

SS7

Protocols & Operation and Services

Course Duration:

- ▶ 3 days

Course Description:

- ▶ This course addresses the needs of engineers and technicians who shall establish sophisticated and detailed knowledge about the Signaling System No 7 and the related protocol stack.
- ▶ The course explains in detail the lower layer of the SS7-protocol stack (MTP 1, MTP2 and MTP3) and lines out the format and parameters of the FISU, LSSU and MSU.
- ▶ The course continues with the SS7 network architecture and explains the tasks and functions of SP's, SCP's and STP's.
- ▶ The next part focuses on the introduction of higher layers of the SS7-protocol stack like the SCCP, TCAP, TUP and ISUP.
- ▶ Of course, we integrated a chapter about Intelligent Networking (IN).
- ▶ The course has been updated and now also covers SIGTRAN which is manifested through the new protocols STCP and M3UA which provide for the routing of SCCP-messages over IP-networks, possibly encrypted.
- ▶ The courses concludes with the practical examination of SS7-recording files in real life networks.

As in all INACON courses we integrated several interactive exercises for a perfect learning experience.

Pre-Requisites:

- ▶ Very good understanding of telecommunication networks and the related protocols.
- ▶ Fundamental knowledge of the Signaling System No 7.

Course Target:

- ▶ The student will be enabled to understand all important aspects of SS7 signaling procedures.

Some of your questions that will be answered:

- ▶ How is routing performed in MTP 2 and 3 through OPC and DPC?
- ▶ What does Change Over / Change Back stand for?
- ▶ When and why are SCCP connection-less or connection-oriented services used by higher layers?
- ▶ Why are points code sometimes provided in 4-3-4-3 syntax, other times in 3-8-3-syntax and yet at other times in hex?
- ▶ How can I determine whether all our ISUP-trunks are load-shared?

Who should attend this class ?

- ▶ Operations staff of switches and the related equipment
- ▶ MTSO-staff who shall perform protocol tester measurements on switches
- ▶ Everybody who requires a detailed understanding of SS7 signaling procedures

Table of Contents:

Physics and Protocols of the Integrated Services Digital Network

The Network Architecture in ISDN

- ⇒ Configuration of an Exchange

The User Interface

- ⇒ Reference Configuration
- ⇒ The Basic Access Link with DSL

The ISDN-Protocol Stack on the U-Interface

- ⇒ Physical Layer (OSI Layer 1)
- ⇒ Data Link Layer (OSI Layer 2)
- ⇒ Network Layer (OSI Layer 3)

Details of the Physical Layer

- ⇒ B- and D-Channel Multiplexing on the U-Interface
- ⇒ 2B1Q-Line Coding

The Data Link Layer on the D-Channel (Layer 2)

- ⇒ Tasks and Functions
- ⇒ Connection-Less vs. Connection-Oriented Operation
- ⇒ Unacknowledged vs. Acknowledged Operation
- ⇒ HDLC-Framing

LAPD-Frame Format (Modulo 128)

- ⇒ I-Frames and Supervisory Frames
- ⇒ Unnumbered Frames

The Network Layer (Q.931-Signaling)

- ⇒ Overview
- ⇒ Basic Call Setup through Q.931 Signaling

The Message Transfer Part 1 – 3 in the CCS7

Message Transfer Part 1 – 3 in the CCS7-Protocol Stack

Details of Message Transfer Part 1

- ⇒ HDB3-Line Coding
 - Details of HDB3-Line Coding
- ⇒ The Plesiochronous Digital Hierarchy (PDH)

The Message Transfer Part 2

- ⇒ Tasks and Functions
- ⇒ The Process of Signal Unit Delimitation and Bit Stuffing
- ⇒ The MTP 2 Message Formats
- ⇒ The Fill In Signal Unit (FISU)
- ⇒ The Message Signal Unit (MSU)
- ⇒ The Link Status Signal Unit (LSSU)
 - Meaning of the Status Field
- ⇒ CCS7-Link Establishment
 - Before Link Establishment
 - Link Alignment Initiated
 - Test Phase
 - Layer 3 Message Exchange

Error Detection and Correction in MTP 2

- ⇒ ARQ-Operation in MTP 2 (Use of BSN/BIB and FSN/FIB)
- ⇒ The Signal Unit Error Rate Monitor (SUERM)

The CCS7-Network

- ⇒ Physical View
- ⇒ Logical View / Introducing SP's, STP's and SCP's
- ⇒ CCS7 in GSM Networks

