COURSE DESCRIPTION
LTE/SAE EVOLVED
PACKET CORE

Format: Classroom
Duration: 3 Days
COURSE SUMMARY

HIGHLIGHTS

- Highly focused and in-depth training from the experts - including relevant updates from Informa’s extensive research team
- Trainers and programme directors that are experts, industry experienced, and highly accomplished training professionals
- Training outcomes and competency development designed to meet your specific requirements

“Very useful and much related to my job!

LA, ZAIN

COURSE SUMMARY

This course describes, in detail, the architecture of the LTE/SAE Evolved Packet Core (EPC) network which is an essential component of next generation mobile networks. The overall requirements of the LTE/SAE proposals are examined along with the relationship with the existing components within a mobile network, this is developed into a description of the key interfaces and the protocols deployed.

A detailed analysis of the LTE/SAE architectural functionality is provided along with a description of the architectural reference points and protocols including the SGW, PGW, PCRF and interfaces, S1, S5, S6, S11 as well as a detailed look at the interactions between the IMS and EPC.

The importance of Policy Control and Charging is studied with a description of the PCRF and functions it provides in respect of managing user connections. VoLTE, SIP and the IMS will also be explained, outlining the concepts of VoLTE and the network requirements to support voice and voice based services.

VoLTE SIP signalling examples will be described, giving a global view of the end to end procedures for typical VoLTE events.

OUTCOMES & COMPETENCY DEVELOPMENT

Participants will develop or be able to:

- Relate theoretical diagrams of the SAE/EPC with practical implementations.
- Detailed understanding of each network node, eNB, MME SGW
- Be fully conversant with the EPC interfaces and protocol sets.
- Be able to describe the detailed relationship between core network nodes.
- Understand and explain the S1_U and S1_MME interface and describe the protocol stacks for each interface.
- Follow detailed procedures and appreciate the function of each interface for various scenarios such as, Registration, Bearer Functions, Handover, QoS Modifications.
- Describe the protocols used on the EPC interfaces S1, S5, S11, S6, S3 and S4
- Use message flow diagrams to explain the operation of the networks nodes for various scenarios
- Use the theoretical knowledge gained to follow real network protocol captures.
- Confidence to make decisions on technology implementation and procurement that are commercially viable, minimise risk, and in line with the strategy and goals of the wider organization.

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COURSE CONTENTS

**EVOLUTION OF LTE**
- Evolution of Mobile Broadband
- LTE Capabilities and Services
- Comparison of Mobile Broadband
- LTE Market Analysis
- Review of LTE market players and activities

**EPC ARCHITECTURE**
- Introduction to the Evolved Packet Core (EPC)
- MME Functions
  - Admission Control
  - Session Control
  - Mobility Management
  - S11 Reference Point
  - GTP-Control
- Gateway Functions in the EPC
- SGW Functions
  - Bearer Establishment
  - GTP on the S1 and S5
  - Handover Control
- PGW Functions
  - IP Address Allocation
  - Service Control
  - EPS Bearers and QCI
- Policy Control Functions
  - PCRF Functions and Architecture
  - PCC Rules
- Charging Requirements and Functionality
  - Online and Offline Charging
- SGW – PGW Options
- S1-Flex
- Pooling
- Roaming in LTE
- Trusted and Non-Trusted Architectures

**S1 INTERFACE**
- S1 Control Plane (S1AP)
- S1 Context Management/Setup/Modification
- S1 Paging and Mobility Functions
- S1 Signalling Procedures
  - Paging procedure
  - UE Context Release procedure
  - Initial Context Setup procedure
- UE Context Modification procedure
- E-RAB signalling procedures
- E-RAB Setup procedure
- E-RAB Modification procedure
- E-RAB Release procedure
- Handover signalling procedures
  - Handover Preparation procedure
  - Handover Resource Allocation procedure
  - Handover Notification procedure
  - Handover Cancellation
  - Path Switch procedure
  - NAS transport procedures
  - S1 Setup procedure
  - eNB Configuration Update procedure
  - Location Reporting procedures

**X2 INTERFACE**
- Interference Coordination Concepts
- X2 Control Plane (X2AP)
- X2 Messages
- X2 Control Plane Procedures
- Handover Preparation procedure
- Handover Cancel procedure
- UE Context Release procedure
- SN Status Transfer procedure
- Error Indication procedure
- Load Indication procedure
- X2 Setup procedure
- X2 Setup/Load Indication
- X2 User Plane
  - X2_U Operation

