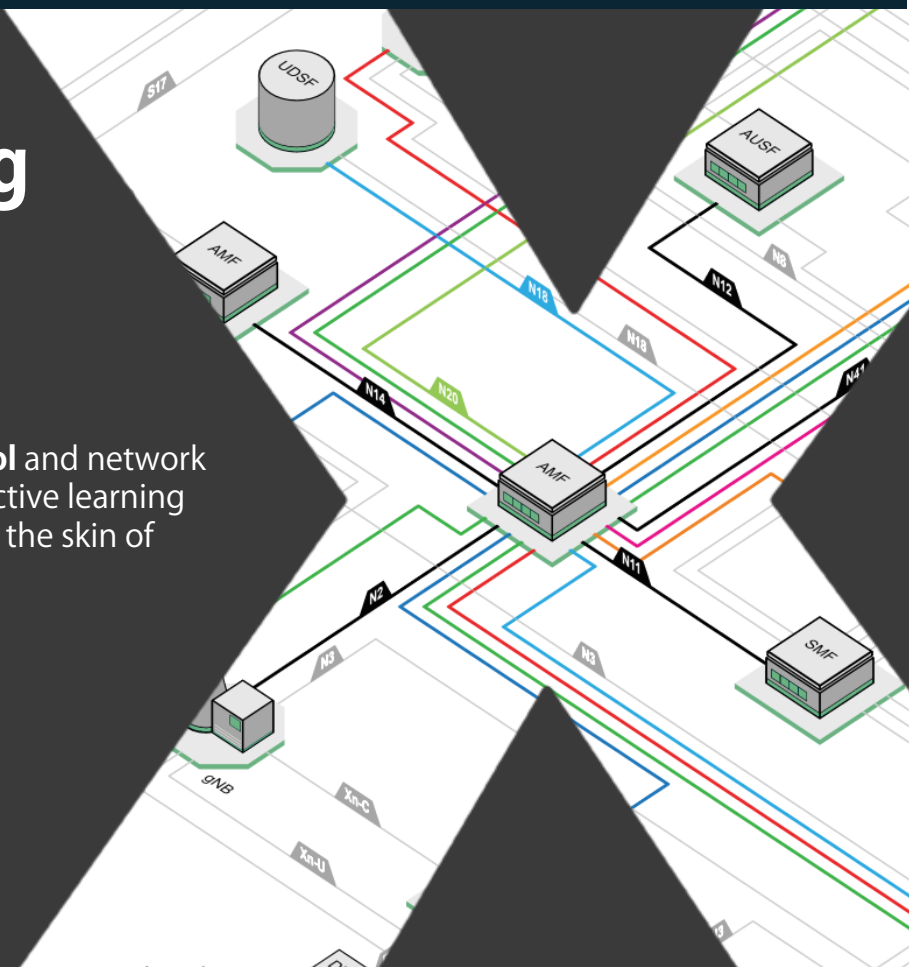


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