JunOS MPLS and VPNs
Course JMV; 5 Days, Instructor-led

Course Description
This five-day course is designed to provide students with MPLS-based virtual private network (VPN) knowledge and configuration examples. The course includes an overview of MPLS concepts such as control and forwarding plane, RSVP Traffic Engineering, LDP, Layer 3 VPNs, next-generation multicast virtual private networks (MVPNs), BGP Layer 2 VPNs, LDP Layer 2 Circuits, and virtual private LAN service (VPLS).

This course also covers JunOS operating system-specific implementations of Layer 2 control instances and active interface for VPLS. Through demonstration and hands-on labs, students will gain experience in configuring and monitoring JunOS routers running MPLS and VPN.

This Juniper Networks course provides the foundational knowledge required to configure Juniper Networks devices running JUNOS Software and implementing MPLS and Virtual Private Networks (VPNs).

Course Topics
- Explain common terms relating to MPLS
- Identify packet flow and handling through a label-switched path (LSP)
- Configure and troubleshoot RSVP-signaled and LDP-signaled LSPs
- Describe the CSPF algorithm and its path selection process
- Analyze LSP priority and preemption
- Describe the operation and configuration of fast reroute
- Describe the operation and configuration of link and node protection
- Describe the LSP optimization options
- Specify the differences between Layer 2 VPNs and Layer 3 VPNs
- Configure a BGP extended community
- Configure a Layer 3 VPN using a dynamic CE-PE routing protocol
- Use operational commands to view Layer 3 VPN control exchanges
- Use operational commands to display Layer 3 VPN VRF tables
- Monitor and troubleshoot PE-CE routing protocols
- Describe the four ways to improve Layer 3 VPN scaling
- Describe the flow of control and data traffic in a hub-and-spoke topology
- Describe the various Layer 3 VPN class-of-service (CoS) mechanisms supported by JunOS
- Monitor and verify the operation of next-generation MVPNs
- Configure a BGP Layer 2 VPN and describe the benefits and requirements of over-provisioning
- Monitor and troubleshoot a BGP Layer 2 VPN
- Configure an LDP Layer 2 circuit
- Monitor and troubleshoot an LDP Layer 2 circuit
Describe and configure circuit cross-connect (CCC) MPLS interface tunneling
Explain the provisioning of CE and PE routers
Configure BGP and LDP VPLS
Troubleshoot VPLS

**Audience Profile**
Network engineers, support personnel, reseller support, and others responsible for implementing Juniper Security products utilizing the topics covered in this class.

**Prerequisites**
- Students should have intermediate-level networking knowledge and an understanding of the OSI model and the TCP/IP protocol suite.
- Students should also have familiarity with the Protocol Independent Multicast-Sparse Mode (PIM-SM) protocol.
- Students should also have attended the Introduction to the Junos Operating System (IJOS) course, the Junos Routing Essentials (JRE) course, the Junos Intermediate Routing (JIR) course, and the JunOS Service Provider Switching (JSPX) courses prior to attending this class.

**Course Outline**

**Chapter 1: Course Introduction**

**Chapter 2: MPLS Fundamentals**
- MPLS Foundation
- Terminology
- MPLS Configuration
- MPLS Packet Forwarding

**Chapter 3: Label Distribution Protocols**
- Label Distribution Protocols
- RSVP
- LDP

**Chapter 4: Constrained Shortest Path First**
- RSVP Behavior Without CSPF
- CSPF Algorithm
- CSPF Tie Breaking
- Administrative Groups

**Chapter 5: Traffic Protection and Optimization**
- Default Traffic Protection Behavior
- Primary and Secondary LSPs
- Fast Reroute
- Bypass LSPs
- LSP Optimization

**Chapter 6: Miscellaneous MPLS Features**
- Routing Table Integration
- Forwarding Adjacencies
- Policy Control over LSP Selection
- LSP Metrics
• Automatic Bandwidth
• TTL Handling
• Explicit Null Configuration
• MPLS Pings

Chapter 7: VPN Review
• Overview of VPNs
• CPE-Based VPNs
• Provider- provisioned

Chapter 8: Layer 3 VPNs
• Layer 3 VPN Terminology
• VPN-IPv4 Address Structure
• Operational Characteristics

Chapter 9: Basic Layer 3 VPN Configuration
• Preliminary Steps
• PE Router Configuration

Chapter 10: Troubleshooting Layer 3 VPNs
• A Layered Approach
• The routing- instance Switch
• PE-Based and CE-Based Traceroutes
• Viewing VRF Tables and PE-PE Signaling Flow
• Monitoring PE-CE Routing Protocols

Chapter 11: Layer 3 VPN Scaling and Internet Access
• Scaling Layer 3 VPNs
• Public Internet Access Options

Chapter 12: Layer 3 VPNs—Advanced Topics
• Exchanging Routes Between VRF Tables
• Hub-and-Spoke Topologies
• Layer 3 VPN CoS Options
• Layer 3 VPN and GRE Tunneling Integration
• Layer 3 VPN and IPsec Integration

Chapter 13: Multicast VPNs
• Multicast VPN Overview
• Next-Generation MVPN Operation
• Configuration
• Monitoring

Chapter 14: BGP Layer 2 VPNs
• Overview of Layer 2 Provider-Provisioned VPNs
• BGP Layer 2 VPN Operational Model: Control Plane
• BGP Layer 2 VPN Operational Model: Data Plane
• Preliminary BGP Layer 2 VPN Configuration
• BGP Layer 2 Configuration
• Monitoring and Troubleshooting BGP Layer 2 VPNs
Chapter 15: Layer 2 VPN Scaling and CoS
- Review of VPN Scaling Mechanisms
- Layer 2 VPNs and CoS

Chapter 16: LDP Layer 2 Circuits
- LDP Layer 2 Circuit Operation
- LDP Layer 2 Circuit Configuration
- LDP Layer 2 Circuit Monitoring and Troubleshooting
- Circuit Cross-Connect

Chapter 17: Virtual Private LAN Services
- Layer 2 MPLS VPNs Versus VPLS
- BGP VPLS Control Plane
- BGP VPLS Data Plane
- Learning and Forwarding Process
- Loops

Chapter 18: VPLS Configuration
- VPLS Configuration
- VPLS Troubleshooting

Chapter 19: Interprovider VPNs
- Hierarchical VPN Models
- Junos Support of Carrier-of-Carriers Model
- Junos Support of Carrier-of-Carrier VPN Applications