

# JUNOS LAYER 2 VPNS (JL2V)

Course Code: 100553

Gain experience in configuring and monitoring the Junos OS and in device operations.

This three-day course is designed to provide students with the knowledge to configure and troubleshoot MPLS-based Layer 2 virtual private networks (VPN). The course includes an overview of MPLS Layer 2 VPN concepts, such as BGP Layer 2 VPNs, LDP Layer 2 circuits, forwarding equivalence class (FEC) 129, virtual private LAN service (VPLS), Ethernet VPN (EVPN), and Inter-AS MPLS VPNs.

This course also covers Junos OS-specific implementations of Layer 2 VPN instances, VPLS, and EVPNs. This course is based on the Junos OS Release 21.4R1.12.

## What You'll Learn

After completing this course, the successful student should be able to:

- Describe some of the different kinds of VPNs, their mechanics, and their use cases.
- Describe the types of MPLS VPN that operate at layer 2.
- Describe the mechanics of BGP-signaled pseudowires, also known as L2VPNs.
- Configure BGP-signaled L2VPNs with Ethernet and Ethernet-VLAN encapsulations.
- Demonstrate how to troubleshoot some of the most common BGP-signaled L2VPN configuration problems.
- Describe how BGP-signaled L2VPNs use a block of labels to bring efficiency to hub-and-spoke advertisements.
- Configure advanced BGP-signaled L2VPN features, such as multihoming, VLAN normalization, and route target constraint.
- Describe the mechanics of LDP-signaled pseudowires, also known as Layer 2 Circuits.
- Describe the causes and solutions of some of the most common L2Circuit configuration problems.
- Configure advanced LDP-signaled L2Circuit features, such as multihoming and local switching.
- Explain how the FEC 129 pseudowire method combines BGP for autodiscovery and LDP for signaling.
- Describe the purpose and mechanics of a VPLS.

- Create a VPLS instance that is signaled using BGP and demonstrate the commands that verify its status.
- Create VPLS instances that are signaled using LDP and FEC 129 and demonstrate the commands available to verify their status.
- Describe how mismatched VLAN tags are handled in a default VPLS configuration.
- Configure a VPLS to swap mismatched VLAN tags automatically, and to create multiple bridge domains inside a single VPLS instance.
- Configure the most important VPLS traffic management features, including flood protection, MAC limiting, IRB interfaces, and automated Site IDs.
- Configure hub-and-spoke VPLS topologies.
- Configure multihomed sites in a VPLS.
- Describe the features of Ethernet VPN, and the enhancements that EVPN brings over VPLS. Explain how EVPNs advertise MAC addresses, and how they request to receive flooded traffic within a bridge domain.
- Configure and verify a single-homed VLAN-based EVPN instance.
- Configure and verify a single-homed VLAN-aware bundle EVI.
- Configure a multihomed EVPN and explain the purpose of the EVPN Type 4 route.
- Describe the features provided by EVPN Type 1 routes.
- Describe how to use MAC Mobility and IRB interfaces in an EVPN.
- Explain how EVPNs can tightly integrate themselves into MPLS Layer 3 VPNs to provide highly efficient forwarding.
- Describe and configure various solutions that create MPLS VPNs between service providers.
- Describe the circuit-cross connect pseudowire method and explain how this old method can still have value in modern networks.
- Describe how multisegment pseudowires can create layer 2 VPNs across autonomous system boundaries.

## Who Needs to Attend

Benefits individuals responsible for configuring and monitoring devices running the Junos OS in a service provider environment, in MPLS-based data centers, and in larger enterprises

## Prerequisites

Students should have intermediate-level networking knowledge and an understanding of OSPF, IS-IS, BGP, and Junos policy.

Students should have experience configuring MPLS label-switched paths using Junos. Students should also attend Introduction to the Junos Operating System (IJOS), Junos Routing Essentials (JRE), Junos Service Provider Switching (JSPX), Junos Intermediate Routing (JIR) and Junos MPLS Fundamentals (JMF) courses prior to attending this class.

