Course: 5G

Program: 5G Engineering overview

Duration: 2 days | Certified Training

Overview

You'll start with an overview of the 5G development process and 5G performance goals. 5G use cases are then considered, along with the applications they enable. A review of LTE Advanced Pro, License Assisted Access (LAA) and Wi-Fi Offload focuses on the capacity enhancements they provide. The first day concludes with an outline of the 5G New Radio (NR) interface.

The second day begins with an overview of 4G network architecture developments impacting 5G; in particular, small cells, SDN and NFV, and network slicing. You'll learn about standalone and non-standalone 5G network architecture variants. Following this, key Internet of Things (IoT) aspects are considered, focusing on the 4G and 5G IoT specific interfaces. The course concludes with an examination of 5G security mechanisms.

Target audience

Many roles and industries will be impacted by 5G rollouts and emerging 5G services. Course participants may include those from both technical and non-technical backgrounds in network operations, vendors, service providers, application developers, management staff and engineers in finance, government or commercial services.

Course objectives

By the end of the course you should be able to:

- Outline the 5G development process and describe 5G performance targets
- Outline key 5G use cases and emerging applications enabled by the technology
- Describe the key features of LTE Advanced Pro, and how they relate to 5G
- Understand how License Assisted Access (LAA) and Wi-Fi offload mechanisms increase mobile network capacity

- Describe the main features of 5G radio interfaces
- Understand how Software Defined Networking (SDN) and Network Functions Virtualisation (NFV) are transforming network deployments and will underpin 5G
- Outline how network slicing will provide 5G service flexibility
- Describe the 5G Service Based Architecture concept, and list key 5G core network functions
- Describe major IoT applications and their underlying interface requirements
- Understand new security challenges arising from 5G

Day 1

5G Evolution **9:00 AM**

- **Mobile generations** – Mobile generation definition. 3GPP role in standards development.
- **5G development process** – Why 5G standardisation has been different. 3GPP, ITU, Industry Groups: 5G PPP.
- **5G performance targets** – IMT 2020 targets. Comparison with 4G.
- **5G deployments and trials** – International trials and rollouts. Australian 5G market projections.

5G Use cases and applications **10:45 AM**

- **5G use cases** – Enhanced mobile broadband, massive IoT, ultra-reliable low latency.
- **Communication services** – Large ad hoc crowds, disaster services, consumer broadband.
- **Automotive** – Automated vehicles, traffic management and road safety, vehicle maintenance.
- **Industrial** – Smart grids, massive sensor networks.

5G context – co-existing technologies **1:15 PM**

- **LTE advanced pro** – Release 13 overview. Data rate targets, latency considerations.

- **4G capacity developments** – Active Antenna Systems (AAS), beamforming. Carrier aggregation enhancements. Multi-User Transmission (MUST). 5G carryover.
- **Wi-Fi integration** – LTE-U, License Assisted Access (LAA). Co-existence mechanisms. Wi-Fi offload.

5G New Radio (NR) interface **3:00 PM**

- **5G spectrum** – 5G spectrum requirements. Sub 6 GHz, mm Wave bands. Spectrum auctions.
- **5G New Radio (NR) standards** – Release 15 5G NR overview.
- **5G New Radio (NR) structure and mechanisms** – Sub-carrier spacing, self-contained slot structure. Latency implications. New coding schemes, modulation enhancements. MIMO enhancements.
- **5G NR/LTE co-existence** – Dual connectivity. Frequency band sharing mechanisms.

Day 2

Network architecture developments – the 5G context **9:00 AM**

- **4G architecture review** – System Architecture Evolution (SAE), Evolved Packet Core (EPC). Why LTE networks are “flat”.
- **Small cells** – Capacity, deployment benefits. HetNet Architectures. Pico eNodeBs, Home eNodeBs. Interference issues. Collaborative Multipoint.
- **SDN and NFV** – Software Defined Networking (SDN) Architecture and Platforms NFV Definition, Scope and Use Cases.
- **Network slicing** – Networks for specific markets, virtual operators. End to end slicing architecture (RAN and Core). Operational requirements, scaling.

5G architecture overview **10:45 PM**

- **5G architecture overview** – Standalone, non-standalone modes. 5G network slicing support. Service data flows. How 5G and 4G will interwork.

- **5G core network** – Advantages of 5G service based architecture. Network Repository Functions (NRF). Core network functions.
- **5G radio access network** – gNB, ng-eNB. Cloud-based RAN (C-RAN). gNB NR function split options. Dual connectivity, control/user plane functions.

IoT in 5G networks **1:15 PM**

- **IoT overview** – IoT scope, components, key applications and interface characteristics. Service providers: e.g. Amazon.
- **IoT interfaces** – Different markets served by LTE-M, NB-IoT. Proprietary IoT systems.
- **5G IoT support** – 5G NR latency impact on industrial automation. 5G NR support for LTE-M, NB-IoT.

5G Security overview **3:00 PM**

- **5G security challenges** – Security assurance, identity management, energy efficiency, cloud security.
- **4G security mechanisms** – LTE Security architecture, key hierarchy.
- **5G security architecture** – Security domains. Security Edge Protection Proxy. gNB security requirements.
- **5G security mechanisms** – Authentication and key agreement. 3GPP and non 3GPP access. Dual connectivity. IMS Emergency session security.