MPIRICAL
Innovating Telecoms Training

“

Thank you! Looking forward to other detailed sessions on 5G in the future.

”

Watch our course intro video.

Analyzing the 5G Core

Course Description

Building on the foundation of 5G System Engineering, this course provides a detailed examination of the 5G Core Network. Key emphasis is placed on the Service Based network architecture, as well as the main network procedures that occur during a mobile's typical interactivity with the 5G network. Analysis of the 5G Registration, PDU Session establishment, PDU Session usage, Policy Control , MEC, 4G Interworking and network slicing will be provided as part of this process.

Prerequisites: 5G System Engineering or equivalent knowledge.

3 **day** (LiveOnsite, LiveOnline)

18 **hours learning** (OnlineAnytime)

18 **CPD Learning Credits**

Level: 3 (Advanced)

This course will contain the following sections:

1. 5GC Service Based Architecture

Topic areas covered include:

- Positioning the 5G System:
  - The 5G System.
  - Centralized – Radio Access Network.
  - C-RAN Impact on the 5G Core.
- 5G Core Network:
  - AMF.
  - SMF.
  - UPF.
  - AUSF.
  - PCF.
  - NEF.
  - UDM.
- Supplementary 5G Core Network Functions:
  - UDSF.
  - NWDAF.
  - NSSF.
  - NRF.
  - CHF.
  - SCP.
  - SMSF.
- 5G Service Based Architecture:
  - SBA Model.
  - SBI Interaction.
  - Virtualization and Cloud Native.
- 5G Service Based Interfaces:
  - SBI Protocol Stack.
  - HTTP/2.
  - Standardization of 5G SBI APIs.

5GC Service Based Architecture (cont.)

- 5GC Protocols:
  - 5GC Protocols Overview.
  - GTPv2-C.
  - GTPv1-U.
  - 5G NAS.
  - NGAP.
  - PFCP.

2. 5G Registration Analysis

Topic areas covered include:

- Network Function Registration:
  - Service Registration.
  - Profile Updates and Heartbeat Mechanism.
  - Service Discovery.
  - NF Deregistration.
  - Status Subscription.
- Device Registration – Part 1:
  - Overview.
  - AMF Selection.
  - NAS Registration Request.
  - Interaction with Old AMF.
  - NAS Identification Request / Response.
- Device Registration – Part 2:
  - Overview.
  - Security Phase.
  - Registration Status Update.
  - Registering the Subscriber.
- Device Registration – Part 3:
  - Overview.
  - Subscriber Data Acquisition.
  - Subscriber Data Subscription.

3 day (LiveOnsite, LiveOnline)

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LiveOnsite, LiveOnline, OnlineAnytime

5G Registration Analysis (cont.)

- Device Registration – Part 4:
  - Overview.
  - AM Policy Association Establishment.
  - PDU Session Reactivation.
  - NAS Registration Accept.
  - NAS Registration Complete.
- Initial Registration and Security.

3. 5G Security Analysis

Topic areas covered include:

- Supporting Security in 5G:
  - 5G Security Overview.
  - Standards bodies.
- 5G Cryptographic Processes:
  - 5G Security Algorithms.
  - Authentication and Key Agreement.
  - AV Generation.
- 5G AKA:
  - Mutual Authentication.
  - High Level 5G AKA Procedure.
  - Generation of 5G-SE-AV.
  - Device Authentication.
  - Authentication Confirmation.
- Key Derivation and Usage:
  - Encryption and Integrity Checking.
  - Key Derivation Process.
- Protecting Service Based Interfaces – HTTPS:
  - TLS Overview.
  - TLS Operation.
  - Certificate Exchange.
  - TLS Cipher Suites.
- Protecting the 5G SBA - OAuth 2.0:
  - OAuth 2.0 Basic Concept.
  - Access Token Acquisition.
  - Access Token Utilization.
- Roaming Security:
  - Security Edge Protection Proxy.
  - PRINS.
  - IPUPS.
  - Steering of Roaming Protection.

4. PDU Session Establishment Analysis

Topic areas covered include:

- PDU Sessions - Part 1:
  - PDU Session Connectivity.
  - QoS Model for 5G.
- PDU Sessions - Part 2:
  - QoS Rules and Packet Detection Rules.
  - QoS Flow Parameters.
- Application Triggering:
  - Scenario.
  - Procedure.
- PDU Session Establishment Procedure - Part 1:
  - Overview.
  - NAS PDU Session Establishment Request.
  - AMF to SMF – Create SM Context Request.
  - SM Related Subscriber Data Acquisition.
- PDU Session Establishment Procedure - Part 2:
  - Overview.
  - SMF to AMF – Session Establishment Response.
  - PDU Session Authentication and Authorization.
  - PDU-CAN Session Establishment.
  - PFCP Session Establishment.
- PDU Session Establishment Procedure - Part 3:
  - Overview.
  - PDU Session Establishment Accept.
  - NGAP Initial Context Setup Request.
  - RRC Reconfiguration.
- PDU Session Establishment - Part 4:
  - Overview.
  - NGAP Initial Context Setup Response.
  - Finalizing the PDU Session.

