

LTE/EPS Technology

The 3GPP evolution for the 3G mobile system created the new base station system, called Evolved UMTS Terrestrial Radio Access Network (E-UTRAN) and a new core network, called Evolved Packet Core (EPC) as a result of two standardisation projects: Long Term Evolution (LTE) and System Architecture Evolution (SAE). Under these specifications a mobile phone gets access to higher bandwidth with low latency in an improved and more efficient network architecture. The standards define an all-IP network as a base for the E-UTRAN/EPC. The E-UTRAN/EPC does not have a separate PS data traffic and CS voice network, both communicate over the same new Evolved Packet System (EPS) network. LTE/EPS Technology course is an intermediate technical course, which covers all aspects of architecture and functionality of the EPS.

Target audience

The course is intended for technical GSM/UMTS staff and their management who plan to or already work on introducing LTE/EPS network.

Training contents

- **Introduction**
(3GPP mobile network evolution, requirements for the LTE system),
- **Network architecture**
 - EPC – Evolved Packet Core
(MME -Mobility Management Entity, S-GW – Serving Gateway, P-GW – Packet Data Network Gateway, HSS - Home Subscriber Server, EIR - Equipment Identity Register, PCRF - Policy and Charging Rules Function),
 - E-UTRAN
(UTRAN and E-UTRAN architecture comparison, evolved Node B – eNB, the need for eNB-eNB X2 interface),
 - Architecture for interworking with GERAN/UTRAN
(SGSN - Serving GPRS Support Node, interfaces: S3, S4, S12 and one tunnel option),
 - Architecture for roaming
(user traffic routed to the HPLMN, local breakout),
 - Architecture for interworking with non-3GPP IP access (WLAN, WiMax)
(trusted and untrusted non-3GPP IP access, ePDG - evolved Packet Data Gateway, AAA - Authentication Authorisation and Accounting),
 - Interfaces and protocol stacks
 - Geographical network structure
(TA - Tracking Area and TA list registration),
 - Identity numbers
(IMSI, MSISDN, IMEI, PDP address, GUTI, S-TMSI, M-TMSI).
- **OFDMA and SC-FDMA**
(multiple access technologies, FT - Fourier Transform and DFT - Discrete Fourier Transform , orthogonality of frequencies, channel separation in FDMA and OFDM, transmission example, implementation, advantages and disadvantages of OFDM, OFDMA, SC-FDMA),

- **E-UTRAN**

- Duplex mode
(FDD and TDD),
- Frequency bands
- ICI - Inter-Cell Interference
(ICI randomization, cancellation, co-ordination/avoidance),
- Basic time structures and parameters
(resource grid, resource block, radio frame, reference symbols),
- MIMO – Multiple Input Multiple Output
(multiple antenna systems, reference symbols from multiple antennas, MIMO channels estimation),
- Channels
(radio, physical, transport, logical channels and their characteristics, UTRAN and E UTRAN channel comparison),
- Transmission process
(link adaptation, HARQ, scheduling).
- LTE-Uu protocol stack

- **Core network**

- MME in Pool
(pool area, MME selection and addressing, load balancing, overload control),
- Signalling Transport - SIGTRAN
(SCTP, multihoming, streams, stream oriented / message oriented protocol – comparison, security, SIGTRAN in GSM/UMTS / SIGTRAN in EPS – comparison),
- User data transport
(tunneling concept, GPRS Tunneling Protocol – GTP, tunnel establishment),
- Diameter
(3GPP Diameter applications, Proxy/Relay agent),
- QoS
(EPS default bearer, EPS dedicated bearer, bearer establishment, QoS parameters, exchange of QoS related parameters between EPS and service network).

- **Policy Control and Charging - PCC**

(PCC in UMTS R5-, R6 and UMTS/EPS R8, Policy Decision Function – PDF, Charging Rules Function – CRF, Policy and Charging Rules Function – PCRF, interaction with services, flow based charging and policy control),

- **Traffic Cases**

(EMM, ECM and RRC states, attach procedure, TA update, UE/network triggered service request, S1 release procedure, dedicated bearer activation, UE requested bearer resource allocation, handover, intersystem handover, Idle mode Signalling Reduction - ISR),

- **Security**

(EPS Authentication & Key Agreement - EPS-AKA, key hierarchy, ciphering, integrity protection),

- **EPS Management**

(Self Organising Network – SON, eNB establishment, optimisation of the neighbourhood list, coverage and capacity optimisation, continuous optimisation due to dynamic changes, handover optimisation),

- **Services**

(IMS – IP Multimedia Subsystem, network architecture, identification, QoS, protocols, IMS discovery, registration, security procedures, mobile-to-mobile call, mobile-to-PSTN call, presence service, push-to-talk over cellular, instant messaging, session based messaging, SMS, VCC - Voice Call Continuity, SR-VCC Single Radio Voice Call Continuity),

- **CS Fallback and SMSoSGs**

(MSC-MME interworking, combined IMSI/EPS Attach, combined LA/TA update, CS call, SMS, other CS services).

Prerequisites

The participants should have attended the following courses for better understanding: "UMTS Technology" or "WCDMA Air Interface", or have the equivalent knowledge on UMTS..

Training method

Lecture

Duration

2 days

Level

Intermediate