

Networking 4 VVoIP – Mitel ‘Style’

Course Objectives

This course will give students a good understanding of LANs, WANs and VVoIP (Voice and Video over IP) as well as show them how some of these elements work in a Mitel environment.

It is aimed at those who want to move into the world of VVoIP and require a solid foundation before attending Mitel’s (as well as any other manufacturers or service providers) own systems courses. It can be taken as a standalone course and also used as a foundation for The SIP School’s SSCA® SIP training program.

Being a modular training course, students can work through all modules or simply choose the module they really need.

‘Timings’ are shown in this document below though these can vary greatly depending on the existing skill levels of each student and should be treated as a ‘rough guide’. The ‘average’ time to complete the course is (approx.) **13hrs**.

You will notice each module (when running) shows a ‘module length’ timer. This is a shorter time as shown in this document as the ‘timer’ does not include student’s lab and quiz work.

Most modules have their own ‘mini’ quiz at the end to help students ‘gauge’ how well they are doing

Mitel ‘hosts’ a *version* of the official test for this program on their own Mitel Learning Management system and that is where the test should be taken by students who use the web site <http://mitel.thesipschool.com>. If you require the official SSVVP™ accreditation test then this is available separately from www.thesipschool.com

- NOTE: Topics in **Blue** are new additions/updates from January 2020

The Modules are detailed on the following pages:

What is VVoIP?

This is an introduction module that sets out the scope of the course and introduces the concepts of LANs and WANs.

- *Running time = 3m 20s*
- **Total = 3m 20s**

Networking Components

This module is designed to introduce you to Data networks and how devices connect to them. It does this by describing the most commonly used topologies and cabling types in use today.

- Topologies
- What is a Protocol?
- UTP and STP Cables
- RJ-45 Connectors
- UTP Implementations
- [Power over Ethernet, POE Plus and 4PPOE](#)
- Fiber Optics

- *Running time = 10m 28s*
- *Quizzes = 3m (average)*
- **Total = 13m 28s**

Ethernet

Ethernet is the predominant force in networking today and this module introduces all of the concepts needed to understand this specification along with introducing basic network components like LAN cards and LAN switches.

- Ethernet and 802.3
- Ethernet 'Types'
- NIC Cards
- Hubs and Ethernet
- Collisions and CSMA/CD
- Repeaters
- Bridges
- LAN switches
- Routers
- Bandwidth

- *Running time = 8m 50s*
- *Quizzes = 3m (average)*
- **Total = 11m 50s**

The OSI Model

The OSI Model was designed to break networking components and software into 'bite-size' interoperable chunks. This module explains the 7 layers of the OSI model and compares them to the real-world implementation of the TCP/IP layered model.

- The Reasons for OSI
- The 7 Layers
- Role of the 'Application' layers
- Role of the 'Data' layers
- OSI v TCP/IP
- Physical Layer functions
- Datalink Layer functions and MAC addresses
- IEEE 802.2/3 Frame format
- Switches and the Datalink layer
- Network Layer Functions
- IPv6 introduction
- Transport Layer Functions
- Encapsulation / De-encapsulation
 - *Running time = 14m 50s*
 - *Quizzes = 3m (average)*
 - ***Total = 17m 50s***

TCP/IP Networks

This module explains how TCP/IP networks work by describing the functionality of each TCP/IP layer. By understanding these layers you will understand how a TCP/IP network works which will give you a good understanding of how voice can be carried across an IP network.

- TCP/IP Protocol Stack
- Application Layer overview
- Transport Layer overview
- Ports and Sockets
- TCP/IP Internet Layer – Overview
- Address Resolution Protocol – ARP
- IP Datagrams
- ICMP
- Multipath TCP (MPTCP)
- Stream Control Transmission Protocol - SCTP
 - *Running time = 13m 27s*
 - *Quizzes = 3m (average)*
 - ***Total = 16m 27s***

WANS

Wide Area Networks connect buildings, homes and people together. This module aims to explain what a WAN is and how they work along with explaining some WAN protocols such as PPP, ADSL, Frame Relay and the newly popular - MPLS

- What is a WAN?
- DTE/DCE and DSU/CSU
- Synchronous communications
- The Point to Point Protocol – PPP
- DSL
- ‘Local Loop’ unbundling
- ADSL @ Home
- ADSL Channels and Contention ratios
- ADSL Developments
- [VDSL2](#)
- [Fiber options](#)
- Finding an ISP
- Frame Relay
- EPS9/EPS8
- LAN Extension Services
- EFM, Ethernet, GEA
- Cable networks
- WAN Physical Layer implementations
- MPLS and its Benefits
- Metro Ethernet
- Virtual Private LAN service (VPLS)
- WAN Optimization, Hybrids and SD-WAN
- Virtual Private Networks (VPNs)
- VPNs for Business
- [Get your own VPN](#)
 - *Running time = 33m 20s*
 - *Quizzes = 3m (average)*
 - **Total = 36m 20s**

TCP/IP Addresses

IP Addresses, Subnet Masks, Default Gateways. It's all here and delivered to you in a way so that you will understand what these numbers are for and how they work with each other.

