Hands-On

Multi-Service Access and Next Generation Voice Service

Course Description

The next generation of telecommunications networks is being deployed using VoIP technology and soft switching replacing circuit switching and ISDN signaling. By deploying communications as multimedia streams over IP it is possible to extend the services from simple voice to improved voice quality, better bandwidth utilization and expanded services into video and television carried over the same technology. Already cost effective VoIP services have been deployed using H.248, MGCP and SIP over Intranet infrastructures. However to integrate this with existing ISDN and SS7 architectures and eventually to replace local exchanges and transit exchanges in carrier networks requires large scale signaling and switching changes.

The next generation of telecommunications networks is likely to use IP and for efficient and high-speed quality of service switching deploy MPLS to select routes. Across the access interface IEEE 802.1Q will be deployed to deliver VLAN services and Q-in-Q implementation allowing customer and carrier VLANs to be supported. It is also possible that migration eventually to IPv6 will eventually occur.

To build soft switches and distribute the switching function over a carrier level infrastructure, gateways will be controlled using H.248, Media Gateway Control Protocol (MGCP) or SIP. Eventually SIP will evolve to take over as the primary signaling protocols in Next Generation Networks

Students Will Learn

- **Identify The Market Of Next Generation Services**
- **Describe How Xdsl Functions Today**
- **Migrate Access To Multi-Service And VLAN Operation With Gigabit Ethernet**
- **Describe How MPLS Functions Today**
- **Analyze The Relationship Between MPLS, IP And Vlans**
- **Identify How 802.1Q Can Be Deployed For Carrier And Customer VLAN Support**
- **Discuss How Qos Can Be Delivered Over Access, Aggregation And Core Networks**
- **Discuss The Mechanisms Used To Carry Voice Over IP And How IP May Evolve To Multimedia And TV**
- **Compare SIP, H.248 And Media Gateway Control Protocol To Build Soft Switches**
- **Analyze Protocol Exchanges**
- **And Much More**

Prerequisites

A basic knowledge of IP will be assumed.

Course Outline

Module I: Introduction To Next Generation Architecture

Where is the market for Next Generation?

Next Generation Services

Triple Play Networks

Current generation switching

Next generation IP Infrastructure

Switch Control protocols and interfaces

- Switching Control: General Switch Management
- Switching Function: MPLS and CES
- Gateway Control : MGCP/SIP/H.248

Hands-on Demonstration of Multi-services in operation deploying VoIP and IPTV

Module II: Access Fundamentals

Asymmetric digital subscriber line (ADSL)

Modes of operation

Loop requirements of ADSL

Specific requirements for an ADSL system operating in the frequency band above POTS

Dynamic Rate adaptation

ADSL2 G922.3 functional model

Transport Protocol Specific Convergence Functions

ADSL 2+ G.992.5

Frequency band differences

Initialization

Overlapping spectrum operation

PPPoE/PPPoA Advantages and disadvantages

PPPoA operation recap

- RFC1483
- SNAP
- OUI
- Selecting bridging and routing protocols
- VC selection by protocol

PPPoE Architecture

- RFC2364/2516
- Aggregation and links to service provision
- Linking to Service Providers
  - L2TP and other service provision
- Maximum receiver unit considerations
- Security Considerations

Module III: Gigabit Ethernet and VLANs

Evolution of Ethernet

- CSMA/CD and its replacement by Switching

Layer 1 presentations

Concept of a LAN and a VLAN

Bridging: 802.1d

Spanning Tree and Rapid Spanning Tree

VLAN Trunking with 801.1Q

Deploying Q-in-Q

Selection of VLAN Identifiers

Aggregation of Gigabit Ethernet Links

Hands-on Deploying Aggregated Ethernet to deliver reliable services

Module IX: Precedence and Quality of Service

Mechanisms for QoS

Layer 3:

- RSVP
- DiffServ

Layer 2: 802.1P

- Bits in shim header

Delivering QoS

Hands-on Demonstration of QoS

Module V: MPLS Fundamentals

Routing options: How do I get from here to there

What MPLS Offers

MPLS Plain Vanilla

- Components: LER, LSR, FEC, LDP, LSP, Labels

Label Distribution and Selection Concepts

- Explicit Routed LSP
- Constraint Based LSP
- RSVP interoperation

Label Distribution Methods

- Downstream Mode
- On Demand
- Independent Mode
- Label Retention Considerations
- Constraints and Label Bumping
- Extensions to RSVP

Extending MPLS for Quality of Service

Constraint based LSP

Link attributes and constraints

Experimental bits in shim header

Delivering QoS

Pseudo Wire Emulation of E1 and Primary rate ISDN TDM Services

Module VI: Evolution of IP

Internet Growth

Routing Problems

Classless and Classful Addressing

Multicasting

IGMP

PIM

Hands-on Demonstration of Multicasting IPTV

IPv4 Features

Packet Delivery Services

Plug and Play Concepts

Auto configuration

Neighbor Discovery

Module VII: Carrying Multimedia Conferences over IP

Voice over IP Concepts

Control Plane

Information Plane

Signalling functions

IP/TCP/UDP

RTP

CODECs and Encoding Media

RTCP

Example SIP connection

Session Description Protocol

- Defining media streams

Architecture of a Soft Switch

Hands-on Exercise Analyzing VoIP calls

Module VIII: VoIP using IETF Architecture SIP

Why has SIP become important?

SIP Components

- Register Function
- Command and 3 digit responses
- SIP Addressing
- Connection signaling
- Invite, Cancel and Bye
- Capabilities exchange

SIP Message Format

Comparing SIP and H.323

Hands On Session Voice Over IP Working using SIP

- Set up and use VoIP applications on each PC to place calls across the classroom
- Experience Different IP environments and observe VoIP performance issues
- Observe Network Performance Using Netmeter

Module IX:Delivering Voice Services

Motivation: Why use VOIP

Comparison between current voice and data networks

One Integrated Network

Sharing resources

Migration

Where VOIP can be deployed

Integration at the PBX

Integration at the PC

Integration at the desk with IP phones

Which IP Network

Internet Telephony

VOIP over an Intranet

Internet Telephony Service Providers

Hands-on SIP Proxy Controlled Services

Module X: Session Description Protocol

Evolution of SDP

SDP Syntax

- Using SDP to negotiate media channels

- Identifying media streams

- Constructing ephemeral connections

- Carrying DTMF signals

- CODECs and Media streams

Hands-on Observing SDP exchanges in calls

Module XII: Evolution of SIP to SIP-T

Limitations of basic SIP

- Impact of signaling packet loss

- Alternative operation to remove limitations

- Positive acknowledgements

- Carriage over TCP

- Carriage over SCTP

Example operation of SIP-T exchanges

- SIP-T Implementation Agreements

Module XIII:MGCP, Megaco and H.248

Evolution of Megaco from MGCP

Megaco Components

- Contexts and Terminations

- Properties and Packages

- Constructing a call over and NGN

- Using ephemeral connections

- Megaco call exchanges between residential gateways

- Megaco controlled call between a SIP phone and residential gateway

Hands-on Examining a MEGACO Captures

Module XIV: SIP-I for Carrier Operation

What is SIP-I?

- Signaling boundary functions

-Bearer Independent Call Control Protocol (BICC)

- ISDN User Part (ISUP)

- Carriage of BICC and ISUP functions over SIP

- Q.1912.5

ETSI TS 186 002-2 Test Suite Structure

Mapping SIP-I to SS7 ISUP functions

- Inter-working examples for Supplementary Services

Summary and Review

Delivery Method

Instructor led with numerous Hands-On labs and exercises.

Equipment Requirements

(This apply's to our hands-on courses only)

BTS always provides equipment to have a very successful Hands-On course. BTS also encourages all attendees to bring their own equipment to the course. This will provide attendees the opportunity to incorporate their own gear into the labs and gain valuable training using their specific equipment.

Course Length

4 Days