Addressing and Routing in CCS7 (MTP 3)

- ⇒ Introduction
- ⇒ Meaning of the Network Indicator (NI)
- ⇒ Format of International Signaling Point Codes (ISPC)
- ⇒ Format of National Signaling Point Codes (NSPC)
- ⇒ The Routing Label

CCS7 Network Management, Test and Maintenance**Tasks and Functions of SNM and SNTM**

- ⇒ Signaling Network Test and Maintenance
- ⇒ Signaling Network Management

General Message Format of SNM and SNTM

- ⇒ Format, Meaning and Use of SNTM-Messages
 - SLTM (Signaling Link Test Message)
 - SLTA (Signaling Link Test Acknowledgement Message)
 - Example of an SLTM-Message
 - Example of an SLTM-Message
 - The Related SLTA-Message
 - The Related SLTA-Message

- ⇒ Format, Meaning and Use of SNM-Messages
 - COO (Change Over Order)
 - COA (Change Over Acknowledge)
 - CBD (Change Back Declaration)
 - CBA (Change Back Acknowledge)
 - ECO (Emergency Change Over Order)
 - ECA (Emergency Change Over Acknowledge)
 - TFC (Transfer Controlled)
 - TFP (Transfer Prohibited)
 - TFR (Transfer Restricted)
 - TFA (Transfer Allowed)
 - RST (Signaling Route Set Test for Prohibited Destination)
 - RSR (Signaling Route Set Test for Restricted Destination)
 - DLC (Signaling Data Link Connection Order)
 - CSS (Connection Successful Signal)
 - CNS (Connection Not Successful Signal)
 - CNP (Connection Not Possible Signal)
 - LIN (Link Inhibit Signal)
 - LUN (Link Uninhibit Signal)
 - LIA (Link Inhibit Acknowledgement Signal)
 - LUA (Link Uninhibit Acknowledgement Signal)
 - LID (Link Inhibit Denied Signal)
 - LFU (Link Forced Uninhibit Signal)
 - LLT (Link Local Inhibit Test Signal)
 - LRT (Link Remote Inhibit Test Signal)
 - UPU (User Part Unavailable)
 - TRA (Traffic Restart Allowed Signal)
 - RCT (Signaling Route Set Congestion Test)
- ⇒ The Change Over Procedure
 - Example of a COO-Message
 - Example of a COO-Message
 - The Related COA-Message
 - The Related COA-Message

The Signaling Connection Control Part (SCCP)

The SCCP in the CCS7-Protocol Stack

- ⇒ Underlying Protocols
- ⇒ Application Protocols

Tasks and Functions of the SCCP

- ⇒ Provision of Various Different SCCP-Message Types
- ⇒ End-to-End Routing of SCCP-Messages
- ⇒ Provision of Different Service Classes
- ⇒ SCCP-Subsystem Management

Use Studies

- ⇒ Use of the SCCP for Subsystem Distinction
- ⇒ Use of the SCCP for End-to-End Addressing

Means for End-to-End Addressing

- ⇒ Structure of the Called / Calling Party Address Fields
- ⇒ Subsystem Number
- ⇒ Global Title
 - Global Title Indicator = '0001'(bin)
 - Global Title Indicator = '0010'(bin)
 - Global Title Indicator = '0011'(bin)
 - Global Title Indicator = '0100'(bin)

SCCP-Messages

- ⇒ Formatting of SCCP-Messages
- ⇒ Important SCCP-Message Types
 - CR (Connection Request)
 - CC (Connection Confirm)
 - CREF (Connection Refused)
 - RLSD (Released)
 - RLC (Release Complete)
 - DT1 (Data Form 1)
 - DT2 (Data Form 2)
 - AK (Data Acknowledgement)
 - UDT (Unit Data)
 - UDTS (Unit Data Service)
 - IT (Inactivity Test)
 - SSA (Subsystem Allowed)
 - SSP (Subsystem Prohibited)
 - SST (Subsystem Status Test)

The Different Protocol Classes

- ⇒ Protocol Class 0 (Basic Connection-Less Class)
- ⇒ Protocol Class 1 (Sequenced Connection-Less Class)
- ⇒ Protocol Class 2 (Basic Connection-Oriented Class)
- ⇒ Protocol Class 3 (Flow-Control Connection-Oriented Class)
- ⇒ SCCP Connection-Oriented Operation Using SLR and DLR

CP Connection-Oriented Operation Using SLR and DLR

The Transaction Capabilities Application Part (TCAP) and the Mobile Application Part (MAP)