

Course ID

5G-PRIOR1

Course Duration

3-5 days

Course Title

5G Wireless Priority Services Training: 5G Layers 1-3 with Focus on Priority Services

Related Courses

- 5G Wireless Training: Layers 1, 2, 3 (5G-TF1, 4-5 days)
- 5G Wireless Technology/Applications (5GTA, 5 days)
- Evolution of LTE to 5G Wireless (5G1, 5 days)
- SDN/NFV: Software Defined Networks & Network Functions Virtualization (SDN-NFV, 2 days)
- M2M Course with IoT and LTE (M2MIOTLTE, 3 days)
- IoT Training: In Depth (IOT3D, 3 days)
- WiFi Training in Depth: Technology, Security, Deployment ... with M2M, IoT, 5G (WIFI-DIVE, 5 days)

Aimed At

Government agencies, telecommunications operators, equipment vendors, consultants, and others with interest in Priority Services within the evolving 5G wireless technology.

Prerequisites

- LTE / LTE-A Deep Dive: RAN and Core (LTE-DIVE, 4 days)

Course in a Nutshell

5G Wireless Training: Layers 1-3 with Focus on Priority Services opens with a review of the key concepts from LTE and LTE-Advanced, 5G wireless standardization process, 5G wireless requirements and services, 5G wireless technology drivers, and 5G overall architecture. We will follow this with a dive into 5G NR Layers 1-to-3 and conclude with a discussion of the mission-critical and priority services within 5G. The course content is continually updated to keep it synched with the 5G wireless state-of-the-art.

Customize It!

We can adapt *5G Layers 1-3 with Focus on Priority Services* to your specific needs or interests by including or excluding certain topics, making it shorter or longer, or by making it more or less technical as needed.

The course duration, indicated as 3-5 days, depends on the desired depth of focus on 5G and Priority Services.

**Course
Outline**

- 1. 5G Wireless Priority Services Training: LTE and LTE-Advanced Concepts and 5G Standardization Process**
 - a. 3GPP LTE Standardization Process and Status
 - i. 5G in Release 15
 - ii. 5G in Release 16
 - b. LTE Basics
 - c. LTE and LTE-Advanced Features Used in 5G Specifications
- 2. 5G Wireless Priority Services Training: 5G Requirements and Services**
 - a. ITU IMT 2020
 - b. 5G NGMN Requirements
 - c. METIS 5G Generic Services and Requirements
 - i. xMBB: Extreme Mobile BroadBand
 - ii. uMTC: Ultrareliable Machine Type Communication
 - iii. mMTC: Massive Machine Type Communication
- 3. 5G Wireless Priority Services Training: 5G Technology Drivers**
 - a. RAN Sharing
 - b. Network Densification
 - c. Millimeter Wave (mWave), High Frequencies
 - d. Massive MIMO
 - e. Software Defined Networking (SDN)
 - f. Cloud RAN
 - g. Device to Device Communications
 - h. Internet of Things (IOT)
 - i. Device Centric Architecture
 - j. Use Cases supported by 5G
 - i. Private Network
 - ii. Neutral Host
- 4. 5G Wireless Priority Services Training: Overall Architecture**
 - a. Architecture
 - i. gNB and ng-eNB Functionalities
 - ii. AMF Functionalities
 - iii. UPF Functionalities
 - iv. SMF Functionalities
 - b. 5G Network Interfaces
 - i. NG Interface
 - ii. Xn Interface
 - c. 5G Radio Protocol Architecture
 - i. Control Plane
 - ii. User Plane

- iii. Multi-RAT Dual Connectivity
- iv. General Concept
- v. Radio Protocol
- vi. Layer 2 & RRC Architecture
- vii. Network Interfaces
- viii. Bearer Handling
- ix. Multi-Connectivity Operation
- d. 5G: Channel Model
 - i. 5G Channel Models outside 3GPP
 - ii. Antenna Modeling
 - iii. Path Loss

5. 5G Wireless Priority Services Training: 5G NR Radio Requirements

- a. 5G Spectrum
 - i. Global 5G Frequency Bands
 - 1. Sub-6GHz
 - 2. cmW
 - 3. mmW
 - ii. Spectrum Management
 - 1. Spectrum Sharing
 - 2. Dynamic Spectrum Access
 - 3. Cognitive Radio
- b. UE 5G NR Radio Requirements
- c. Base Station 5G NR Radio Requirements
- d. Common UE and BS Radio Requirements

6. 5G Wireless Priority Services Training: 5G New Radio (NR) Layer 1

- a. 5G NR Waveform
- b. 5G NR Frame Structure
- c. 5G NR Numerology
- d. 5G NR DownLink
 - i. DL Transmission Scheme
 - ii. DL PHY Shared Channels
 - iii. DL PHY Control Channels
 - iv. DL PHY Signals
 - v. DL PHY Synchronization Signals
 - vi. 5G NR DL Procedures
 - 1. Power Control
 - 2. Cell Search
 - vii. Idle Mode Operation
 - 1. Mobility in Idle Mode
 - 2. Cell Selection and Reselection
 - 3. Transition to/from Idle Mode