- Analogies
- Binary and Hexadecimal
- The IP address
- IP Address Classes – A, B, C and more!
- Special IP addresses
 - 127.0.0.0 the 'loopback'
 - APIPA and the 169 network
- TCP/IP addressing quizzes
- The Subnet mask
- IP Address and Subnet mask 'in combination'
- Sample IP networks
- Addressing without subnets
- Why subnet at all?
- How many Subnets do you need?
- Easy Subnetting
 - *Running time = 25m 3s*
 - *Quizzes (inc. exercises) = 120m (average)*
 - **Total = 145m 3s**

DHCP

This Module introduces the Dynamic Configuration protocol (DHCP) and describes what it is, how it works and how it works in a multi-network environment along with introducing some troubleshooting commands.

- Overview of DHCP
- Static or Dynamic addressing
- DHCP Discovery
- DHCP Offers
- Lease and Renewal Times
- Multiple DHCP Servers
- Relay Agents
- DHCP 'Extra' Options
- IPConfig utility
- Home setup 'example'
 - *Running time = 10m 41s*
 - *Quizzes = 3m (average)*
 - *Lab Exercises = 8m (average)*
 - **Total = 21m 41s**

Troubleshooting IP Networks

Follow the tips in this module and you will be able to solve the majority of problems you will encounter on a Network.

- Troubleshooting Rules
 - Layer 8
 - Are you connected?
 - Ping utility
 - Loopback address
 - IPConfig utility
 - APIPA addresses (revisited)
 - Ping Tests
 - Troubleshooting exercises
 - [More PING tools](#)
 - [Net Shell – netsh>](#)
 - [PowerShell](#)
- *Running time = 18m 20s*
 - *Quizzes = 3m (average)*
 - *Lab Exercises = 10m (average)*
 - ***Total = 31m 20s***

An Introduction to Wireshark

This module teaches you how to use Wireshark to analyse traffic on the network in order to help troubleshoot even the more difficult of problems.

- Where? and What? to Monitor
 - Wireshark basic screen layout
 - Capturing (and Saving) Traffic
 - Analysing Frames
 - PCAP format explained
 - DNS Analysis
 - Colouring Rules
 - DHCP Analysis
 - [Your turn to Analyse](#)
 - [LANs, WANs and Wi-Fi advice](#)
- *Running time = 16m 56s*
 - *Lab Exercises = 60m (average)*
 - ***Total = 76m 56s***

SNMP

The Simple Network Monitoring Protocol is a valuable protocol that enables Network Operation centres to keep an eye on valuable systems and services across a network. This module is an introduction to this important protocol

- SNMP Components
- Managers and Agents
- The Management Information Base – MIB
- The SNMP Name tree
- SNMP Get Request
- Other SNMP Commands
- [Configuring SNMP in Windows](#)
- Testing SNMP
 - *Running time = 5m 47s*
 - *Quizzes = 3m (average)*
 - *Lab Exercises = 10m (average)*
 - **Total = 18m 47s**

Switches and VLANS

This module explains the fundamental operation of a LAN switch along with the important concepts of Virtual LANs (VLANs).

- Switch Functions
- LAN Switch Structure
- Address learning
- Filtering and Forwarding Frames
- Broadcast Frames
- Redundant Topologies
- Broadcast Storms and Loops
- Multiple Frame Copies
- MAC table instability
- The Spanning Tree Protocol
- How STP works
- VLANS
- 802.1Q/P Tagging
- Connecting VLANs
- Router Sub-interfaces
- Per-VLAN Spanning tree (PVST+)
- Rapid Spanning Tree - 802.1w
- Multiple Spanning Tree (MST)
- Layer 3 Switches

- *Running time = 15m 04s*
- *Quizzes = 3m (average)*
- ***Total = 18m 04s***

Routing

Routers are used on the edge of networks to pass data onto a WAN and within Layer 3 LAN switches. This module describes how routers work along with a brief explanation of Routing protocols.

- What is Routing?
- Routers
- Port guides
- Static and Dynamic routes
- Default Routes
- Routing Decisions
- Distance Vector Routing Protocols
- RIP and Routing Table updates
- Interior Gateway Protocol – IGRP
- Other Routing Protocols
- Testing Routes with TraceRT (Trace Route)
- Alternative Trace tools
- Internet traffic report
- Software Defined Networking (SDN), OpenFlow
- Software Defined WAN (SD-WAN)
- [Open Networking Foundation \(ONF\)](#)
 - *Running time = 17m 14s*
 - *Quizzes = 10m (average)*
 - ***Total = 27m 14s***

Wireless Networks

Wireless is one of the fastest moving areas in the world of networking. This module explains the basics of Wireless networking along with information on securing your wireless network.

- Wireless Networks
- Wireless Bridging
- Wi-Fi and Specifications
- [Wi-Fi 6](#)
- [Wi-Fi Analysers](#)
- WiMAX
- VoWi-Fi

- Wireless Security
- Bluetooth
- Cellular networks
- Cellular speeds from 2G to 5G
- Vo-LTE
- Satellite networks
- Wi-Fi and the Internet of Things
 - *Running time = 24m 50s*
 - *Quizzes = 3m (average)*
 - ***Total = 27m 50s***

IP Applications (and Services)

So many other services can be found on a network and some, if not all, will have an impact on how your voice will work. This module looks at services such as FTP, TFTP, Firewalls, NAT, Proxy Server, DNS and VPNS.

