

5G NG-RAN Architecture – 2 days

CONTENTS

This course provides a thorough overview of the Next-Generation Radio Access Network (NG-RAN) which is part of the 3GPP 5G System. The focus is on Standalone (SA) operation with NG-RAN connected to the 5G Core Network.

The course starts with a brief introduction to the 5G System, but focuses on the nodes/functions, interfaces, protocols and procedures in the NG-RAN. The course also describes dual connectivity as well as various NG-RAN implementations such as C-RAN, O-RAN (from O-RAN Alliance) and IAB (Integrated Access and Backhaul).

PREREQUISITES

Knowledge of LTE/4G is required. Basic knowledge of the overall 5G System is recommended. Good 5G background knowledge is provided e.g. by Apis' 5G System Overview course.

5G System Overview

- 5G System introduction
- E-UTRAN and NG-RAN elements: gNB, eNB, ng-eNB, en-gNB
- Non-Standalone (NSA) vs Standalone (SA) deployment options
- PDU Sessions and QoS flows

C-RAN – Centralized RAN

- Reasons for C-RAN
- gNB Central Unit and gNB Distributed Unit
- gNB-CU Control Plane and User Plane separation
- F1-C, F1-U interfaces
- F1AP – F1 Application Protocol
- E1 interface
- E1AP – E1 Application Protocol

O-RAN Architecture

- Reasons for O-RAN
- Relation to 3GPP specifications
- O-RAN Architecture and Interfaces (A1, E2, O1, O2)
- Non-RT vs Near-RT RAN Intelligent Controller (RIC)
- Virtualization of NG-RAN functions

Standalone NR with 5GC

- Architecture for SA NR
- Basic procedures: Registration and PDU Session Establishment
- NR-NR Dual Connectivity (NR-DC)
- Handling of control plane and user plane connections

NG-RAN Protocol Overview

- Overview of NG-RAN interfaces and protocols
- N2/N3/NG interfaces and NGAP/GTP-U protocol functions
- Xn interface and XnAP protocol functions
- RRC, SDAP, PDCP, RLC and MAC

NR Uu Channel Architecture

- Overview of the radio interface protocol stack
- Layer 2 protocols: SDAP, PDCP, RLC, MAC
- RLC Channels, Logical Channels, Transport Channels and Physical Channels

RRC and RRC States

- RRC Overview
- RRC States
- Behavior of Network and UE in IDLE, CONNECTED and INACTIVE states
- RAN Notification Areas

Integrated Access and Backhaul (IAB)

- Reasons for IAB
- IAB Architecture: IAB-donor and IAB-node
- Bandwidth Adaptation Protocol (BAP)

Support for 5G Use Cases

- How and in what way does NG-RAN support the main 5G use cases: eMBB, mMTC and URLLC