- 4. Paging
- 5. Cell Reselection to/from 5G Core from/to EPC
- viii. 5G NR Modulation Techniques
- ix. 5G NR Channel Coding
- e. 5G NR UpLink
 - i. UL Transmission Scheme
 - ii. UL PHY Shared Channels
 - iii. UL PHY Control Channels
 - iv. UL Random Access
 - v. UL PHY Signals
 - vi. UL Procedures
 - 1. Link Adaptation
 - 2. Power Control
 - 3. UL Timing Control
 - vii. 5G NR Modulation Techniques
 - viii. 5G NR Channel Coding
- f. 5G NR Carrier Aggregation
 - i. Supplemental Channels

7. 5G Wireless Priority Services Training: 5G NR Layer 2

- a. Layer 2 Overall Overview
- b. 5G NR MAC Sublayer
 - i. Services and Functions
 - ii. Logical Channels
 - iii. Transport Channels
- c. 5G MAC Procedures
 - i. Random Access
 - 1. Random Access CHannels (RACH)
 - 2. Random Access Procedure
 - ii. DL Data Transfer
 - iii. UL Data Transfer
 - iv. Discontinuous Reception (DRX)
 - v. Semi Persistent Scheduling (SPS)
- d. MAC PDU Formats
- e. 5G NR Radio Link Control (RLC) Architecture
 - i. RLC ARQ Procedure
 - ii. RLC PDU Format and Structure
- f. 5G NR Packet Data Convergence Protocol (PDCP) Architecture
 - i. 5G PDCP Structure
 - ii. 5G PDCP Services
 - iii. 5G PDCP Functions
 - iv. 5G PDCP Procedures
- g. Service Data Protocol (SDAP) Sublayer

- h. New AS Sublayer
- i. Carrier Aggregation
- j. 5G NR Radio Resource Control
 - i. RRC States
 - 1. RRC Idle State
 - 2. RRC Inactive State
 - 3. RRC Active State
- k. NG Identities
- l. NR Mobility
 - i. Intra-NR
 - ii. Inter-RAT
 - iii. Roaming
- m. Scheduling
 - i. Basic Scheduling in 5G NR
 - ii. DL Scheduling
 - iii. UL Scheduling
- n. UE Power Saving
- o. 5G NR Security
 - i. Cyber Security Business Models in 5G
 - ii. Cyber Security Threats for 5G
 - iii. Cyber Security Principals for IOT
 - iv. New Security Features in 5G
 - v. Enhanced and Carried-Over 4G Security Features
 - vi. Scalable, Orchestrated, and Intelligent 5G Security Architecture Framework
 - vii. 5G NR Security Termination Points
 - viii. Security in State Transition and Mobility
- p. Self-Optimization (SoN) and Self-Configuration

8. 5G Wireless Priority Services Training: 5G NR Layer 3

- a. RAN-CN Interfaces
- b. 5G: The New Core
 - i. Standalone and Non-Standalone 5G Networks
 - 1. Tight Interworking with LTE
 - ii. Cloud RAN (C-RAN)
 - iii. Collaborative Communications Protocols
 - iv. Virtualization and Software Defined Networking (SDN)
 - 1. The SDN Concept
 - 2. Network Functions Virtualization (NFV)
 - 3. vRAN /C-RAN
 - v. Internet of Things (IoT)
 - 1. Alternative Technology Solutions
 - 2. IoT Security Challenges and Solutions

- vi. Tight Interworking with LTE
- c. NR Vertical Support
 - i. IMS Voice
 - ii. Network Slicing
 - iii. Resource Isolation and Management
 - iv. URLLC

9. 5G Wireless Priority Services Training: Mission Critical and Priority Services in 5G

- a. 5G NR QoS Architecture
- b. Different Class of Services and Their Priorities
- c. Scheduling in LTE
 - i. Scheduling for Emergency/Public Safety Devices
- d. Bearer Management in 5G
- e. Priority Access in Network Architecture
 - i. Voice and Video Prioritization
- f. Congestion Control in LTE
- g. Orchestration and Control Architecture
- h. Emergency Services in 5G
- i. Support of Emergency Alerts in 5G
- j. Public Warning Support in 5G
 - i. ETWS: Earthquake and Tsunami Warning System
 - ii. CMAS: Commercial Mobile Alert System
 - iii. Enhancing PWS with eMBMS
- k. Mission Critical Push to Talk (MCPTT)
- l. 5G Public Safety Communication
- m. Lawful Services in 5G
- n. Spectrum Sharing
- o. V2X Services
- p. Augmented Reality (AR) / Virtual Reality (VR) in 5G
- q. IOT Support
 - i. eMTC Cat-M1
 - ii. NB-IOT Cat-B1
- r. Massive Internet of Things (IOT)
- s. Context Aware Networks
- t. Energy Efficiency
- u. Virtual Reality (VR)

10. 5G Wireless Priority Services Training: Course Recap and Discussion



5G Wireless Priority Services Training: 5G Layers 1-3 with Focus on Priority Services
Eogogics DCN F.INL.f