5. Utilizing PDU Sessions

Topic areas covered include:

- QoS Flow Establishment (Session Modification):
  - Scenario.
  - Procedure.
- Utilizing PDU Sessions – Service Request:
  - Scenario.
  - Procedure.

Utilizing PDU Sessions (cont.)

- Utilizing PDU Sessions – Paging:
  - Scenario.
  - Procedure.
- Releasing the Access Network Resources:
  - Scenario.
  - Procedure.

6. 5G Policy and Charging Control

Topic areas covered include:

- 5G PCC Fundamentals:
  - High Level Concepts.
  - Monetizing Services Using Policy Control.
  - Service Data Flows.
- PCC Architecture:
  - High Level Architecture.
  - Policy Control Function.
  - Binding Support Function.
  - Network Analytics Related Policy Decisions.
- Access and Mobility Related Policy Control:
  - Overview.
  - AM Policy Association Establishment.
  - AM Policy Control Request Triggers.
- UE Related Policy Control:
  - Overview.
  - UE Policy Session Creation.
  - UE Policy Delivery Service.
  - Focus on ANDSP and URSP.
- Session Management Policy Control:
  - SM Policy Association Establishment.
  - SM Related Policy.
- PCC Binding Mechanism:
  - Overview.
  - Session Binding.
  - PCC and QoS Rule Authorization.
  - QoS Flow Binding.
- 5G Charging Concepts:
  - 5G Charging Architecture (Service Based).
  - Nchf API.
  - Converged Charging Example.

7. MEC Concepts and Architecture

Topic areas covered include:

- MEC Deployment:
  - Overview.
  - MEC Application Functions.
  - MEC Example Scenario.
- MEC Key Concepts:
  - Connectivity Models.
  - Local Access to the Data Network.
  - Standardization of MEC.
- ETSI MEC Framework and Architecture:
  - ETSI MEC Framework.
  - ETSI MEC Reference Architecture.
  - 5G and ETSI MEC Integration.
- ETSI MEC Procedural Aspects:
  - Application Package On-Boarding.
  - Application Instantiation.
- 3GPP Edge Computing Architecture:
  - MEC and 3GPP High Level Architecture.
  - Integration with the 5G Core.
- 3GPP Edge Computing – Initial Procedures:
  - ECS Discovery.
  - Service Provisioning.
  - Registration.
  - EAS Discovery.
- 3GPP Edge Computing – Operational Aspects:
  - EAS Instantiation.
  - Application Context Relocation.

8. MEC and 5G Enablers

Topic areas covered include:

- 5G Enablers for MEC – Local Networks:
  - AF Influenced Traffic Routing.
  - Traffic Steering Control.
  - Local Area Data Networks.
- 5G Enablers for MEC – UL CLs and BPs:
  - Uplink Classifiers.
  - 5G Uplink Classifier Addition Procedure.
  - IPv6 Multi-homing (Branching Points).

MEC and 5G Enablers (cont.)

- 5G Enablers for MEC – SSC Modes:
  - SSC Overview.
  - SSC Mode 1.
  - SSC Mode 2.
  - SSC Mode 3.
  - UEs and MEC Application Mobility.

9. 5G and 4G Interworking

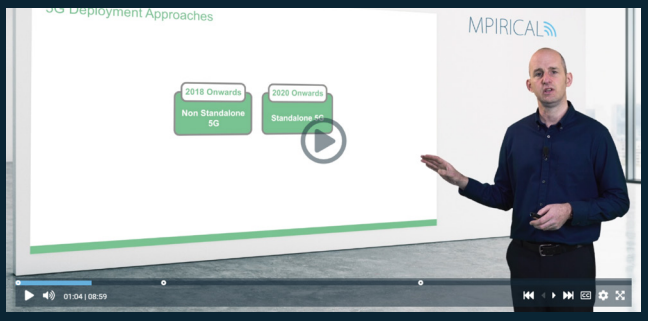
Topic areas covered include:

