

## Technological Understanding of MPLS and VPNs

### Course Objectives

Upon completion of this course the student will be able to:

- Explain MPLS and MPLS VPNs from a conceptual standpoint
- Describe the architecture & components of MPLS VPNs
- Compare and contrast the Label Distribution Protocols employed in MPLS and MPLS VPNs
- Explain the use of BGP and modified BGP for MPLS VPNs
- Describe how Quality of Service and traffic engineering are delivered using MPLS VPNs

### Audience

Individuals that need to gain a technical understanding of the MPLS VPNs specifically Systems Engineers, Network Administrators, Network Consultants, Technical Architects, and Security Consultants.

### Course Description

This course reviews the concepts of MPLS switching and delivers a detailed coverage of the Multi-Protocol Label Switching from a standards approach. The course covers in detail the MPLS VPNs as per RFC2547bis.

**Duration:** 2 days

**Course Type:** Instructor-Led

### Prerequisites

Firm understanding of Wide Area Networking protocols, TCP/IP, routing, and Local Area Networking.

## Course Outline

### Introduction

- The IP Routing Paradigm
- Data Processing
- Limitations of IP Routing
- Enterprise vs. Service Providers
- Enabling Internet Technologies
- MPLS as a Solution
- The concept of MPLS
- Examples of Label Technology
- Benefits of MPLS
- Applications of MPLS

### Concepts and Terminology

- Definition of a Label
- Definition of a Shim
- Label Switch Router
- Label Edge Router
- Label Switch Path
- Label Information Base
- Forward Equivalence Class
- Label Stacks
- TLV
- Label Distribution Protocol
- Establishing an LSP
- Traffic Flow Aggregation and Splitting
- Popping and Attaching Labels

### The Label

- Shim Review
- Layers and Labels
- Frame Relay and ATM
- Ethernet, Gig, and 10 Gig
- OSPF, BGPv4, IGRP, and E-IGRP
- Shims detailed
- Encapsulation
- Implementations

### ICMP

- ICMP Overview
- MPLS and ICMP
- ICMP Messages
- ICMP Structure
- Examples of MPLS and ICMP

### Signalling Protocols – Label Distribution Protocol

- Architecture of LDP
- LSP Establishment
- Label Binding
- Unsolicited vs. Ordered
- Liberal vs. Conservative
- LDP & TCP
- Message Format
- Encoding Detailed

- Examples of Encoding

### Signalling Protocols – Constraint-based Routed Label Distribution Protocol

- Architecture of CR-LDP
- Benefits of CR-LDP
- Routing and TLVs
- Node and Abstract Node
- Pre-emption
- Route Pinning
- Resource Class
- CR-LDP Formats
- CR-LDP Messages
- TLC Encoding
- Messages with Examples

### Signalling Protocols – Resource Reservation Protocol – TE

- RSVP Overview
- PATH and Messages
- RSVP Header Format
- RSVP Messages
- TE Header
- TE Messages
- RSVP-TE LSP Setup Flow
- New RSVP-TE Objects



- New C-types
- RSVP-TE Label Request & Label Objects
- LSP Tunnel IP Session Object
- ERO & RRO Objects
- Path Additional Data Object

## **MPLS and ATM**

- ATM Overview
- Drivers for MPLS over ATM
- Updated Terminology
- ATM-MPLS Models
- RFC 2684
- Shims and Encoding
- Implementations of MPLS and ATM
- ATM Label Stack Encoding
- Passing SHIM fields across ATM

- VC Merge & Non-VC Merge ATM-LSRs
- Communication from edge to edge LSRs

## **BGP 4 and MPLS**

- Overview of BGP
- IBGP vs. MPLS
- Extensions to BGPv4
- MBGP
- BGP-MPLS operation
- Messages

## **Virtual Private Networks**

- A brief review of VPN
- VPN Overlay & Peer Models
- VPN Peer Model Key Technologies
- Constrained Distribution of Routing

- Communities
- VPN-IP Address
- BGP in PE, IGP within the Provider Network
- MPLS as the forwarding Mechanism

## **MPLS QoS Support**

- IP QoS Overview
- IntServ QoS Model
- MPLS RSVP-TE Support of IntServ QoS
- Diff-Serv QoS Model
- MPLS Support of Diff-Serv

## **Conclusion**

- MPLS Analyzers
- Internet Initiatives
- Wrap up Q&A