

5G Core Network Architecture in a Day

CONTENTS

This course presents the 5G Core Network Architecture as defined in the R16 3GPP standards. It quickly introduces the new network features (when compared with the 4G EPC), and focuses on the Service Based Architecture (SBA) concept and on the functionalities of the 5G CN Network Functions (NF).

This condensed 5G Core Network Architecture course is intended to give a good understanding of how the 3GPP standards define the technology for a core network that is stable, secure, scalable and (relatively) cheap to deploy and maintain, and can provide cost-efficient handling and data transfer for the huge variety of applications that the 5G networks are expected to service.

It has been designed to be covered by students within one normal working day. This course also exists as a full three-day course, and as an one hour overview variant.

PREREQUISITES

Technical knowledge of the mobile telecom, especially the 4G LTE/EPS is strongly recommended.

NOTE: This course is not delivered with the FoldOut methodology.

Putting 5G into context

- What are the requirements of the modern applications/services?
- Can the 4G LTE/EPS meet these requirements?
- Defining a new radio and a new core network as a way towards meeting these requirements
- The ITU grouping of expected applications – the basic 5G Use Cases:
 - Enhanced Mobile Broadband, eMBB
 - Massive Internet of Things, MIoT
 - Ultra-Reliable and Low Latency Communication, URLLC
 - Vehicle-to-Anything, V2X

5G Deployment Options

- What is Dual Connectivity?
- 5G Dual Connectivity Deployment options:
 - Options 3 and 7: Non-Standalone New Radio
 - Option 4: Non-Standalone E-UTRA
 - Option 2: Standalone New Radio
- In which 5G deployment options is the 5GC used?
- Co-existing/Combined EPS and 5GC

Virtualization as a tool to realize the 5GC

- What is virtualization?
- What are the benefits of virtualization?
- Virtualization techniques:
 - Virtual Machines
 - Dockers/Containers
- Management and Orchestration, MANO, as a tool to manage virtual networks

5G Network Features

- Network Slicing
 - What is a Network Slice?

- What are the benefits of deploying Network Slices?
- Identifiers of the Network Slices
- Principles to allocate appropriate Network Slice(s) for a UE/service and the role of the Network Slice Selection Function, NSSF
- Multi-access Edge Computing, MEC
 - What is Edge Computing?
 - What are the benefits of using Edge Computing?
 - ETSI MEC as a realization of the Edge Computing concept
- 5G-specific PDU Session features
 - Various PDU Session types (IP/Ethernet/Unstructured)
 - PDU Session with Multiple PDU Session Anchors, PSAs
 - PSA/IP address change for an active PDU Session

Service Based Architecture, SBA

- Basic definitions:
 - Network Function, NF
 - Network Service, NS
 - Service Based Interface, SBI
 - Service Producer and Consumer
- Communication Principles over the SBA:
 - NS Registration and the role of the Network Repository Function, NRF
 - NS Discovery and the role of the Service Communication Proxy, SCOP
 - Security over the SBA

5G UE

- 5G Subscription and the role of the Unified Data Repository, UDR
- 5G Identifiers and the roles of the Unified Data Management, UDM and the 5G Equipment Identity Register, 5G-EIR
 - Subscription Permanent Identifier, SUPI
 - Subscription Concealed Identifier, SUCI
 - 5G Globally Unique Temporary UE Identity, 5G-GUTI
 - Generic Public Subscription Identifier, GPSI
 - Permanent Equipment Identifier, PEI
- Capabilities of the 5G UEs and the role of the UE Radio Capability Management Function, UCMF

5G Core Network Procedures: network access and mobility

- 5G Registration and the role of the Access and Mobility Function, AMF
- Network Access security and the role of the Authentication Server Function, AUSF
- NF/Network Slice selection principles
- Stateless AMFs and the role of the Unstructured Data Storage Function, UDSF
- Policy Control at network access and the role of the Policy Control Function, PCF
- Application Influencing of network access and the role of the Network Exposure Function, NEF
- Inter-operator Control Plane security and the role of the Security Edge Protection proxy, SEPP

5G Core Network Procedures: session handling

- PDU Session Establishment and the role of the Session Management Function, SMF
- Session-related Policy Control and the role of the Policy Control Function, PCF
- Session/UE identification and the role of the Binding Support Function, BSF
- Policy Control for session management and the role of the Policy Control Function, PCF
- Charging in 5G and the role of the Charging Function, CHF
- SMS in 5G and the role of the SMS Function, SMSF

5G User Plane, UP

- Definitions of UP-related parameters:
 - Packet Classification
 - QoS parameters
 - Routing rules
- User Plane resource handling in the 5GC and the role of the User Plane Function, UPF
- User Plane resource handling outside the 5GC, in the:
 - gNB
 - UE
- Inter-operator User Plane security and the role of the Inter-PLMN User Plane Security, IPUPS