

Course ID

5G1

Course Duration

4-5 days

Course Title

4G LTE Evolution to 5G Wireless

Related Courses

- 5G Wireless Training: Layers 1, 2, 3 (5G123, 5 days)
- 5G Wireless Technology Tutorial (5GTUTE, 3 days)
- 5G Wireless Technology and Applications (5GTA, 5 days)
- LTE/LTE-A Deep Dive: RAN and Core (LTE-DIVE, 4 days)

Aimed At

Planners, strategists, and others interested in a study of the factors shaping the evolution of 4G LTE to 5G wireless and the technologies being included in 5G.

Prerequisites

Good knowledge of the current wireless technologies including at least a high-level understanding of the LTE/LTE-A standards.

Course in a Nutshell

This course, updated periodically, discusses the requirements envisioned for the 5th Generation (5G) Wireless Communications as well as the technical specifications being developed for 5G. For those intimately familiar with LTE, a shorter course with an abbreviated LTE overview replacing the first two sections of the course is available. A shorter, less technical version of this course aimed at a nontechnical audience is also offered.

Course Outline

Evolution of LTE to 5G Wireless: Introduction

- History and Standardization of 4G and 5G Communications Systems
- ITU Requirements and Technologies
 - IMT-2000 Requirements and Technologies
 - IMT-Advanced Requirements and Technologies
- 3GPP LTE Standardization Process and Status

Review of LTE and 4G LTE-Advanced

- LTE Network Architecture and Components
 - UE
 - eNB
 - MME, S-GW, P-GW, PCRF, HSS
- LTE and LTE-Advanced Air Interface Basics
 - LTE Physical Layer
 - LTE RRC and RLC Layers
 - LTE Network Entry
- LTE-Advanced Specifications

- LTE Release 11 Features
- LTE Release 12 Features
- LTE Release 13 Features
- LTE Release 14 Features (LTE Advanced-Pro)

5G Requirements and Services

- ITU IMT 2020
 - Process and Timeline
 - ITU 5G Use Cases
 - IMT Technologies between 6 and 100 GHz
- 5G NGMN Requirements
 - User Experience
 - System Performance
 - Device Requirements
 - 5G Enhanced Services
 - Network Operation, Deployment, and Management
- METIS 5G Generic Services and Requirements
 - xMBB: Extreme Mobile BroadBand
 - uMTC: Ultrareliable Machine Type Communication
 - mMTC: Massive Machine Type Communication
- 5G Wireless Objectives
 - Capacity Increase
 - Variety of Services and Applications
 - Variety of Device Types
 - Energy Savings

5G Technology Drivers

- RAN Sharing
- Green Communications
- Network Densification
 - Small Cell Development
 - HetNet Development
- Millimeter Wave (mWave), High Frequencies
- Massive MIMO
- Software Defined Networking (SDN)
- Cloud RAN
- Device to Device Communications
- Internet of Things (IOT)
 - Machine to Machine (M2M)
- Backhaul Development
- Device Centric Architecture
- 3GPP LTE 5G Network Services
 - Massive Internet of Things (IOT)

- Critical Communications
- Enhanced Mobile Broadband
- Network Operation
- C-V2X Communications
- Private LTE
- Context Aware Networks
- Self Backhaul
- Energy Efficiency
- NS-SS (Spectrum Sharing)
- GigaBit LTE
- Augmented Reality (AR)
- Virtual Reality (VR)

5G NR Radio Requirements

- 5G Spectrum
 - 5G Frequency Bands
 - Sub-6GHz
 - cmW
 - mmW
 - Spectrum Management
 - Spectrum Sharing
 - Dynamic Spectrum Access
 - Cognitive Radio
- UE 5G NR Radio Requirements
- Base Station 5G NR Radio Requirements
- Common UE and BS Radio Requirements

5G Technology

- Overall Architecture
- 5G Network Interfaces
- 5G: Channel Model
- 5G: New Radio PHY
 - 5G NR WaveForm
 - Frame Structure and Numerology
 - 5G NR DownLink Channels and Signals
 - 5G NR DownLink Procedures
 - 5G NR UpLink Channels and Signals
 - 5G NR UpLink Procedures
 - 5G NR Random Access
 - 5G NR Modulation and Coding
 - Dual Connectivity
 - 5G NR New Multiple Access Systems
 - Non-orthogonal Multiple Access (NOMA)

- Resource Spread Multiple Access (RSMA)
- 5G NR layer 2
 - MAC Layer
 - 5G NR Radio Resource Control (RRC)
 - 5G NR Radio Link Control (RLC) Architecture
- 5G New Core
- RAN-CN Interfaces
- 5G: The New Core
 - Standalone and Non-Standalone 5G Networks
 - Tight Interworking with LTE
 - Cloud RAN (C-RAN)
 - Collaborative Communications Protocols
 - Virtualization and Software Defined Networking (SDN)
- 5G: Advanced Features
 - Advanced MIMO and Beamforming
 - 3D Beamforming and Diversity
 - Interference Management
 - Millimeter-Wave Beamforming
 - Cognitive Radio Small-Cells
 - Advanced IOT
- 5G Advancement Beyond NR (Release 16)

Course Recap, Discussion, and Course Evaluation

DCN V.Nnj.f