- IP Applications
- FTP – File Transfer Protocol
- Setting up an FTP Server
- FTP Clients
- Connecting to FTP
- Transferring files
- 'More' FTP Clients
- Other FTP Servers
- TFTP - Trivial File Transfer Protocol
- Firewalls
- Network Address Translation
- Network Address (and Port) Translation
- Proxy Servers
- Telnet
- DNS – The Domain Name System
- DNS Root Servers
- DNS Discovery
- Virtualization
- Network Functions Virtualization (NFV)
 - *Running time = 26m 11s*
 - *Quizzes = 3m (average)*
 - ***Total = 29m 11s***

Voice over IP (VoIP)

This module introduces the different implementations of Voice over IP and describes the basics of codecs, signalling, the real time protocol (RTP), quality of service (QoS) and the basics of network design to reduce delay and jitter that can affect the quality of voice on a network.

- What is Voice over IP
- VoIP in the OSI model
- VoIP over the Internet
- Branch to Branch VoIP
- Signaling paths
- Speech paths
- IP PBX advantages
- Encoding
- Codec types
- RTP – The Real Time Protocol
- Bandwidth Requirements
- Delay, Jitter and Packet Loss
- Measuring Delay
- Jitter and Packet Loss
- [Ping tests and VoIP speed testing](#)
- VoIP acceptance criteria
- LAN guidelines for Voice quality
- Dedicated voice LAN
- Shared LAN for Voice and Data
- Utilizing VLANs and 802.1Q
- VLAN Tagging and Priority for QoS
- VLAN QoS 'trace' example
- Quality of Service for Wide Area Networks
- QoS everywhere!
- [VoIP Security](#)
 - *Running time = 27m 55s*
 - *Quizzes = 3m (average)*
 - **Total = 30m 55s**

Hosted VoIP

Hosted voice over IP is a new way of delivering top quality telephone solutions to customers at very low cost. This module is designed to be an introduction to hosted voice over IP and covers:

- Hosted Telephony
- A 'traditional' Phone System
- A Hosted Solution
- Provisioning
- Quality considerations
- QoS considerations for hosted VoIP
 - *Running time = 7m 58s*
 - *Quizzes = 3m (average)*
 - ***Total = 10m 58s***

Video over IP

As well as Voice running over IP, Video is doing so as well. This module is designed to introduce the concepts of Video over IP as well as describing the codecs, Signaling and other elements that make this area of communications so engaging.

- What is Video over IP?
- Video Transmission Types
- Unicast vs. Multicast
- **Video Conferencing types**
- Video Resolution and Pixels
- Video Formats
- Codecs for Video and Voice
- H.264, H.265 (HVEC)
- More inc. VP8 and VP9
- Multipoint Conferencing
- Multipoint Control Unit (MCU)
- MCU and IP PBX
- Simulcasting with AVC
- H.264 Scalable Video Coding
- Video Gateways
- Bandwidth Consumption
- Data vs. VVoIP Bandwidth
- **Control your network**
- Video device landscape
- Video in the Cloud
- The Video Codec 'Battle'
- **The i3 Forum (and OVCC)**
 - *Running time = 47m 04s*
 - *Quizzes = 3m (average)*

- **Total = 50m 04s**

IPv6

The IPv4 address space is almost gone and IPv6 is the answer to this problem. As well as explaining what IPv6 is along with all its benefits, this module covers what IP addressing is all about along with configuring a PC for IPv6 connectivity and testing.

- IPv4 to IPv6
- IPv6 Benefits
- The IPv6 Header
- IPv6 addressing
- Unicast, Multicast, Anycast
- Neighbor Discovery (NDP)
- ICMPv6 (and Ping)
- IPv6 address allocation
- Stateless Address Autoconfiguration (SLAAC)
- Routers and IPv6
- DHCPv6
- [DNSv6](#)
- [DNS Root Servers and IPv6](#)
- Transition technologies and Tunnelling
- Configuring and testing IPv6 on a PC
- More testing commands
- The effects of IPv6 on Voice and Video over IP
- [Resources and websites](#)
 - *Running time = 72m 30s*
 - *Quizzes = 5m (average)*
 - *Lab Exercises = 60m (average)*
 - **Total = 137m 30s**

'Mitel Style'

After looking at all of the Networking technologies in all of the other modules, this Mitel Style module aims to show you how Mitel equipment relates to these technologies and services.

- MAC Address details
- VLAN Tagging
- IP Phone booting and DHCP
- IP Phone Config check
- On the Edge
- Virtualization
- Quality of service
- Layer 2 QoS settings
- Layer 3 QoS settings
- Signaling
- Codecs
- Video solutions inc. UC360
- IPv6 support details
- Sources of information
 - *Running time = 20m 15s*
 - ***Total = 20m 15s***

Note:

An access license for any of our training courses and certification tests is for 12 months from the date and time of purchase.