5G System Overview

Who Should Attend?

This training is an ideal selection for engineers who have experience with previous generations of mobile technology and are beginning to work with the new 5G system. It maintains a proper balance among topics related to 5G CN, NG-RAN (the radio part), and 5G-based teleservices, offering participants the chance to understand the system comprehensively. Additionally, this training delivers the necessary background knowledge required to engage fully in more advanced training sessions that focus on specific subsystems or network element issues.

Course Scope

1. Introduction.
   ○ 3GPP Mobile Network Evolution.
   ○ 5G System Performance.
   ○ Technical and Business Use Cases.
2. Architecture.
   ○ 5GS Service Based and Reference Point Architecture: UDM, UDR, UDSF, 5G-EIR, AMF, SMF, UPF, Multiple Packet Session Anchors, PCF, AF, NEF, NEF, NWDAF, N3IWF, NRF,
   ○ Session and Service Continuity,
   ○ SMS over NAS,
   ○ IMS/VoLTE Support ,
   ○ Interworking with LTE/EPC,
   ○ Identifiers: SUPI/IMSI, SUCI, PEI/IMEI, 5G-GUTI, GPSI/MSISDN/external identifier, Internal-Group Identifier, External Group Identifier, DNN, LADN, DNAI,
   ○ International Roaming,
   ○ GTPv1-U tunnelling,
   ○ Protocol Stacks.
3. PDU Sessions and QoS.
   ○ DU Session Types,
   ○ QoS Flows,
   ○ QoS Rules & Packet Detection Rules (PDRs),
   ○ QoS profile: 5QI, non-GBR, GBR and delay critical GBR characteristics; ARP, RQA, notification control,
   ○ UE-AMBR & Session-AMBR,
   ○ UPF traffic processing: Forwarding Action Rules, QoS Enforcement Rules, Usage Reporting Rules,
   ○ Support for Edge Computing.
4. Network Slicing & Network Virtualisation
   ○ Network Slicing Concept,
   ○ UE's Multiple Network Slices, S-NSSAI and NSSAI,
   ○ Network Slice Instances (NSIs),
   ○ Subscription Parameters & UE Configuration, AMF Selection,
   ○ PDU Session Establishment and SMF Selection

- Network Function Virtualisation (NFV),
- RAN Virtualisation.

5. Traffic Cases.
    - RM States: RM-REGISTERED and RM-DEREGISTERED,
    - TA/TA List Management,
    - CM states: CM-CONNECTED with RRC-CONNECTED state, CM-CONNECTED with RRC-INACTIVE state, CM-IDLE,
    - Selective (De)activation of U-plane Connections,
    - UE Reachability in CM-CONNECTED: RAN-based Notification Area (RNA) and Paging,
    - MICO Mode,
    - Procedures: Registration, UE Triggered Service Request, Network Triggered Service Request, AN Release, PDU Session Establishment, SMS, Xn-based Handover, N2 based Handover, N26-based 5GS to EPS Handover.

6. Security.
    - User Identity Confidentiality.
    - Authentication and Key Agreement (AKA).
    - NAS, RRC and User Data Ciphering and Integrity Protection, Mobile Equipment Identification.

7. NG-RAN
    - Separation of gNB-CU and gNB-DU,
    - Separation of gNB-CU-CP and gNB-CU-UP,
    - F1 and E1 Interfaces,
    - Fronthaul Options (CPRI, eCPRI, nFAPI),
    - F1/E1 procedures: F1 Startup and Cells Activation, gNB-CU-UP E1 Setup, UE Initial Access, Inter-gNB-DU Mobility, RRC-CONNECTED to RRC-INACTIVE State Transition, RRC-INACTIVE to other RRC States Transition.

8. NR
    - Frequency Bands (FR1/FR2),
    - Carrier Aggregation(CA) & Supplementary Uplink (SUL),
    - OFDMA & Multiple Numerologies,
    - Channel Bandwidth, Bandwidth Part (BWP)
    - FDD/TDD, Dynamic TDD,
    - Resource Structure: ARFCN, Frame Structure, Resource Element (RE) & Resource Block (RB),
    - Cell Search & SSB blocks,
    - Reference Signals,
    - MIMO: Digital and Analogue Beamforming, Beam Sweeping,
    - Resource Allocation Methods.

9. Multi-RAT Dual Connectivity.
    - MR-DC types: NR-DC, EN-DC, NGEN-DC, NE-DC,
    - Data Bearer Types: MCG, SCG and Split Bearer,
    - Signalling Bearers,
    - Traffic Cases.

5G System Overview

Course Objectives

This training is an excellent choice for engineers who have already gained experience with previous generations of mobile technology and begun to work with the new 5G system. Training maintains an appropriate balance between the topics related to 5G CN, NG-RAN (radio part) and 5G based teleservices, giving the opportunity to understand the system as a whole. This training also provides required background knowledge needed to fully participate in more advanced training sessions focused on particular subsystem or network element issues.

Prerequisites

The participants should have general technical telecommunications/computer science knowledge on a degree level. Knowledge about LTE is recommended.

Training Structure

Four-day training divided into logical sessions.

Methodology

Instructor-led training.Lectures and multimedia presentations.