5G NG-RAN Signalling

Who Should Attend?

The course is addressed to network engineers involved in the network design and optimisation, managerial staff responsible for network operation and anybody who requires detailed knowledge on 5G NG-RAN signalling and function.

Course Scope

1. 5G System Architecture
   - Overall Network Architecture
   - Nodes, functions and interfaces
   - 5G identities
2. 5G Protocol Architecture
   - Introduction (SAP, OSI model)
   - NG-RAN protocol layer
   - Strata (NAS, AS)
   - User plane
   - Control plane
   - QoS flow, profile, architecture
   - Radio interface structure
   - 3GPP TS for 5G
3. Non-Access Stratum
   - Domain selection
   - Network slicing
   - 5GC mobility management (states, behaviour, procedures)
   - 5GS session management (states, QoS, LADN, procedures)
4. RRC
   - RRC protocol architecture
   - RRC services and functions
   - SRBs
   - RRC procedures and messages (system information, paging, RRC connection establishment, initial security activation, RRC connection reconfiguration, RRC connection re-establishment, RRC connection release, radio link failure related actions)
5. NGAP
   - NGAP protocol architecture
   - NGAP procedures (PDU session management procedures, UE context management procedures, UE mobility management procedures, paging, interface management procedures)
6. XnAP
   - XnAP protocol architecture
   - XnAP procedures (basic mobility procedures, procedures for Dual Connectivity, global procedures)
7. F1AP
   - F1AP protocol architecture

- ○ F1AP procedures (interface management procedures, UE context management procedures, RRC message transfer procedures)
8. Mobility
- ○ Intra-NR (measurements, mobility in RRC_IDLE, RRC_INACTIVE and RRC_CONNECTED)
- ○ Inter RAT (intra 5GC, from 5GC to EPC)
- ○ Roaming and access restrictions
9. 5G security
- ○ Security architecture
- ○ 5G key hierarchy
- ○ Authentication
- ○ NAS security
- ○ RRC security
- ○ Security of non-3GPP access
10. SDAP
- ○ SDAP protocol architecture
- ○ SDAP services and functions
- ○ SDAP procedures
- ○ SDAP PDU formats
11. PDCP
- ○ PDCP protocol architecture
- ○ PDCP services and functions
- ○ PDCP procedures
- ○ PDCP PDU formats
12. RLC
- ○ RLC protocol architecture
- ○ RLC services and functions
- ○ RLC procedures and parameters
- ○ RLC PDU formats
13. MAC
- ○ MAC protocol architecture
- ○ MAC services and functions
- ○ MAC procedures and parameters
- ○ MAC PDU formats
14. NR physical layer
- ○ NR physical layer structure
- ○ Downlink physical channels and signals (P-SS, S-SS, PBCH, PT-RS, DM-RS, CSI-RS, PDCCH, PDSCH)
- ○ Uplink physical channels and signals (PT-RS, DM-RS, SRS, PUCCH, PUSCH, PRACH)

Course Objectives

The 5G NG-RAN Signalling course offers a complete understanding of all signalling protocols implemented in the NG-RAN. The course presents the 5G architecture with its nodes, interfaces and protocol stacks and describes protocols through functions and and services

they provide. The course focuses on the details of the NR interface signalling exchanged between the UE and the network, however the most important aspects of other NG-RAN interfaces are also covered. Most important network procedures, such as signalling connection establishment, registration, service request and handover are discussed and presented on signalling diagrams.

The course is based on the 3GPP Release 15 version September 2018 and it is equipment vendor independent.

Prerequisites

Earlier participation in the [LTE Signalling](#) training would be beneficial.

Training Structure

Four-day training divided into logical sessions.

Methodology

Instructor-led training.