Course ID
MPLS
Course Duration
2-3 days

Course Title
MPLS: Integrated Routing with End-to-End QoS for the Next Generation Networks

Related Courses

- Wireless Network Structure, Operation, and Technologies (3 days, WIRELESSNET)
- Multimedia Applications: IMS, SIP, and VoIP (2 days, MULTIMEDIA)
- IMS: The Technology, Applications, and Challenges (2 days, IMS)
- IP-Based Systems: TCP/IP and Mobile IP (2-3 days, IPSYS)
- Internetworking with TCP/IP Version 6 (IPV6, 2-3 days)
- VoIP: Protocols, Design, and Implementation (VOIP, 2-3 days)
- VoIP Security (VOIPSEC, 2 days)
- State-of-the-art of VoIP Technology for Professionals, Managers, and Executives (VOIP-EXEC, 1 day)
- Traffic Engineering Models for Network Design (TRAFFIC, 3 days)
- Interconnect Technologies: T1/E1, Microwave, Fiber (2 days, XCONNECT)

Aimed At

Those with a technical background who are familiar with data networking concepts and have the need to understand the evolving MPLS-based systems.

Group Size

5-25

Prerequisites

You should have some familiarity with communications engineering as well as a general understanding of data networking and the IP protocol concepts. For those unfamiliar with IP, the course can be extended to three days to include a review of the necessary IP background.

Course in a Nutshell

Multi Protocol Label Switching (MPLS) is one of the central elements of next generation networks. It provides an IP-compatible, QoS-capable infrastructure that enables the convergence of voice, IP, ATM, Ethernet, and Frame Relay onto the same backbone network. MPLS can combine the intelligence and scalability of routing with the reliability and manageability of traditional carrier networks. It is the key to scalable virtual private networks (VPNs) and end-to-end quality of service (QoS).

This course provides an in-depth study of the MPLS technology, including the theory and configuration, network design issues, operations, VPN, traffic engineering, and GMPLS. We will start with an overview of conventional routing and how it compares to MPLS routing. We will then learn about the underlying concepts, features, functions, benefits, and applications of MPLS. We will also study the frame-mode and cell-mode MPLS, the concept of MPLS labels, label stack and different label formats, the label distribution process between LSRs, the loop detection and prevention mechanisms in MPLS, MPLS architecture, MPLS VPN, MPLS QoS, and MPLS traffic engineering. We will conclude with an exploration of the future trends related to the MPLS technology.

Customize It!

Customize this course to your specific needs at little-to-no additional cost. We offer distinct versions tailored for:

- Network design and optimization engineers
- Equipment or application designers
- Less technical audiences such as managers, executives, business planners, sales and marketing specialists, and operations and support personnel

If your audience is unfamiliar with IP, you may extend the course to three days to include an up-front review of the IP protocol.

Learn How To

Upon course completion, you will be able to:

- Describe the features, functions, and benefits of MPLS
- Identify suitable applications for MPLS
- Explain the underlying concepts of MPLS
- Elaborate on the frame-mode MPLS and cell-mode MPLS
- Describe the concept of MPLS labels, label stack and different label formats
- Describe the label distribution process between LSRs
- Describe the loop detection and prevention mechanisms in MPLS
- Describe the QoS mechanisms in MPLS
- Describe the VPN in MPLS

Course Outline

- Overview of Routing and MPLS
  - Layer 3 Routing
  - Native Hop-by-Hop Network Layer Routing
  - Next Hop Selection Functions
  - Label Switching
  - MPLS Forwarding Paradigm
  - Integration of IP and ATM
  - Advantages of MPLS Forwarding over Conventional Network Layer Forwarding
  - Why MPLS?
- Label Switch Routers (LSRs)
  - LSR Basics
  - ATM LSRs
  - LSR Routing Operation
- MPLS Labels
  - MPLS Labels Basics
  - Label Encapsulation

