

Cutting Edge Technologies 2006 / 2007

Course Duration:

2 Days

Course Description:

- ▶ This course addresses the needs of Account Managers, Consultants, Technical Sales staff, Product- and Project Managers and Technicians who need to get familiar with advanced developments in the field of wireline and wireless communication technologies.
- ▶ The course is an annual update with the focus on business, service and technical perspective of selected new technologies on the radar screen of development or close to implementation.
- ▶ The current version covers technological evolutions in 3GSM networks with the EDGE family and highspeed data channels for upload and download, HSDPA and HSUPA.
- ▶ A further section will provide basic understanding and roadmap for wireless technologies for local and metropolitan areas, WiFi, WiMAX and Flash OFDM.
- ▶ With the previous topics in mind, we will present the future network convergence with the concept and ideas of "Next Generation Networks" (NGN), based on the IP Multimedia Subsystem (IMS). This section will include hardware, software and protocol topics like soft switches (Media Gateways), SIP, SDP, H.248, ENUM or SIGTRAN.
- ▶ The course concludes with a view on a selected mobile application, DVB-H, which could enable a whole set of new broadcast services, enhancing and using the "All IP network" concept .

Pre-Requisites:

- ▶ The student should possess basic technical and business understanding of today's wireline and / or wireless communication technologies.
- ▶ A basic understanding of Mobile Communication technologies, such as GSM and / or UMTS is desirable.

Course Target:

- ▶ The student is enabled to understand the business aspects, services and technical aspects of the new technological developments and how they fit to the communication roadmap.
- ▶ In addition the student will understand the driving forces behind the migration towards an all IP-network and become aware of future technological and business opportunities.
- ▶ The student will be enabled to effectively communicate to content and service providers, customers, decision makers etc. when it comes to the design, application and / or introduction of new technology features and services.

Table of Contents:

Overview

- **Our Playground** / The User Terminal, The Access Network, The Core Network, The Applications & Services Domain
 - **Evolution of the Applications & Services Domain** / Fast Internet Access, Instant Messaging, Triple-Play / Quadruple Play, PoC (Push to talk over Cellular), Wideband Speech Codecs, MBMS (Mobile Broadcast/Multicast Services), DVB-H (Digital Video Broadcast – Handheld)
 - **Evolution of the Core Network Domain** / IMS (IP-Multimedia Subsystem), All IP-based Transport Network, Use of IPv6?
 - **Access Network Improvements** / EDGE (Enhanced Data Rates for GSM Evolution), HSDPA / HSUPA (High Speed Downlink Packet Access / High Speed Uplink Packet Access), OFDM / OFDMA (Orthogonal Frequency Division Multiplexing / Orthogonal Frequency Division Multiple Access), SAIC / DARP (Single Antenna Interference Cancellation / Downlink Advanced Receiver Performance), MIMO (Multiple Input / Multiple Output), AAS (Adaptive Antenna Systems)
 - **New Access Network Technologies** / WLAN / WiFi (Wireless LAN), WIMAX (Worldwide Interoperability for Microwave Access), UMA (Unlicensed Mobile Access)
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Evolution of the Applications & Services Domain

- **Triple Play and Quadruple Play** / Initial Situation, Triple Play, Quadruple Play, Conclusions
- **Overview of Broadcasting Technologies** / Digital Video Broadcast (DVB) Standards, DVB-S, DVB-C, DVB-T, DVB-H, DVB-MHP, DVB System Overview, DVB-Comparison, DVB-Comparison
- **DVB-T/H Architecture Overview** / Service Provider, Broadcast Network Operator, User Station, Mobile Operator, Cooperation Platform
- **What are the specific DVB-H PHY Layer Features?**
- **What are the specific DVB-H Link Layer Features?** / DVB-T/H Transmission, Source Multiplexer, DVB-T Modulator, DVB-H Time Slicing, DVB-H Handover, MPEG-2 Multi Program Transport Streams, MPEG-2 TS Frame Format, MPEG-2 TS Frame Coding at DVB-T Transmitter, MPEG-2 Transport Frame, Reed Solomon FEC, Interleaving, TPS Frame
- **IP Datacast (IPDC) over DVB-H**
- **DVB-H Business Scenarios – Cooperation and mixed Models** / Mobile Operator with broadcaster cooperation, Broadcaster led approach, Independent DVB-H Service Provider

- **DVB Business Scenario – Mobile Operator led**
 - **DVB-H Competition, Benefits and Open Issues**
 - **Outlook, Ongoing Activities**
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Evolution of the Core Network Domain