**CHARGING AND POLICY CONTROL**
- Review of the high-level billing architecture
- Charging models and requirements
- 3GPP specifications relating to charging
- Online and offline charging functions
- Credit management triggers
- Termination actions
- Flow-based charging concept and SDF charging examples
- Charging rules
- Gating and QoS control
- SDF detection
- Bearer service establishment, modification and termination procedures (online and offline)
- The IMS and charging

**IMS AND VOLTE**
- IMS Elements, Interfaces and Protocols
- LTE Bearers for VoLTE
  - QoS and Scheduling
- LTE and IMS Identities
- SIP Basics
- VoLTE Call Procedures Overview
- VoLTE and Mobility
- CS Fallback
  - Text
  - Fallback Principles
  - Fallback Architectural Requirements
  - Fallback to GSM
  - Fallback to UMTS
- Voice Call Continuity
  - SR-VCC Concepts
  - SR-VCC Architecture
  - SR_VCC Signalling

**GLOBAL PROCEDURES FOR LTE**
- Mobility Management
- LTE UE State management
- Registration Procedures
- UE Network Discovery
- System Information
- Access and Registration
- Cell Selection and Reselection
- Session Establishment and Control
- Session Management Protocol
- Bearer Establishment and Control
- Interworking with 3GPP Networks
- LTE – UMTS Handovers
- Bearer Switch during handover
- Interworking with External Networks
- Negotiating and Controlling QoS
- Support of non-3GPP Access
**OUR TRAINING SERVICES**

**TELECOMS & TECH ACADEMY STRUCTURE**

Our training programmes are delivered worldwide as part of the training and development plans of many operators, vendors, and service providers. The programmes cover a wide range of competency development requirements.

To ensure we meet the training needs of the industry as effectively as possible, we operate three schools:

**School of Telecoms & Tech Business**

Business training tailored to the telecoms industry, ranging from the intensive 5-day Telecoms Mini MBA to specialist leadership and marketing training.

**School of Advanced Communication Technologies**

Covering a multitude of technologies, these courses range from overviews aimed at nontechnical staff to in-depth engineering training.

**Distance Learning**

Our comprehensive suite of Distance Learning programmes provide an excellent opportunity to expand knowledge and build confidence.

**OUR TRAINERS**

We only use trainers and programme directors that satisfy the following three criteria:

- Experts in their field
- High level of Industry Experience
- Expert facilitators and training professionals.

All our trainers have undergone a rigorous election process and are subject to continuous monitoring and evaluation. Each trainer is accredited for specific courses or topic areas. Whether engineers or business experts, all our trainers are required to continue their own development within their specialist areas, and to broaden their Industry view of trends, best practice and technology.

This is achieved by our on-going work with many tier 1 operators and vendors, and by full exposure to Ovum research and KNect 365 TMT worldwide events.

**UNIVERSITY ACCREDITATION**

Some of our programmes have been accredited by the University of Derby Corporate; a UK-based university highly acclaimed in the area of employer engagement. They are at the forefront of the drive to integrate highly focused industry-led training with the academic rigor and quality control of university-based education. Our comprehensive Advanced Telecoms Management Series have been accredited Post-Graduate Level, with our extensive suite of Distance Learning at Undergraduate Level

We would be happy to discuss extending accreditation to tailored ATMS or programmes based on our Distance Learning modules. Although accreditation is specific to these programmes, the work we do with the University of Derby enable us to develop and apply best practice across our portfolio.

**CUSTOMISED IN-HOUSE TRAINING**

Telecoms & Tech Academy has worked with countless companies to deliver customised training programmes. We take time to understand your requirements, you’ll work with our specialist training team to ensure that we deliver your perfect training programme for your business.

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- Content can be customised to focus on the issues you want – work with us to develop the training course to match the exact needs.
- Unique industry research – from Ovum’s team of industry leading analysts
- Expert trainers – our team of versatile trainers have the knowledge and experience to deliver a highly effective learning experience
- The most efficient way to train your staff – at the time and location to minimise disruption
- Flexible delivery options – with a range of instructor led, distance learning and virtual classroom formats available you can build a blended solution to maximise training effectiveness over the long term
- Pre and post course assessment – can be included in programmes to measure competencies and check on the required progress.

Contact us to discuss how we can build your perfect programme.