



Ceragon Training Syllabus

5G E2E System Overview

e-learning

Author: Catalin Georgescu

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Introduction

The **5G E2E System Overview Training** is a theoretical fundamentals course that aims to provide you with an understanding of the 5G Technology and System Architecture, explaining the latest features, requirements and implementation solutions.

After this course you will understand what the key features and benefits of the products forming the Ceragon's 5G Ready Microwave Networks portfolio.

Learning Objectives

Upon completion of this course the participants will be able to:

1. Understand what 5G means, what are the opportunities, use cases and challenges
2. Know the evolution of the cellular generations leading to 5G
3. Understand the 5G requirements and ecosystem
4. Explain the architecture and principles of 5G networks
5. Describe the structure, functions and features of the new Radio Access Network and new Core Network
6. Understand the RAN Transport Networks features and relevant protocols
7. Introduce the Ceragon IP-50 Portfolio | Disaggregated solutions
8. Know how to implement Ceragon products in 5G Networks | Use Cases
9. Understand the key features to support the 5G requirements

Target Audience

The Target audience for this course is:

Students, ICT Job Seekers, System Engineer, Service Engineer, Network Design Engineer, Service Design Engineer

Prerequisites

The participants should be familiar with general telecom technologies.

Learning Situation

This course is a theoretical e-Learning course with a duration of 11 hours.



Agenda



The slide features a city skyline background with a network diagram overlay. The CERAGON logo and 'TRAINING SERVICES' are in the top right. The title '5G E2E System Overview Agenda' is in red. The agenda items are listed in two columns.

5G E2E System Overview Agenda

CERAGON
TRAINING SERVICES

1. Introduction
 - 1.1 What is 5G? Opportunities and Challenges
 - 1.2 In a nutshell: What is new in 5G?
 - 1.3 Why 5G? Use Cases and Requirements
 - 1.4 Who makes 5G? Standardization Organizations
2. How? Evolution of Mobile Networks
 - 2.1 Cellular generations leading up to 5G
 - 2.2 Radio Access Network Evolution
 - 2.3 Core Network Evolution
3. 5G Ecosystem
4. 5G Overall Network Architecture
5. The New Radio Interface
6. The New Radio Access Network
7. The New RAN Transport Features
8. The New 5G Core Network
9. Disaggregated wireless hauling
10. IP-5G Platform Key Features
11. Course Summary
12. Certification EXAM

Proprietary and Confidential

Course Content

The topics to be discussed during this training are:

1. Introduction to 5G

1.1. What is 5G: New Opportunities and Challenges

- 1.1.1. The 5G opportunities & challenges
- 1.1.2. Resolving the operators' 5G challenges
- 1.1.3. What's New in 5G in a Nutshell?

1.2. Why 5G: 5G use cases and requirements

- 1.2.1. Verticals for 5G (eMBB, URLLC, mMTC) and M.2083 goals
- 1.2.2. Enhanced Mobile Broadband
- 1.2.3. Residential Broadband (FWA)
- 1.2.4. Downstream Video (VoD) / Upstream Video
- 1.2.5. VR/AR/MR
- 1.2.6. Smart Homes / Smart Utilities / Smart Cities (5G IoT)
- 1.2.7. Industrial IoT (IIoT)
- 1.2.8. Connected Vehicles (V2X)
- 1.2.9. eHealth / Telemedicine
- 1.2.10. 5G Spider Diagram for applications
- 1.2.11. IMT-2020 Goals

1.3. Who makes 5G: Standardization Organizations you should know (3GPP, ITU, ORAN, OCP/TIP)



2. How did we get to 5G: History & Evolution

2.1. The evolution of Mobile Networks

- 2.1.1. Cellular generations leading up to 5G
- 2.1.2. What's missing in 4G?
- 2.1.3. 5G usage categories
- 2.1.4. From 4G to 5G

2.2. Radio Access Network Evolution

- 2.2.1. The new air interface (sub-6 and mmW, BWs, MIMO, integrated subframe, densification)
- 2.2.2. Decomposed gNB (RU, DU, CU), functional splits and vRAN/cRAN
- 2.2.3. Integrated Access Backhaul
- 2.2.4. New RAN transport features (required rates, slicing, TSN, IAB)

2.3. Core Network Evolution

- 2.3.1. The evolution to network slicing
- 2.3.2. 5G core Service Based Architecture
- 2.3.3. AMF, SMF, UPF and MEC

3. The 5G Ecosystem

- 3.1. 5G actual deployments
- 3.2. Operators' approach to 5G – deployment strategies
- 3.3. RAN vendor eco-systems
- 3.4. Market disruption
- 3.5. End devices eco-system
- 3.6. Industry organizations
- 3.7. Wireless hauling in the 5G era

4. 5G Overall Network Architecture

- 4.1. Architecture and interfaces (Reference points)
- 4.2. History of cellular architecture and interfaces
- 4.3. Segments of 5G (NR, gNB, NG-RAN, 5GC)
- 4.4. The new air interface NR
- 4.5. The gNB
- 4.6. The NG-RAN
- 4.7. The new core - 5GC
- 4.8. Interfaces (F1, F2, NG, Xn, N1, N2, N3, ...)

5. The New 5G Air Interface

- 5.1. A little communications theory
- 5.2. OFDM&OFDMA
- 5.3. LTE and NR
- 5.4. Locating BW - sub-6 and mmW
- 5.5. System bandwidth and scalable numerology
- 5.6. Cell size and densification
- 5.7. MIMO
- 5.8. Self-contained integrated subframe
- 5.9. The peer-to-peer interface (PC5)



6. The New 5G Radio Access Network

- 6.1. Functional splits and the decomposed gNB (RU, DU, CU)
- 6.2. Backhaul, fronthaul and midhaul
- 6.3. eCPRI and RoE
- 6.4. Virtualization, vRAN, cRAN
- 6.5. Expected rates and new Ethernet physical interfaces
- 6.6. Time Sensitive Networking for URLLC
- 6.7. Integrated Access Backhaul
- 6.8. Synchronization requirements

7. The New RAN Transport Features

- 7.1. Challenges – rate, latency, reliability
- 7.2. Transport network topologies
- 7.3. Time Sensitive Networking and DetNet
- 7.4. FlexE
- 7.5. Network slicing
- 7.6. SDN and NFV
- 7.7. Whiteboxes
- 7.8. Network orchestration and the MEF LSO model
- 7.9. Segment Routing over MPLS, over MPLS/UDP/IP, SRv6
- 7.10. TILFA
- 7.11. Network programming

8. The New 5G Core Network

- 8.1. From EPC with CUPS to 5GC
- 8.2. AMF, SMF, UPF
- 8.3. Service Based Architecture (including REST interfaces)
- 8.4. Security aspects
- 8.5. Application Functions (and the NEF) and MEC
- 8.6. Standalone options 1 and 2 (and 5)
- 8.7. NSA option 3/3A/3x
- 8.8. NSA options 4 and 7

9. Disaggregated Wireless Hauling

- 9.1. 5G Wireless hauling challenges
- 9.2. Disaggregated hauling Vales and Benefits
- 9.3. Introducing the IP-50 Platform and use cases
- 9.4. IP-50C&S Key features and usage scenarios
- 9.5. IP-50FX Key features and usage scenarios
- 9.6. IP-50E Key features and usage scenarios

10. Course Summary

11. Course Evaluation and Feedback



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