- **The IP-Multimedia Subsystem (IMS)** / What is the IMS?, Involved Standards Organizations, High Level View at the IMS and its Environment, Mobility Issues, Relationship to other Networks, User Terminals
 - **Example: The 3GPP-Version of the IMS** / Introduction, Architectural Overview (Network Perspective), And what is inside the IMS?, Detailed View on the IMS, SIP-Servers, Special SIP-Servers, Protocols of the IMS, The Perspective of the Mobile Station
 - **The Session Initiation Protocol (SIP)** / Scope of SIP, Philosophy of SIP-Operation
 - **Simple Example of a SIP-Scenario: VoIP Call Setup with SIP** / Overview, Summary: Some SIP-Terminology, Request: INVITE-Message, Response: 100 (Trying), Response: 180 (Ringing), Response: 200 (OK), Request: ACK, Request: BYE, Response: 200 (OK), The Related Session Description Protocol (SDP) Contents, Structure of SDP-Parameters within a SIP-Message
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Access Network Improvements

- **EDGE (Enhanced Data rates for Gsm Evolution)** / EGPRS, ECSD, Compact EDGE, UWC-136, Improvements of EGPRS vs. GPRS, 8-PSK Modulation, 3/8 Offset 8-PSK
- **Consequences of Using 8-PSK Modulation** / Higher Throughput Rate over the Air, Interference Vulnerability, Incremental Redundancy, Data Throughput Rates and Code Rates with EGPRS
- **HSDPA (High Speed Downlink Packet Access)** / Targets
- **HSDPA Characteristics** / Modulation Types, Higher Throughput Rates, AMC (Adaptive Modulation and Coding), Hybrid ARQ, Transmission and Retransmission Scheduling in NodeB, QPSK versus 16-QAM Modulation, Hybrid ARQ Techniques
- **New Channels with HSDPA** / Physical Channels, Transport Channel, HS-DSCH Channelization Code Tree, Multicode Operation in HSDPA
- **HSDPA Basic Operation** / MAC-hs, New Channels, UE Scheduling
- **HSDPA Packet Switched Protocol Stack** / HSDPA Control Plane, HSDPA User Plane with MAC-c/sh
- **HSDPA and DPCH Operation – HSDPA Setup** / HSDPA Setup via DPCH, HSDPA Transmission and Retransmission, Physical Channel Combinations supported with HSDPA on the same FDD Frequency

- **HSDPA Timing Relations** / Timing between HS-SCCH and HS-PDSCH
- **HSUPA (High Speed Uplink Packet Access)** / Important Changes with HSUPA, New Channels with HSUPA, Achievable Data Rates in HSUPA – UE Categories
- **OFDM (Orthogonal Frequency Division Multiplexing)** / What is OFDM?, History and Use of OFDM, Summary: OFDM..., What is the Meaning of “Orthogonality”?, Mathematically ..., When are two Sine Waves Orthogonal?, Which Frequencies are Orthogonal?, The Impact of Orthogonality in the Frequency Domain, Step 1: View into the Frequency Domain for unmodulated Sine Waves, Conclusions...
- **Implementing OFDM** / Characterizing Parameters of OFDM-Systems, Parameters of some Example Technical Implementations, DAB (Digital Audio Broadcasting), DVB-T (Digital Video Broadcasting – Terrestrial), IEEE 802.11a/g
- **FDD and TDD in OFDM** / Option 1: View of an FDD-implementation, Option 2: View of a TDD-Implementation
- **Subchannelization** / System without Subchannelization, Introduction to Subchannelization, Static or Variable Number of Subchannels, Implementation
- **And what is OFDMA?** / Summary: OFDMA ...
- **MIMO and SAIC** / The Basics: Signal Fading Physics between Tx and Rx, Multiplexing Dimensions, Equalization – Distinction of Tx1 and Tx2, Characteristics of SAIC, Application in MIMO-Systems
- **Conclusions & Future Outlook**

New Access Network Technologies

- **WLAN Overview**
- **WLAN Architecture** / How does a Station join a WLAN?, WLAN Channel Access Principles
- **WIMAX** / Overview of the Protocol Stack, Main Features of the MAC-Layer
- **Network Operation and Registration in IEEE 802.16** / Frequency Scan and PHY-Synchronization, Listen to Broadcast Messages, Initial Ranging, Negotiate Basic Capabilities, SS-Authentication, Authorization and Key Exchange, Registration, Obtain IP-Address, Obtain "Time of Day", Receive additional SS-configuration data, Establish pre-provisioned connections
- **WIMAX** / Support for Mobility Features, Handover, Sleep Mode, Idle Mode
- **WIMAX** / Main Features of the Physical Layer
- **UMA (Unlicensed Mobile Access)** / Ideas and Targets, UMAN Architecture, UMAN Operation, UMAN-Registration
- **UMAN Protocol Stacks** / Circuit-Switched Domain / Control Plane, Circuit-Switched Domain / User Plane, Packet-Switched Domain / Control Plane, Packet-Switched Domain / Control Plane, Packet-Switched Domain / User Plane, Mobile Station Operation Modes
- **Future Outlook & Conclusions**