5G Technology

Course Description

The course reviews some of the key concepts that will shape the next generation of mobile systems – the 5G 5G standard, is not only about new radio technologies, but also network architecture revolutions providing a full convergence of mobile network and Internet industries. It is single end-to-end protocol standard for the future mobile Internet!

The course allows you to get understanding, the 5G Ecosystem and Technologies, in-depth. It reviews in details the 5G cutting-edge technologies and architecture like heterogeneous networks, device-to-device communications and others, as well as looks at 5G Internet of Things (IoT) solutions and virtualization methods like SDN and NFV.

The course also deals with the 5G major challenge of integrating technologies and concepts that were separately developed, into one network.

Training Duration: 2 days

Who Should Attend? – Service providers, Network Equipment vendors, Value-added services developers, Regulators, Entrepreneurs and Everyone who seeks to better understand where the mobile Internet industry is heading.

Prerequisites:

- Basic knowledge of cellular networks is expected from the participants.

Course Outline:

1. 5G vision and approach
   - 1.1. Vision, Status and Roadmap
   - 1.2. Insights into 5G network design and motivation
   - 1.3. Standardization and Regulation activity
2. 5G Challenges and Requirements
   - 2.1. 5G diverse service use cases
     - eMBB - Enhanced Mobile Broadband
     - URLL - Ultra-Reliable and Low Latency Communications
     - mMTC - Massive Machine Type Communications
   - 2.2. Service Challenges and Requirements
   - 2.3. IMT2020 vision and standardization activity
     - IMT2020 Network KPIs Requirement o Mobility, Latency, Connection Density, Energy Effciency, Capacity, Data Rates, etc.
     - 5G Network Requirements
3. 5G Network Architecture
   - 3.1. Virtualization in 5G – Introduction
   - 3.2. Cellular Networks Architecture Evolvement 3G-4G
   - 3.3. Network Architecture - Synchronization
   - 3.4. 5G Architecture Principles
     - SBA - Service Based Architecture Model
     - Major Network Functions review (AMF, SMF, UDM, UPF, etc.)
     - Service Based Interfaces and Protocols
     - N3IWF – Inter Working Function Services
   - 3.5. eSIM
   - 3.6. 5G Interfaces
4. Edge Computing and Slicing
   - 4.1. MEC – Mobile Edge Computing
     - Goals and 5G Network Provision
     - Use Cases
   - 4.2. Slicing and Virtualization Architecture - SW centric Network
     - Goals and 5G Network Provision
     - Use Cases
   - 4.3. Exposure to 3rd Party
5. 5G QoS

5.1. QoS Model
5.2. PCF Functionality
5.3. Flow Characteristics

6. 5G Deployment Alternatives and Transport Network
   6.1. 5G Deployment Alternatives
   6.2. 5G Backhaul/Fronthaul/Midhaul Configuration
      - CD/DU split
   6.3. vRAN /C-RAN/D-RAN
      - RRH (BBU) – Remote Radio Head (Baseband Unit)
   6.4. Connectivity
      - IAB
      - NTN
7. 5G Radio Principles and Spectrum Allocation
   7.1. 5G Radio Principles
   7.2. 5G Spectrum allocation planning
      - Low-Band – up to 1GHz
      - Mid-Band – 1GHz - 6GHz
      - High-band – mmWave
   7.3. Licensed and Unlicensed Bands
   7.4. 5G Radio and Multiple Access Principles
      - OFDM Signal Generation & CP-OFDMA
      - PAPR (Peak-tp Average-Power-Ratio) and Uplink Single Carrier (DFT-S-FDMA)
   7.5. 5G MIMO Fundamentals
8. Radio Structure
   8.1. LTE Vs. 5G Flexible Waveform, Numerology and Frame Structure
   8.2. Carrier Aggregation
   8.3. Multi Connectivity
   8.4. PHY Channels
      - Downlink Physical Signals and Channels
      - Uplink Physical Signals and Channels
9. 5G Private Networks
10. MAC/RLC/PDCP Layers
    10.1. MAC Architecture
    10.2. RLC/PDCP Layers
11. Mobility Management
    11.1. Mobility in IDLE mode
    11.2. Handover (procedure and criteria)
    11.3. Mobility with other 3GPP(3G/4G)/non-3GPP access systems
12. 5G Network Procedures
    12.1. Cell Selection and Reselection (procedure and criteria)
    12.2. Registration
    12.3. RRC Connection establishment and reconfiguration
    12.4. UE Initiated Service Request
    12.5. Paging
    12.6. Random Access procedure
    12.7. Session Establishment and Management
13. IoT Verticals Typical Use-Cases
    13.1. IoT Segments
    13.2. Connected Car - V2X (Vehicle to Everything)
    13.3. Industrial management and Smart Grid
    13.4. Smart City
14. C–IoT solutions
    14.1. NB-IoT – 3GPP LPWA Narrowband IoT solution
    14.2. 14.2 C-IoT URLLC Solutions • Connected Car
      - Industrial and Tactile IoT

15. VoNR / VoWiFi
    15.1. Data, voice and SMS handling
        - VoNR introduction and architecture
        - SMS delivery
        - VoWiFi
16. Management and Orchestration for 5G Networks 16.1 FCAPS principles

16.2 3GPP SDN/NFV Orchastration and Management Architecture

16.3 MANO and Slices Management

16.4 Management and NEF – Network Exposure Function

16.5 Common Information Model

16.6 Unified Datacenter Management

17 5G Security 17.1 Cellular Networks Security in General

17.2 5G Security Vision

17.3 Elements of a 5G security architecture

• Trust Model

• Slices Security

17.4 Identity Management

17.5 User privacy protection