Hands-On

Evolving Telecommunications to Triple Play:

IPTV, VoIP, 3D TV and Delivery Systems for System Engineers

Course Description

With the introduction of Next Generation Networks to telecommunications carrier infrastructures, customers expect a full range of Triple Play services. These include High-Speed Internet Access, Voice Telephony and Television delivered over the same network interface. These customers may be domestic where service is delivered directly into homes, business where increasing richness of multimedia content allows businesses to communicate more effectively or in military where remote stand-off control or information gathering becomes feasible.

Ideally high bandwidth fiber optic communication would be used for new richer services. However existing infrastructures often contain copper loops and for economic reasons these must be used to deploy these services. Careful design of services that work within these more restricted bandwidths is therefore important. This is one of several key challenges to delivering IPTV. It will be necessary to deliver TV quality that can match existing over-the-air and cable delivery. It will also be necessary to ensure that all services can be delivered together and will not significantly affect the performance of other services. Also that voice services can be interfaced to existing telephone networks so that they will integrate into the standard telecommunications infrastructure used around the world.

This course will provide an understanding of the technologies being used to deliver a range of services including voice, point to point video, broadcast/multicast TV, HDTV and even 3D communications. It will provide a technical understanding of the different RF, wired and cable standards used for distributions and delivery. I will further provide hands-on exercises which will demonstrate how voice, multicast IPTV, Video on Demand and Web Television can be delivered over a common IP infrastructure.

The course will used standard Windows PC or Laptop computers running Windows XP or Windows 7 attached to an in class LAN and emulated WAN infrastructure isolated from live infrastructures allowing the exercises of all services without firewall and security restrictions. The course exercises will use free and open source software allowing attendees to build systems which can be transferred to home, or business systems with little or no operational cost allowing further learning and experiment.

Students Will Learn

- **Describe the basics of voice, video and Television transmission over IP**
- **Configure the basic protocol mechanisms for multicast and unicast delivery**
- **Differentiate between technologies such as streaming, download and play, and file transfer**
- **Configure VoIP to allow communication between softphones and regular standard analog phones**
- **Analyze the key protocols used for delivering services**
- **Select appropriate VoIP signalling protocols**
- **Appreciate the Quality of service issues for acceptable delivery quality**
- **Implement a Triple Play solution including 3D TV in the classroom**

- **Compare DSL, CATV HFC, Fiber Optic and twisted pair access solutions**
- **And more...**

Target Audience

This course is intended for engineers, service designers, developers, managers and systems engineers involved in the supply, integration or development of Multimedia, voice or video systems and services. Also network professionals who are responsible for designing and deploying infrastructures to deliver systems or interconnect them to the Internet. Security professionals, who are concerned about the weaknesses of VoIP/IPTV environments, and need to appreciate their security implications. Members and leaders of support teams who will be responsible for supporting operational VoIP/IPTV services.

Prerequisites

Knowledge of basic telecommunications and using a computer running Microsoft Windows 7 or XP will be assumed.

Course Outline

Day 1

1. Evolving Telecommunications to

Architecture and Components

Evolution of Telecommunications

Circuit Switched voice

Packet Switching Data

Motivation: Why use VOIP

Comparison between current voice and data networks

One Integrated Network

Sharing resources

Migration

Carrying Voice over IP

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

The Business Case

Cost per minute savings

Improved Call Center Integration

e-Commerce with Voice Enabled Websites

Hands-on Exercise: Here is Voice Over IP Working

1. Set up a VoIP soft phone application and place calls across the classroom
2. Use a Protocol analyzer on each PC and capture VoIP traffic
3. Experience Different IP environments and observe VoIP performance issues

2. VoIP Architectures

Source of VoIP standards

- ITU H.323 and IETF SIP

Multimedia conference over packet network

- What counts as Multimedia
- Voice, audio and Video
- Conference
- Sources and mixes

How a normal phone call gets connected

- Call Map
- Conversion to digital

- Dialing and Signaling
- Alerting and Call Progress Tones

SIP Components

- Addressing and Connection signaling
- Capabilities exchange
- SIP Message Format

Connecting SIP Calls

- INVITE and its responses
- Making the SIP phone ring
- Answering SIP calls
- Defining the media streams

Session Description protocol

- Negotiating CODECs

Hands-on Exercise: Setting Up SIP Services

1. Setup a SIP Proxy controlled VoIP service
2. Configure a SIP application
3. Configuring Analog Telephone Adaptors or IP Phones

