



Who Should Attend?

This course is aimed at technical staff, and anyone else who needs to understand Core Network Architecture and its Protocols.

Course Scope

Part I. Introduction to Mobile Technology - 3 days (focus on legacy, non-IP)

1. Overview of Network and Procedures

- GSM Circuit-switched Services
- GSM Packet-switched Services
- Network Organisation
- Mobile Network Functions
- Common Databases
- Circuit-switched Subsystem Nodes
- Packet-switched Subsystem Nodes
- GERAN Nodes
- GSM CS Interfaces
- PS Service Interfaces
- MSC Server and Media Gateway
- 3G Architecture from R5
- IMS Architecture
- IMS Interworking
- Pre-paid Solutions
- CS Registration
- GPRS Attach
- Call
- PDP Context Activation
- SMS
- International Roaming
- Handover
- Call Forwarding
- Push-to-talk over Cellular
- Protocols

2. SS7 Principles and SCCP

- SS7 Protocol Stack
- SS7 Key Concepts
- SS7 Signalling Modes
- Classical and Broadband Transport
- MTPL3 Signalling Network
- SCCP Basics and Routing
- SCCP Functional Structure
- SCCP Connection-oriented
- SCCP Message Parameters



- SCCP Address Component
- Global Title Translation - Routing
- Connection-less Service
- SCCP Examples
- 3. SS7 Mobile Services
 - TCAP
 - TCAP Structure
 - TCAP Messages and IEs
 - TCAP Information Element and Tag
 - TCAP Message Exchange
 - Mobile Application Part
 - MAP—Context and Coding
 - General MAP Structure
 - MAP examples—Location Updating
 - MAP examples—HLR and EIR
 - MAP examples—Call
 - MAP examples—Handover
 - MAP examples—SMS
 - MAP Messages per Interface
 - Mobile IN Architecture
 - IN Services
 - CAMEL
 - CAMEL CS examples
 - PDP Context with CAMEL
- 4. SS7 Call and Bearer Control
 - Call and Bearer Control Protocols
 - ISDN User Part
 - ISUP Messages
 - Bearer Independent Call Control
 - BICC Serving Node
 - BICC Features and IEs
 - H.248/MEGACO Introduction
 - Media Gateway Connection Model
 - Command and Parameters
 - Packages and Profiles
 - Bearer Control Protocols
 - Position of ALCAP in UTRAN
 - Transport for UTRAN Signalling
 - Short ATM Overview
 - Q.2630 Architecture
 - Signalling Transport Converter
 - Q.2630 Messages
 - Signalling Association Identifiers
 - Q.2630 Addressing Parameters
 - Generic Bearer Setup
 - Q.2630 example



5. SS7 Classical Transport
 - Classical and Broadband Transport
 - Layered Structure of MTP
 - MPT 1—Signalling Data Link
 - High-speed Signalling Link
 - MTP L2—Signal Unit Types
 - MTPL2—FLag
 - Service Information Fields
 - MTP L2—Status Field
 - MPTL2—Signalling Link Functions
 - Error Correction
 - MTP L3 Functions
 - MTP3—Routing Labels
 - MTP L3—Routing Tables
 - MTP3—Load Sharing.
6. RAN Signalling
 - RANAP
 - RANAP in Mobile Networks
 - Elementary Procedures
 - RANAP Messages
 - RANAP Scenarios

Part II. IP in Mobile Networks - 2 days (selected IP, MPLS and IP-based signalling)

1. Internet Protocol
 - IPv4 Packet and Addressing
 - IPv6 New Features and Addressing
 - QoS in IP
2. Main IP L4 Protocols
 - Internet Control Message Protocol
 - Transmission Control Protocol
 - User Datagram Protocol
3. Stream Control Transmission Protocol
 - SCTP Packet
 - SCTP Chunk
 - SCTP DATA Chunk
 - SCTP Association Setup
 - Selective Acknowledgement.
4. Transmission Technology
 - Ethernet
 - WLAN
 - ATM
 - MPLS and GMPLS
5. MPLS
 - Introduction to MPLS
 - Label Switching Concept



