COURSE DESCRIPTION
LTE END TO END SIGNALLING

Format: Classroom
Duration: 1 Day
## LTE STANDARDS AND PROTOCOLS
- LTE Standards Overview
- Network Elements and Interfaces
- LTE Identities and Areas
  - IMSI, x-TMSI
  - GUTI
  - x-RNTI
  - Location, Routing and Tracking Areas
  - Base Station Naming and Identification
  - Application Layer Identities (SIP)

## LTE RADIO INTERFACE SIGNALLING
- PHY Signalling
  - DCI Formats
  - PDCCH Signalling
- MAC Protocol Structure
  - MAC Signalling
  - MAC Procedures
  - Timing Advance
  - Power Reporting
  - Buffer Status
  - Logical Channel Id
- RLC Frame Structure and Headers
  - UM Functions
  - UM Control Headers
  - AM Functions
  - AM Control Headers
  - AM Signalling
- PDCP Protocol
  - PDCP Headers
  - PDCP Operations
- RRC Protocol
  - RRC Functions Overview
  - RRC Messages
  - RRC Messages in Detail
  - RRC Procedures

## S1_MME (S1AP) INTERFACES AND SIGNALLING
- S1 Interface Functional Overview
- S1 Protocol Stack
- SCTP Protocol
- SCTP Messages and Procedures
- S1AP Protocol
- S1AP Messages
- S1AP Message Elements and Coding
- S1AP Procedures
  - Initial Context
  - eRAB Setup
  - eRAB Modification
  - Handover (S1/X2)
  - eRAB Release
  - UL/DL Transfer

## S1_MME (NAS) PROTOCOLS
- EMM and ESM Functions
- EMM and ESM Messages
- EMM and ESM Message Elements and Coding
- EMM Procedures and Signalling
  - Attach/Registration
  - Default Bearer Establishment
  - Dedicated Bearer Establishment
  - Location Management
  - Paging
  - Bearer Modification

## X2 INTERFACE AND SIGNALLING
- X2 Functional Overview
- X2 Protocol, Control and User Plane
- X2AP Protocol Stack
- X2AP Messages
- X2AP Message Elements and Coding
- X2AP Procedures

## S11/S1_U INTERFACE AND SIGNALLING
- S11 and S1_U Functional Overview
- S11 GTP_C Protocol
- S11 GTP_C Messages and Coding
- S11 GTP_C Procedures
- S1_U GTP Procedures

## S5 INTERFACE AND SIGNALLING
- S5 Functional Overview
- S5 GTP_C, GTP_U Protocol
- S5 GTP Procedures and Signalling

## HSS/S6 INTERFACE AND SIGNALLING
- HSS/S6 Functional Overview
- Diameter Protocol Overview
- Diameter AVP
- Diameter on the S6
- S6 Procedures
  - Location Management
  - Subscriber Data Handling
  - Authentication
  - Notifications

## GX/PCRF/PCEF INTERFACE AND SIGNALLING
- PCRF/PCEF Functional Overview
- PCRF/PCEF Architecture
- Diameter on the Gx Interface
- Gx Procedures
  - Credit Control Request (CCR-I) for an idle transaction/active transaction
  - Credit Control Terminate Request (CCR-T) for an active transaction
  - Initiate Event Triggers
  - IP Connectivity Access Network (IP-CAN) Service Establishment
  - Initiate Indication of IP-CAN Service Modification
  - Initiate Indication of IP-CAN Service Termination
  - Abort Session;
  - Reauthorization Request (RAR);
  - Termination request from an active transaction;
  - Rule install for an active transaction;
  - Rule remove for an active transaction;
  - Event to update Quality of Service (QoS) Information.

## IMS/SIP INTERFACE AND SIGNALLING
- IMS Architectural Overview
- SIP Signalling Overview
- SIP/IMS for VoLTE
- VoLTE/RCS Standards and Standardisation
- VoLTE Signalling Procedures
**TELECOMS 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 Management**
  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.

**PACE ENABLED TRAINING**

Our programmes are PACE Enabled – a training method that optimises both training value and student engagement. It delivers highly efficient competency development that is focused squarely on practical application in the work place. It is simple in concept and comprises four key elements;

- **Preparation** – Pre-course preparation in order to “hit the ground running”
- **Application** – Applied Learning that focuses on practical application in order to maximise both training value
- **Consolidation** – Post-course continuing competency development, access to resources and on-going support
- **Experience** – An outstanding end-to-end training experience designed to develop competences as effectively as possible

**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 KNect365 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 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.

A customised training programme from Telecoms Academy ensures you get a course that precisely matches your organisation’s needs, presented by a first-rate training organisation, with access to all the latest industry research and analysis.

Why choose in-house training from Telecoms Academy?

- 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.