

Course Code – VOI12001

Introduction to Voice over IP

The course focuses on theoretical principles of Real-Time Media over Internet Protocol. Although the course is intended to be 'generic', examples of VoIP networks are highlighted utilising Cisco's Callmanager platform and associated Networking devices.

Prerequisites

None, although some prior exposure to IP, Data Networking or Telecommunications would be advantageous.

Aim:

To provide delegates with a fundamental understanding of how voice and multimedia is delivered using packet switched IP networks, and to highlight the measures taken to make it possible.

Objectives:

By the end of the course delegates will be able to:

- Understand how VoIP protocols have been integrated with existing TCP/IP Core Protocols.
- Be able to explain the reasons for the development of VoIP.
- Describe the potential benefits of VoIP.
- Understand voice quality issues such as latency and jitter when associated with VoIP.
- State the function of the real time protocols RTP and RTCP.
- Understand the differences between H.323 and SIP when used for the setting up, teardown and signalling for VoIP calls.
- Understand Quality of Service (QoS) and what it means, particularly in relation to Voice and multimedia over IP.
- Appreciate how IP Multicasting plays a part in the Real-Time media delivery.

Course Profile:

Introduction to Voice over IP

- How does it work?
- Encapsulation
- VoIP Protocols
- VoIP Service Providers
- VoIP Networks
- Why VoIP
- What does VoIP have to offer?
- Internet Telephony Product Classes
- VoIP Regulatory Bodies

Voice Encoding Schemes

- Waveform Encoding
- Recording and Playback
- PAM – Pulse Amplitude Modulation

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- Quantization
- Vocoders
- MOS – Mean Opinion Score
- Voice Quality Measurement
- Voice Quality Issues
 - Latency
 - Delay Budget
 - Codec Latency
 - Serialisation Latency
 - Network Latency
- Jitter
- Silence Suppression
- Packet Loss
- Echo Problems in VoIP
 - Acoustic Echo
 - Hybrid Echo
 - Echo Suppression
 - Echo Cancellation

Protocols Network and Transport Layer

- OSI – 7 Layer Network Model
- TCP/IP Suite
- Internet Protocol
- Transmission Control Protocol
 - Ports and Sockets
- User Datagram Protocol

Routing Protocols

- The Routing Process
 - Advertising Networkss
 - Discovering Routes
 - Interior Gateway Routing Protocols
 - Exterior Gateway Routing Protocols
 - Autonomous Systems
 - Distance Vector Routing Protocols - RIP
 - Hybrid Routing Protocols - EIGRP
 - Link State Routing Protocols – OSPF

Real Time Protocols

- ITU-T H.323 Protocol Stack
- RTP
- Encapsulation Overhead
 - Header Compression
 - Multi Payload
- RTP Translators
- Audio Conferencing (Mixers)
- RTCP
 - RTCP Bandwidth Control

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- RTCP Sender Report
- RTCP Receiver Report
- RTCP Session Description
- RTCP Bye Packets

H.323 and Network Elements

- H.323 Protocol Stack
- H.323 Elements
- H.323 Gateway
- H.323 Gatekeeper
- H.323 MCU
- MGCP – Media Gateway Control Protocol
- Multipoint Conferencing
- Call Signalling (Setup, Media Channels, Teardown)
- Standard Call Model
- FastStart

SIP – Session Initiation Protocol

- SIP Protocol Stack
- SIP Topology
- SIP Operation
- SIP URL
- SIP Signalling Messages
- SDP – Session Description Protocol
- SIP Header Formats
- SIP Servers
 - SIP Registrar
 - SIP Proxy
 - SIP Redirect

Cisco VoIP Example

- Cisco IP Telephony Components
- Cisco CallManager
- SRST – Survivable Remote Site Telephony
- Simple Cisco VoIP Network

QoS – Quality of Service

- Congestion Control
- Quality of Service Models
 - Best Effort
 - Integrated Services
 - RSVP
 - Differentiated Services
- Congestion Management
 - FiFo
 - Priority Queuing
 - Custom Queuing
 - Weighted Fair Queuing

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- Low Latency Queuing
- MPLS – Multi Protocol Labelled Switching

Multicasting

- Multicast Enabled Components
- Review of Address Types
- Multicast Applications
- Mbone
- Distribution Protocols
- Broadcast vs Multicast
- Multicast Hardware Addressing
- Multicast IP Addressing
- Multicast Mapping
- IGMPv1
- IGMPv2
- IGMP Snooping
- CGMP – Cisco Group Management Protocol
- Multicast Forwarding Algorithms
- Flooding
- Reverse Path Broadcast
- Reverse Path Multicast
- Truncated Reverse Path Multicast
- PIM – Protocol Independent Multicast
 - PIM Dense Mode
 - PIM Sparse Mode
 - Rendezvous Points