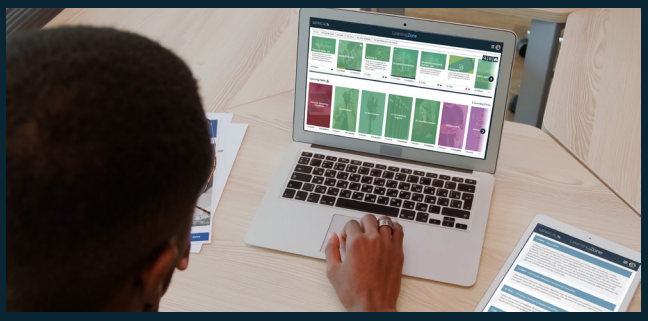
- Interworking with LTE:
  - Interworking Key Concepts.
  - Single and Dual Registration Mode.
- Single and Dual Registration Mode Mobility:
  - 5GC to EPC Mobility (Dual Registration Mode).
  - EPC to 5GC Mobility (Dual Registration Mode).
  - Mobility with Single Registration Mode Supported.
- Architectural Considerations:
  - Architecture for 5G and 4G Interworking.
  - N26 Reference Point.
- Idle Mode Mobility Procedures (with N26):
  - 5GC to EPC Mobility (Single Registration, Idle Mode).
  - EPC to 5GC Mobility (Single Registration, Idle Mode).
  - 4G GUTI to 5G-GUTI Mapping.
- 5GS to EPS Handover:
  - Scenario.
  - Procedure.
- EPS to 5GS Handover:
  - Scenario.
  - Procedure.
- Fallback Mechanisms:
  - EPS and RAT Fallback.
  - High Level Fallback Procedure.
  - Emergency Services Fallback.

10. 5G Network Slicing

Topic areas covered include:

- Network Slicing Concepts:
  - Driving Factors for Network Slicing.
  - What is a Network Slice?
  - High Level Slice Orchestration.
  - Standardization.
- Network Slice Template:
  - Customer Engagement.
  - Alternative Approaches.
  - Example NEST - eMBB with IMS Support.
  - Example NEST - Commercial Flight Telematics.
  - Example NEST - Industry 4.0 and HMTC.
- Network Slicing Architectural Considerations:
  - High Level Architecture.
  - Network Slice Selection Function.
  - Network Slice Admission Control Function.
  - Slice Analytics.
- Defining a Network Slice:
  - Communication Services.
  - Network Slices, NSI and NSSI.
  - NSSAI (Network Slice Selection Assistance Information).
- Network Slice Orchestration:
  - NSI Lifecycle Management.
  - Slice Instantiation.
  - NSSI Allocation.
- Utilizing Network Slicing:
  - 5G Registration.
  - PDU Session Establishment.
- Slice Security:
  - Slice Security Options.
  - Slice Authentication and Authorization.





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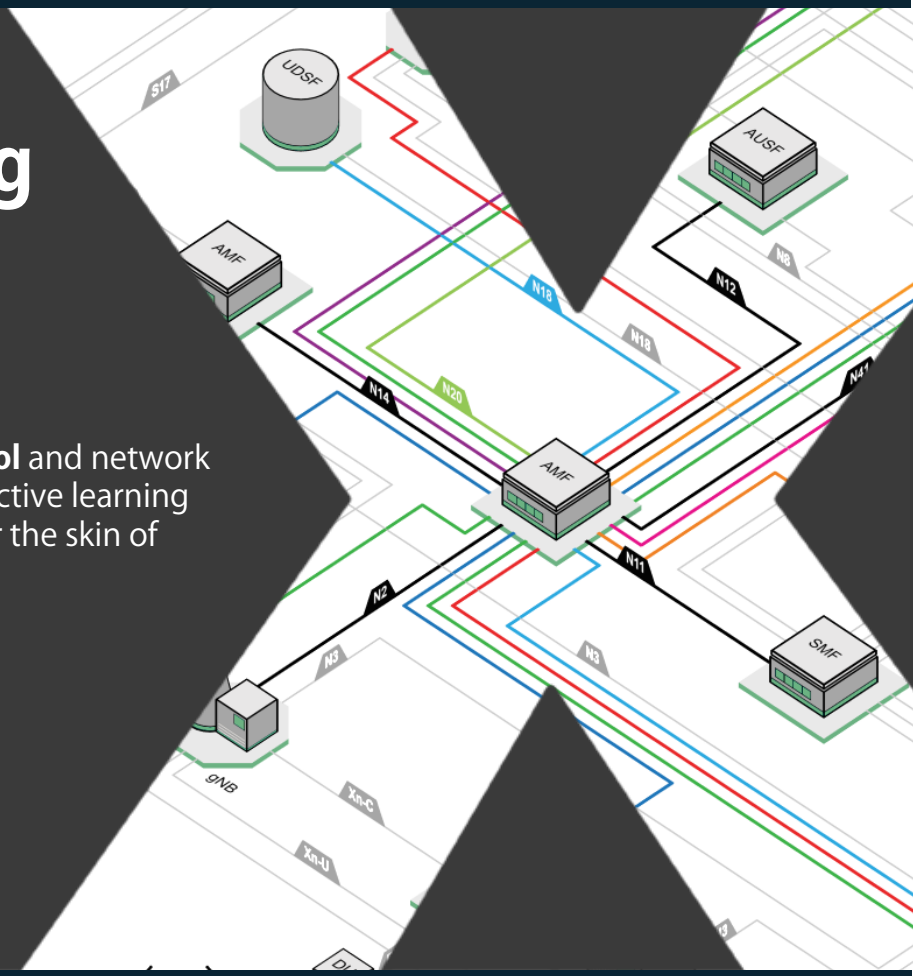

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