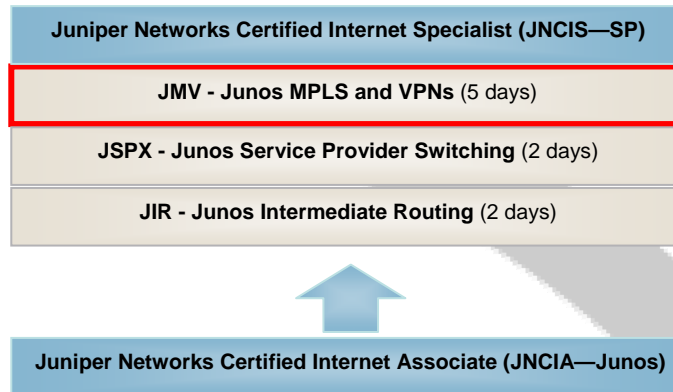




## JUNIPER JUNOS SERVICE PROVIDER ROUTING & SWITCHING



### Junos MPLS and VPNs (JMV)

#### Course Overview

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 demonstrations and hands-on labs, students will gain experience in configuring and monitoring the Junos OS and in device operations.

#### Objectives

After successfully completing this course, you should be able to:

- Understand the history and evolution of CoS.
- Explain common terms relating to MPLS.
- Explain routers and the way they forward MPLS packets.
- Explain packet flow and handling through a label-switched path (LSP).
- Describe the configuration and verification of MPLS forwarding.
- Understand the information in the Label Information Base.

- Explain the two label distribution protocols used by the Junos OS.
- Configure and troubleshoot RSVP-signaled and LDP-signaled LSPs.
- Explain the constraints of both RSVP and LDP.
- Explain the path selection process of RSVP without the use of the Constrained Shortest Path First (CSPF) algorithm.
- Explain the Interior Gateway Protocol (IGP) extensions used to build the Traffic Engineering Database (TED).
- Describe the CSPF algorithm and its path selection process.
- Describe administrative groups and how they can be used to influence path selection.
- Describe the default traffic protection behavior of RSVP-Signaled LSPs.
- Explain the use of primary and secondary LSPs.
- Explain 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.
- Explain the purpose of several miscellaneous MPLS features.
- Explain the definition of the term "Virtual Private Network".



- Describe the differences between provider-provisioned and customer-provisioned VPNs.
- Describe the differences between Layer 2 VPNs and Layer 3 VPNs.
- Explain the features of provider-provisioned VPNs supported by the Junos OS.
- Explain the roles of Provider (P) routers, Provider Edge (PE) routers, and Customer Edge (CE) routers.
- Describe the VPN-IPv4 address formats.
- Describe the route distinguisher use and formats.
- Explain the RFC 4364 control flow.
- Create a routing instance, assign interfaces, create routes, and import and export routes within the routing instance using route distinguishers and route targets.
- Explain the purpose of BGP extended communities and how to configure and use these communities.
- Describe the steps necessary for proper operation of a PE to CE dynamic routing protocol.
- Configure a simple Layer 3 VPN using a dynamic CE-PE routing protocol.
- Describe the routing-instance switch.
- Explain the issues with the support of traffic originating on multiaccess VPN routing and forwarding table (VRF table) interfaces.
- 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 three methods for providing Layer 3 VPN customers with Internet access.
- Describe how the auto-export command and routing table groups can be used to support communications between sites attached to a common PE router.
- 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 the Junos OS.
- Explain the Junos OS support for generic routing encapsulation (GRE) and IP Security (IPsec) tunnels in Layer 3 VPNs.
- Describe the flow of control traffic and data traffic in a next-generation MVPN.
- Describe the configuration steps for establishing a next-generation MVPN.
- Monitor and verify the operation of next-generation MVPNs.
- Describe the purpose and features of a BGP Layer 2 VPN.
- Describe the roles of a CE device, PE router, and P router in a BGP Layer 2 VPN.
- Explain the flow of control traffic and data traffic for a BGP Layer 2 VPN.
- Configure a BGP Layer 2 VPN and describe the benefits and requirements of over-provisioning.
- Monitor and troubleshoot a BGP Layer 2 VPN.
- Explain the BGP Layer 2 VPN scaling mechanisms and route reflection.
- Describe the Junos OS BGP Layer 2 VPN CoS support.
- Describe the flow of control and data traffic for an LDP Layer 2 circuit.
- Configure an LDP Layer 2 circuit.
- Monitor and troubleshoot an LDP Layer 2 circuit.
- Describe and configure circuit cross-connect (CCC) MPLS interface tunneling.
- Describe the difference between Layer 2 MPLS VPNs and VPLS.
- Explain the purpose of the PE device, the CE device, and the P device.
- Explain the provisioning of CE and PE routers.
- Describe the signaling process of VPLS.
- Describe the learning and forwarding process of VPLS.
- Describe the potential loops in a VPLS environment.
- Configure BGP and LDP VPLS.
- Troubleshoot VPLS.
- Describe the Junos OS support for carrier of carriers.
- Describe the Junos OS support for interprovider VPNs.

#### Target Audience

This course benefits individuals responsible for configuring and monitoring devices running the Junos OS.



**Course Level**  
Advanced

**Prerequisites**

Students should:

- understanding of the OSI model
- intermediate-level networking knowledge
- know the TCP/IP protocol suite
- familiarity with PIM-SM protocol

Students should attend the following courses:

- IJOS
- JRE
- JSPX

**Day One**

**Chapter 1: Course Introduction**

**Chapter 2: CoS Overview**

- CoS History and Evolution
- CoS and DiffServe
- CoS Fields in Packet Headers
- CoS Processing

**Chapter 2: MPLS Fundamentals**

- MPLS Foundation
- Terminology
- MPLS Configuration
- MPLS Packet Forwarding
- Lab 1: MPLS Fundamentals

**Chapter 3: Label Distribution Protocols**

- Label Distribution Protocols
- RSVP
- LDP
- Lab 2: Label Distribution Protocols

**Chapter 4: Constrained Shortest Path First**

- RSVP Behavior Without CSPF
- CSPF Algorithm
- CSPF Tie Breaking
- Administrative Groups
- Lab 3: CSPF

**Day 2**

**Chapter 5: Traffic Protection and Optimization**

- Default Traffic Protection Behavior
- Primary and Secondary LSPs
- Fast Reroute
- Bypass LSPs
- LSP Optimization
- Lab 4: Traffic Protection

**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
- Lab 5: Miscellaneous MPLS Features

**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
- Lab 6: VPN Baseline Configuration

**Day 3**

**Chapter 9: Basic Layer 3VPN Configuration**

- Preliminary Steps
- PE Router Configuration
- Lab 7: Layer 3 VPN with Static and BGP Routing

**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
- Lab 8: Route Reflection and Internet Access

**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
- Lab 9: GRE Tunnel Integration

**Day 4**

**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
- Lab 10: 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
- Lab 11: Circuit Cross-Connect and LDP Layer 2 Circuits

**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

**Day 5**

**Chapter 13: VPLS Configuration**

- VPLS Configuration
- VPLS Troubleshooting
- Lab 12: VPLS

**Chapter 14: Interprovider VPNs**

- Hierarchical VPN Models
- Junos Support of Carrier-of-Carriers Model
- Junos Support of Carrier-of-Carrier VPN Applications
- Lab 13: Carrier-of-Carrier VPNs

**Cost AUD \$4,099 inc. GST**

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