

H.248 / BICC in the Circuit Switched Core Network Trouble Shooting and Protocol Analysis

Course Duration:

- 3 Days

Course Description:

- This course addresses the needs of engineers and technicians who are involved in the operation, optimization and troubleshooting to get familiar with 3GPP Rel. 4 circuit switched networks and above.
- The combination of theoretical protocol knowledge and practical hands-on exercises will provide a thorough understanding for everyone who needs to tune circuit switched 3GPP networks.
- The course starts with an overview of the Mobile Network Architecture Evolution from 3GPP Rel.99 to Rel.4 and beyond with the particular focus on the CS-CN, the new interfaces Nc, Nb and Mc and the reasons for the introduction of split control and user plane entities.
- We will introduce the operation of Soft Switches and the operation of Gateway Control entities and Media Gateways in both ATM and IP transport environments with practical exercises for the students to fully understand the differences and commonalities for these use cases.
- The second part of the course will explain the call setup protocols ISUP and BICC in very detail and will deepen that knowledge with practical analysis of log files and possible error cases using trace tools such as Wireshark.
- At the very heart of the course, we will focus on H.248 / MEGACO protocol and analyze the allocation of contexts, creation, addition and movement of terminations, handling of codec's and studying both message flow and data flow. We will review the RTP / SRTP / RTSP RTCP protocol family and discuss Nb Frame Part as well as the concept of AMR codec's.
- Finally, the students will analyze end to end call scenarios with PSTN originated calls to VoIP terminals and vice versa and experience the requirements for protocol translations in the Media Gateway Controllers and the provision of terminations in a Media Gateway.

Prerequisites:

- The student should possess good knowledge of mobile technologies, such as GSM and / or UMTS and 3GPP Rel.99 architectures and network nodes. Experience in Rel.99 core network administration and optimization is advantageous.

Course Target:

After the course, the student will be able to ...

- Troubleshoot the message flow between Gateway Controllers, Media Gateways and connected network entities.
- Analyze and trace problems in both signaling and media flow in 3GPP Rel.4 based circuit switched networks.
- Control and administrate possible migrations from ATM to IP based transport and related protocol changes in the higher signaling layers.

Some of your Questions that will be answered:

- What are the protocol stacks at the Nb and Nc interfaces and which are the possible optional implementations with 3GPP Rel4?
- What is the detailed Message Structure of ISUP / BICC?
- Where are the differences between ISUP and BICC?
- How does Media Transport work and what are the message header details of RTP / RTCP?
- What is H.248 / MEGACO and how does it work?
- How does a Soft Switch work?
- What are the new and modified network entities and how do they operate?
- What are contexts, terminations and how are they controlled for the provisioning of media resources?

Who should attend this Course:

- The course is particularly useful to Design Engineers and technicians who are involved in the operation, optimization and troubleshooting of circuit switched networks.
- Network operators and technical staff who need understand Soft Switches and their application in 3GPP networks.
- Everybody who requires detailed knowledge about the protocols at the Nb, Nc and Mc interfaces.

Table of Content:

INTRODUCTION AND PROTOCOL OVERVIEW

- **Review of the Protocol Architecture**
 - ⇒ Circuit Switched Core Network Interfaces and Components changes release 4/5 (reason for introduction of Media Gateway / MSC server, their consequences to transport network layer architecture.
 - ⇒ Different possibilities in CN architecture regarding interconnection of MSC server, Media Gateway.

- **Overview of the Protocol stacks in the CS –CN**
 - ⇒ The Nb interfac (ATM based and IP Alternative)
 - ⇒ The Nc Interface (ATM based and IP Alternative)
 - ⇒ The Mc Interface
 - ⇒ The Transport Network Control Plane

- **Considering QoS in IP based Networks**
 - ⇒ QoS Hierarchy and End to End View
 - ⇒ IP related QoS Technologies
 - ⇒ Why MPLS as QoS mechanism?

- **The Future: All-IP based Network Architecture & SIP**
 - ⇒ The IP bearer and SIP / IMS for session setup and control.

- **Practical Workshop:**
 - ⇒ Introduction to the workshop environment.
 - ⇒ Protocol Tracing with Wireshark / Ethereal.
 - ⇒ Configuration of Filters, how to select the required pieces of information.
 - ⇒ Example: Trace Analysis with a simple call setup over IP.
 - ⇒ Identify the architectural differences, mappings and common functionalities in detail.

BICC / ISUP IN THE CIRCUIT SWITCHED CORE NETWORK

- **Overview of ISUP and BICC**
 - ⇒ Functional Overview, Protocol Stack in 3GPP Rel.4
 - ⇒ Discussion of ISUP / BICC use cases
 - ⇒ Which are the important differences?

- **Detailed Review of BICC**

- ⇒ Functional Overview, Protocol Stack in 3GPP Rel.4
- ⇒ BICC Message Header Details
- ⇒ Mandatory Information Elements, fixed and variable length
- ⇒ Optional Information Elements
- ⇒ Review of important BICC Messages – IAM, COT, ACM, ANM, REL, RLC, APM
- ⇒ Overview of Supplementary Services and Additional Functions / Services
- ⇒ Signaling Identifiers used by BICC – Protocol, Network, Connection and Group ID's.
- ⇒ Timer Overview

- **Successful Basic Call Setup Procedure**

- ⇒ call setup, En bloc operation, overlap operation, outgoing and incoming bearer setup cases
- ⇒ Forward / Backward Bearer Establishment
- ⇒ conversation phase, Suspend and Resume, Forward Transfer, codec modifications and negotiations
- ⇒ clear down, release by sender, release by receiver, release by the network

- **Practical Workshop**

- ⇒ Discussion of a BICC log file sample
- ⇒ Completion of a basic call setup message flow by the students.