- Label Assignment and Distribution
- Upstream and Downstream LSR
- Label Distribution: Purpose
- Label Distribution: Protocols
- Label Distribution: Methods
- Label Retention Modes
- Label Switched Path (LSP)
- LSP Setup Control

- MPLS Architecture

  - MPLS Operation
  - MPLS Node Architecture
  - MPLS Elements
  - Loop Survival, Detection, and Prevention in MPLS

- Virtual Private Networks

  - Overview of VPNs
  - Connection-Oriented VPNs
  - Connectionless VPNs
  - Comparison of VPN Technologies
  - Advantages of MPLS VPNs

- Packet-Based MPLS VPNs

  - Basics of MPLS and BGP
  - MPLS VPN Operation
  - Verifying VPN Operation
  - BGP Route Reflectors
  - Carrier-over-Carrier MPLS VPNs
  - Internet Access over MPLS VPNs
  - Trace Route Enhancements
  - MPLS VPN Management

- ATM-Based MPLS VPNs

  - Basics
  - ATM LSR: Merge Capabilities
  - Issues with ATM
  - Downstream-on-Demand and ATM
  - ATM-LSR and VC-merge
  - ATM-Based MPLS VPNs
  - MPLS and Tag Switching Terminology
  - Packet-Based MPLS over ATM
  - ATM-Based MPLS

- Cell Interleaving
- VC Merge
- Label Virtual Circuits
- Label Switch Controllers
- Virtual Switch Interface
- IP+ATM
- Packet-Based MPLS over ATM VPNs
- ATM-Based MPLS VPNs.

- MPLS Traffic Engineering

  - The Need for Traffic Engineering on the Internet
  - Unequal-Cost Load Balancing via Metric Manipulation
  - Advantages of MPLS Traffic Engineering
  - MPLS Traffic Engineering Elements (Dynamic/Static LSPs)
  - MPLS Traffic Engineering Configuration
  - Configuration Case Study of an MPLS Traffic-Engineered Network (IS-IS)
  - Configuration Case Study of an MPLS Traffic-Engineered Network (OSPF)

- MPLS Quality of Service

  - Introduction to Quality of Service
  - Integrated Services
  - IP Precedence
  - Differentiated Services
  - Modular QoS CLI
  - MPLS Implementation of DiffServ
  - MPLS VPN Support of QoS
  - MPLS QoS Implementation
  - Configuring QoS for MPLS VPNs
  - MPLS QoS Case Study

- MPLS Design and Migration

  - MPLS VPN Design and Topologies
  - Migrating MPLS into an ATM Network
  - ATM MPLS Design Criteria
  - Designing MPLS Networks
  - Additional MPLS Design Considerations

- Route Selection

  - Basics
  - Standard IP and MPLS
  - IP Forwarding
  - MPLS Label Distribution

- Label Switched Path (LSP)
- Explicitly Routed LSP (ER-LSP): Basics, Example, Advantages
- Hop-by-Hop versus Explicit Routing

- DiffServ Support in MPLS

  - Basics
  - Types of LSPs for DiffServ Support
  - EXP-Inferred-PSC LSP (E-LSP)
  - Label-Only-Inferred-PSC LSP (L-LSP)
  - Bandwidth Reservation for E-LSP and L-LSP

- Advanced Topics such as Traffic Engineering, GMPLS and Multi-protocol Lambda Switching

- Conclusion: Recap, Q/A, and Evaluation

How You Will Learn

- You will learn in interactive lecture format from a knowledgeable and experienced subject matter expert/trainer.
- If you already know something about the technology, we will build on that. We'll compare and contrast what's familiar with what are new, making new ideas easier to learn as well as more relevant.
- If your background is less technical, we will use meaningful and ingenious examples and analogies to simplify the complex subject matter.
- The Participant Handbook will provide you with a structure to which you can add the information and insight provided in real-time, turning it into a valuable reference resource you can take back to your job.

Revised *Feb. 25, 2007*