LTE Cellular IoT (R10-R14)

Who Should Attend?

The course is intended for E-UTRAN developers and experienced network engineers who are planning or have already worked on introducing Cellular Internet of Things (CIoT).

Course Scope

1. Introduction.
   - IoT requirements and traffic characteristic,
   - Overview of LTE CIoT features,
   - Terminal Categories,
   - Comparison with non-3GPP IoT solutions.
2. USIM, Access Control, Load Control.
   - Conventional and embedded USIM/UICC cards,
   - USIM/UICC power saving,
   - IoT related USIM parameters,
   - Access Baring (AB),
   - Extended Access Barring (EAB),
   - Exceptional Data Reporting (EDR),
   - Usage of low priority indications,
   - overload protection,
   - backoff timers,
   - Service Gap Control (SGC)
3. Basic Features.
   - Low complexity UEs,
   - Power Saving Mode (PSM),
   - extended DRX (eDRX),
   - UE assistance for power optimisation,
   - data inactivity monitoring,
   - monitoring events,
   - device triggering,
   - high latency communication,
   - CN assisted eNB parameters tuning,
   - RAN U-plane congestion mitigation,
   - network status notification,
   - background data transfer,
   - PS-only service provision,
   - SMS in MME.
4. CIoT EPS Optimisations.
   - U-plane and C-plane CIoT EPS optimisations,
   - UE and network capabilities,
   - Connection Suspend/Resume procedure,
   - mobility in Suspended state,
   - MO/MT/SMS data transfer over C-plane,

- bearer establishment during data transfer over C-plane,
- NAS/RRC/S1AP interactions,
- C-plane optimisation reliability:
  - NAS (Non)-Delivery Indication & Reliable Data Service (RDS) protocol,
- C-plane optimisation rate control:
  - serving PLMN rate control,
  - APN rate control,
  - Inter-UE QoS for NB-IoT UEs.
5. Category M (CatM).
  - terminal capabilities,
  - half-duplex operation;
  - Enhanced Coverage / Coverage Extension (CE):
    - CE mode A/B,
    - concept of repetitions,
    - cell (re)selection,
    - Random Access and CE levels,
    - paging optimisation,
    - CE restrictions;
  - narrowbands and widebands;
  - frequency hopping,
  - physical signals:
    - PBCH & system information,
    - PUCCH,
    - MPDCCH;
  - scheduling
6. NB-IoT.
  - Inband, guard and stand-alone operation mode;
  - channel raster;
  - multi-carrier operation:
    - anchor carrier,
    - non-anchor carrier,
    - random access and paging on non anchor carriers;
  - frequency bands,
  - terminal capabilities,
  - half-duplex operation,
  - DL/UL subcarrier spacing,
  - slot and subframe structures,
  - resource/schedulable units,
  - multiple DL antennas,
  - UL physical channels and signals:
    - NB DM-RS,
    - NPUSCH format 1&2,
    - NPRACH,
  - Enhanced Coverage/Coverage Extension (CE):
    - CE levels and random access,
    - concept of repetitions,

- CE restrictions,
- paging;
  - DL physical channels and signals:
    - NRS,
    - NSS,
    - NPBCH,
    - NPDSCH and transmission gaps,
    - NPDCCH and scheduling;
  - system information,
  - cell (re)selection,
  - RRC connection control:
    - connection establishment,
    - connection control,
    - SRB1,
    - SRB1bis,
    - DRB(s),
    - RRC connection re-establishment,
    - Buffer Status Reporting (BSR),
    - Data Volume and Power Headroom Reporting (DPR),
    - NRSRP,
    - NRSRQ and CQI reporting.

Course Objectives

The course contains in-depth description of Cellular Internet of Things (CIoT) / Machine-Type Communications (MTC) features introduced gradually by 3GPP in LTE Releases 10-14.

Currently many MTC UE's are targeting low-end applications that can be handled adequately by GSM/GPRS. Owing to the low cost of these devices and good coverage of GSM/GPRS, there is very little motivation for MTC UE suppliers to use modules supporting the LTE radio interface. As more and more MTC UE's are deployed in the field, this naturally increases the reliance on GSM/GPRS networks. This will cost operators not only in terms of maintaining multiple RATs, but it will also prevent operators from reaping the maximum benefit out of their spectrum Given the likely high number of MTC UE's, the overall resource they will need for service provision may be correspondingly significant, and inefficiently assigned.

The LTE CIoT/MTC features aim at overcoming all of the problems outlined above by making LTE an attractive and effective network for handling IoT/MTC traffic for all interested parties, i.e.: operators, MTC UE suppliers and application owners.

Prerequisites

LTE Cellular IoT (R10-R14)

Knowledge of LTE/E-UTRAN is required. Completion of [LTE/E-UTRAN Signalling](#) course is highly recommended.

Training Structure

Three-day training divided into logical sessions.

Methodology

Lectures, multimedia presentations, and exercises.