- **Unsuccessful Call Setup Actions**

- ⇒ Actions at CSF, CN, CMN
- ⇒ Tones and Announcements

- **Review of Abnormal Conditions**

- ⇒ CIC and Group reset procedures
- ⇒ Handling of unreasonable signaling, message format errors, unexpected messages or parameters, BICC error indication, over length messages
- ⇒ BICC Timer Expiries, overview, identification and use of timers

- **Interworking**

- ⇒ BICC Interworking
- ⇒ Interworking with ISUP
- ⇒ Interworking with other signaling systems and user parts
- ⇒ H.248 Functions for Remote Media Control, mandatory functions, optional functions

- **Practical Workshop**

- ⇒ Discussion of detailed scenarios, Forward and backward bearer establishment, bearer control tunneling, Codec negotiation and collision case, per call bearer establishment, bearer release scenario.

HOW TO CONTROL MEDIA GATEWAY RESOURCES

- **Overview of H.248 / MEGACO**

- ⇒ Media Gateway Operation Principles
- ⇒ Contexts and Terminations

- **Details of H.248**

- ⇒ The H.248 / MEGACO Command Set – Status, Configuration and Report commands
- ⇒ H.248 detailed message encoding – ADD, MOVE, MOD, SUB, NOTIFY, AUDIT and SERVICE_CHANGE commands, Descriptors for Media, Modem, Mux, Events, Signals and more.
- ⇒ Analysis of H.248 header, transaction encoding, action request encoding, ADD Request encoding examples.
- ⇒ Package Definitions, Properties, Events, Signals, Statistics, Procedures
- ⇒ Tags for Media Stream properties, MUX, bearer, ATM, IP

- **Practical Workshop:**

- ⇒ Completion of a given message flow scenario by the student, identification of messages and parameters as an exercise.
- ⇒ Description of the scenario, i.e. what is happening?

- **Encoding of H.248 Messages**

- ⇒ ASN.1 Basic Encoding Rules, TLV Encoding, Packet Encoding
- ⇒ Encoding Example H.248 ADD Request

- **Practical Workshop:**

- ⇒ Decode of a H.248 MOD Request Message by the Students

- **Security Considerations**

- ⇒ Protection schemes, protocol and media
- ⇒ Authentication Header scheme

- **Transport over IP**

- ⇒ Application level framing
- ⇒ Timer handling, RTT, provisional responses
- ⇒ Use of TCP and SCTP

- **Practical Workshop:**

- ⇒ Review of logfile captured at the Mc interface
- ⇒ Analysis and completion of a given message flow, allocate context, common codecs, connection points.
- ⇒ Discuss possible of error cases.

- **Review of RTP / SRTP / RTSP / RTCP**

- ⇒ Operation Overview of RTP and RTCP
- ⇒ Review of the RTP Header Format – CSRC, SSRC, Timestamp, Sequence Number, Payload Types
- ⇒ Tasks and Functions of RTCP
- ⇒ Review of RTP and RTCP Log-Files

- **Practical Workshop:**

- ⇒ Review of RTP / RTCP files with Ethereal / Wireshark
- ⇒ Analysis of the content, reproduction of voice samples.
- ⇒ Discuss security and content encryption issues.

SELECTED BICC – H.248 SCENARIOS

- **Mobile Originating Call Establishment**

- ⇒ Review and discussion of the detailed message flow

- **Practical Workshop:**

- ⇒ Analysis of a MEGACO log file for MOC establishment
- ⇒ Identification of MGW parameters by the students

- **Mobile Terminating Call Establishment**

- ⇒ Review and discussion of the detailed message flow

- **Practical Workshop:**

- ⇒ Analysis of a MEGACO log file for MTC establishment
- ⇒ Creation of the detailed flow diagram by the students

- **SRNC Relocation**

- ⇒ Review and discussion of the detailed message flow

- **Practical Workshop:**

- ⇒ Analysis of a MEGACO log file for SRNC Relocation
- ⇒ Generation of ID lists for each network element by the students

- **Subsequent Handover**

- ⇒ Review and discussion of the detailed message flow

- **Practical Workshop:**

- ⇒ Analysis of a MEGACO log file for Subsequent Handover
- ⇒ Summary and identification of all used parameters by the students

- **Inter MSC Handover**

- ⇒ Review and discussion of the detailed message flow

- **Practical Workshop:**

- ⇒ Analysis of a MEGACO log file for Inter MSC Handover
- ⇒ Creation of a detailed flow diagram by the students

ANALYSIS OF BICC – H.248 ERROR – SCENARIOS

- **Unsuccessful MOC establishment**
 - ⇒ Review and discussion of a detailed message flow
- **Practical Workshop:**
 - ⇒ Analysis of a BICC / MEGACO log file for unsuccessful MOC establishment
 - ⇒ Summary of the causes and resulting actions to be identified by the students
- **Discussion of selected customer log files**
- **Others t.b.d.**