- Proprietary Solutions
- Standardisation of Bodies and Documents
- MPLS Concepts and Terminology
 - Labels
 - Headers
 - Forwarding Equivalence Class
 - Label Switched Path
- Architecture
 - Label Switched Router
 - Label Edge Router
 - Ordered vs. Independent Control
- Signalling Protocols
 - Label Distribution Protocol
 - Resource Reservation Protocol – TE
- MPLS Protection Mechanisms
 - End-to-end protection
 - Fast ReRoute
- QoS in MPLS
 - Definitions
 - Integrated Services (IntServ) and MPLS
 - Differentiated Services (DiffServ) and MPLS
- Applications
 - MPLS Virtual Private Networks (VPN)
 - Pseudowire Emulation (PWE3)
 - Virtual Private LAN Services (VPLS)
- MPLS in Mobile Core Network
- 6. IP-based Signalling Protocols
 - Short IP Overview
 - Access Point Name
 - GPRS Domain (.gprs)
 - GPRS Roaming Exchange
 - Session Management
 - Secondary PDP Context
 - GPRS Tunnelling Protocol
 - GTP-C Functions
 - GTPS Tunnelling Capabilities
 - GTP Header
 - QoS in PS Service
 - GTP Tunnel Setup Case
 - GTP'
 - User IP Address Assignment
 - IMS Session with Policy Control.
 - RADIUS introduction
 - Diameter Protocol
 - Gx, Gy, and Gz Interfaces
 - Session Initiation Protocol (SIP)



- Session Description Protocol (SDP).
- RTP/RTCP voice stream transport
- SIP Multimedia Session Set-up
- P-CSCF Discovery
- IMS Registration
- IMS Session Setup - MO

7. SIGTRAN

- Introduction to SIGTRAN
- M2UA
- M2PA
- M3 User Adaptation—M3UA
- SUA

Part III. Planning and Performance - 3 days (focus on calculations, architectures just for reminder)

1. Core Network Planning Overview

- Traffic planning — objectives, inputs, activities
- Traffic modelling
- Theoretical models
- CS/PS real-time and non-real-time services
- Legacy telephony solutions
- IP networks and Internet
- Modern telephony - VoIP and Soft-switch

2. Core Network Connectivity

- CS architecture
- Call setup
- Interconnect to other CS CN
- International roaming
- SIP-ISUP interworking
- PS architecture
- PDP Context
- QoS in PS service
- Interconnect to other PS CN

3. Traffic Parameters

- Key CS domain parameters and KPIs
- Supplementary CS domain parameters and KPIs
- Key PS domain parameters and KPIs
- Supplementary PS domain parameters and KPIs
- Grade of Service (GoS)
- Erlang theory

4. Traffic Modelling

- CS/PS services
- User profiles and requirements
- CS traffic modelling
- CS traffic cases



- Gi and Gp traffic modeling perspective
- PS traffic cases
- Expansion planning
- 5. Traffic Distribution and Dispersion
 - Reference network model
 - Subscriber distribution
 - Traffic dispersion
 - CS traffic
 - Nb traffic
 - PS traffic
- 6. CS Capacity Planning
 - Network planning
 - Detailed network design
 - CS network solution - nodal perspective
 - CS network solution - features
 - MGW Traffic Model
 - MGW, MSC, HLR, SMS-SC dimensioning principles
- 7. PS Capacity Planning
 - PS network solution
 - PS network topology design
 - PS dimensioning considerations
- 8. Mc Signaling Planning
 - Signalling load and volume calculation
 - H248 introduction
 - H.248/MEGACO protocol
 - H.248 signalling case and calculations
 - BICC features impacting H.248 calculations
- 9. SS7 Signalling Network
 - SS7/SIGTRAN key concepts
 - Signalling network design and planning
 - SCCP and SUA
 - Classical and broadband transport
 - M3UA, M2UA, M2PA
 - SIGTRAN protocols overhead
 - Signalling link dimensioning for TDM, ATM, and IP
- 10. SS7 Applications Capacity Planning
 - ISUP messages, calculations
 - BICC introduction, calculations
 - TCAP message exchange
 - MAP examples
 - TCAP/MAP calculations
 - IN architecture
 - CAMEL CS examples
 - IN network nodes and link dimensioning
 - TCAP/INAP-CAP calculations
- 11. DIAMETER Signalling



- DIAMETER Protocol
 - PCC – features
 - PDP with policy control
 - Gx, Rx and Cx interfaces
 - PDP with flow based charging
 - Gx, Gy signalling cases, calculations
12. QoS Solutions in Transport Network Planning
- Impact of ATM, Ethernet, and MPLS
 - QoS in IPv4 Integrated Services
 - Differentiated Services
 - QoS Handling in MPLS
 - 3G Traffic Classes vs. DiffServ
 - DiffServ and MPLS QoS Mapping.
13. Other Aspects of 3G Network Planning
- Expansion and Migration Planning
 - Interconnection Planning
 - Interconnection of Mobile Backbones
14. Performance Analysis
- Accessibility KPIs for Packet CN
 - Retainability KPIs for Packet CN
 - Service delivery KPIs for Packet CN

Course Objectives

This course provides the participants with more advanced knowledge of core network infrastructure and functionality. It describes the interfaces and interface protocol structure involved in communication within core network elements, and gives examples of traffic, and ways of network planning and dimensioning.

Prerequisites

Participants should have basic knowledge of architecture and communications in Telecom networks.

Training Structure

Eight-day training divided into logical sessions.

Methodology

Instructor-led training. Presentations, examples, exercises.