Day 2

3. Building and Testing VoIP Services

VoIP PBX

SIP Registrar

Location Services

Purpose of Proxy

Network Address Translation and its problems

Managing service Features

SIP Trunking

Hands-on Exercise : Setting up SIP PBX

1. Configuring asterisk within a Virtual Machine
2. Configuring Extensions and Voice Mail
3. Conferences

4. How IPTV Changes the Business of Telecommunications

Internet Protocol based Television

Adding TV to Telecommunications Services

Combines Access

Triple Play

Hands-on Exercise: Receiving IPTV on a PC

1. Install and configure IPTV application
2. Configuring and Application to Stream TV
3. Configuring applications to receive TV

5. IPTV System Model

Set-top Box Architecture

Multimedia Home Platform

Receiver Networks

Streamer Platforms

VoD platforms

Professional TV Head-ends

Content Security

IPTV Standardization

Hands-on Exercise: Configuring VoD Delivery

1. Install and VoD Server using RTSP
2. Request RTSP Streams
3. Configure WebTV VoD service

Day 3

6. Technology of Internet Protocol Networks

Internet Protocol Suite

Multimedia over IP

Streaming Video Protocols

Encapsulation of Media over IP

Multicasting and Unicasting

Adding Multicast to a routed IP infrastructure

Channel Change Delay

Hands-on Exercise: Analysing and Monitoring IPTV stream Quality

1. Use WireShark to monitor IPTV protocols
2. Analyse throughput in real time
3. Reconstruct TV streams from captured traffic

7. IPTV Technology

Analog Signals

Going from Analog to Digital Signaling

Compression Formats

Video Streaming using MPEG Compression Standards

Encoders

Pro-MPEG

Provisioning and Configuration

Hands-on Exercise: Encoding and Transcoding Video

1. Configure live streaming from a Web Camera
2. Configure different encoding methods
3. Transcode a stream

8. IPTV Copy Protection and Digital Rights Management

Need for Security

Encryption

Access Control

Authentication

DRM Systems

Protecting both Digital and Analog Content

Hands-on Exercise: Experimenting with System failures

1. Play encrypted content
2. Verify security

Day 4

9. IPTV Troubleshooting Techniques

Typical IPTV faults symptoms

Blocking

Low Signals

Freeze Frames

Drop Zones

Disconnects

Test Equipment

Network System Check

Fault Locate and Isolate

Hands-on Exercise: Testing IPTV

1. Experiment running stream through an Internet Simulator
2. Observe effects of delay variation and packet loss
3. Reconstruct TV streams from captured traffic

10. Radio Frequency Distribution Principles

Radio Transmission Principles

Propagation over cables

Propagation through space

Propagation through air and atmosphere

Frequency, Wave Length, Phase and polarization

Signal Power and Free Space Loss

Effective Radiated Power (ERP)

Polarization, Absorption, Diffraction, Reflection, Signal to Noise Ratio

Interference effects and Fading

Modulation: Amplitude, Frequency and Phase Modulation

QAM

Multi-Access Systems: FDM, TDM, TDMA, FHSS, DSSS, OFDM, CDMA

Frequency use in cell based systems

Area Coverage Terrestrial Delivery

Antenna Systems

Hands-on Exercise: Monitoring WiFi services

11. Delivery over RF on Cable Systems

Evolution of Community Antenna Systems

How CATV/over the air industry is migrating their system to the digital age

Real Time

Typical Hybrid Fiber Coax (HFC) Networks

Digital Cable DOCSIS standards for delivering IP

DOCSIS 3.0

Architecture of modern Cable TV system

Upstream and Downstream Frequency Division

Channel Bonding

Data Forwarding

Dynamic Bonding and Load Balancing

Day 5

12. Fiber Optic Systems

Principles of Fiber Optic Transmission

Operational System Parameters

Capacity Considerations

Fiber Optics Design Principles

Optical Modulation

Fiber Types: Multimode, Single-mode

Cable Types: Breakout Cables, Ribbon Cables, Armoured Cables

Cable Installation Methods: Ducting, Pulling, Blown Fiber, Ploughed Cables

Video Demonstration of Fiber Cable Installation

Access Solutions: PON, FTTB, FTTC, FTTH

13. 3D TV

Stereoscopic Vision and Human 3D Perception for Video

Visual perception

Stereoscopic 3D viewing

Video and TV

2D Camera Systems

3DTV transport.

Multiview Video Encoding

H.264 Annex H

Anaglyphic 3D using passive red-cyan glasses

Polarization 3D using passive polarized glasses

Alternate-frame sequencing using active shutter glasses/headgear

Autostereoscopic displays without special viewing glasses

HD 3D TV, Stereoscopic principles

Display systems

Hands-on Exercise: 3D Video

1. Use standard PC monitors to observe anaglyptic 3D Video
2. 3D Video using shuttered glasses
3. Construct a 3D Video

Evaluation 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

5 Days