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CLASSROOM LIVE

\$1,900 USD

3 Day

## Classroom Live Outline

### Day 1

1. **Course Introduction**
2. **Refresher—VPNs and MPLS**
  - Explain the basic function and purpose of a VPN
  - Describe how MPLS uses labels to forward traffic
  - Explain the differences between MPLS layer 3 VPNs and MPLS layer 2 VPNs
3. **The Different Flavors of Layer 2 VPN**
  - Describe the purpose and creation of pseudowires
  - Define the different technical terms relating to pseudowires
  - Describe the purpose and creation of VPLS
  - Describe the purpose, creation, and advantages of EVPN
4. **L2VPN, aka BGP-Signaled Pseudowires**
  - Define the concept of an attachment circuit, and of pseudowire encapsulation
  - Explain the importance of route targets, route distinguishers, and Site IDs
  - Explain the control plane and data plane of an L2VPN
  - Describe the contents of an L2VPN BGP packet capture
5. **L2VPN—Configuration**
  - Configure an L2VPN that accepts all Ethernet traffic
  - Configure an L2VPN that accepts specific VLAN tags
6. **L2VPN—Troubleshooting**
  - Diagnose and fix L2VPN problems caused by missing LSPs, mismatched site information, and incorrect configuration
7. **L2VPN—Site IDs, the Label Base, and Overprovisioning**
  - Explain the purpose of the Site ID and the VPN label base
  - Configure an overprovisioned L2VPN with explicit remote Site IDs
  - Configure an overprovisioned L2VPN with implicit remote Site IDs
8. **L2VPN—Advanced Concepts**

- Configure and verify L2VPN multihoming
  - Explain the purpose of Martini encapsulation
  - Configure VLAN normalization in an L2VPN
  - Configure out-of-band route reflection and route target constraint
9. **L2Circuit—LDP-Signaled Pseudowires**
    - Explain the concept of targeted LDP sessions, and the elements that L2Circuits have in common with L2VPNs
    - Configure and verify an L2Circuit
    - Describe the contents of an LDP advertisement packet capture
  10. **L2Circuit—Troubleshooting**
    - Configure the Pseudowire Status TLV
    - Explain the meaning of the most frequent L2Circuit error codes

## DAY 2

1. **L2Circuit—Advanced Concepts**
  - Describe the purpose and benefits of virtual circuit connectivity verification
  - Configure multihoming, local switching, and interworking
2. **FEC 129 Pseudowires**
  - Explain the way that FEC 129 autodiscovers remote PEs and signals pseudowires
  - Configure and verify a FEC 129 pseudowire
3. **Virtual Private LAN Service—Introduction**
  - Describe how a VPLS is built, and how it compares to a regular pseudowire
  - Explain how VPLS forwards traffic between multiple sites
  - Describe the BGP and LDP methods of signaling a VPLS 14
4. **VPLS—BGP Configuration and Verification**
  - Configure a BGP-signaled VPLS
  - Verify a BGP-signaled VPLS 15
5. **VPLS—LDP and FEC 129 Configuration and Verification**
  - Configure and verify an LDP-signaled VPLS
  - Configure and verify a FEC 129 VPLS 16
6. **VPLS—The Default VLAN Mode**
  - Define the four VLAN modes for VPLS
  - Define the concept of a bridge domain, and verify the default VPLS VLAN mode 17
7. **VPLS—VLAN Normalization, VLAN-Aware Instances, and Dual-Stacked VLANs**
  - Configure and verify VLAN-Aware mode
  - Configure and verify VLAN-Normalizing mode and NoVLAN mode
  - Configure and verify dual-stacked VLAN tags in VPLS 18
8. **VPLS—Advanced Features and Troubleshooting**
  - Deploy automated BGP VPLS Site IDs
  - Configure flood protection, MAC flap protection, and MAC limiting
  - Explain how to add IRB interfaces to a VPLS, and configure efficient traffic flooding using multicast LSPs
  - Describe the most important VPLS-specific troubleshooting techniques 19
9. **VPLS—Multihoming**

- Configure multihomed sites in a BGP-signaled VPLS
- Configure multihomed sites and single sites on the same PE in a BGP-signaled VPLS
- Configure best-site multihoming in a BGP-signaled VPLS
- Configure multihomed sites in an LDP-signaled VPLS

## **DAY 3**

### **1. EVPN—Introduction**

- Explain the main disadvantages of a VPLS solution
- Explain how EVPN overcomes these disadvantages, and enables extra features

### **2. EVPN—Using BGP to Advertise MACs and to Flood Traffic**

- Explain the meaning of an EVPN Instance
- Describe how EVPN Type 2 routes advertise MAC addresses and MAC/IP bindings
- Describe how EVPN Type 3 routes request to receive flooded traffic within a bridge domain

### **3. EVPN—Configuring a Single-Homed VLAN-Based EVI**

- Configure a service provider network to host EVPN services
- Configure a single-homed VLAN-based EVI • Verify a VLAN-based EVI

### **4. EVPN—Configuring a Single-Homed VLAN-Aware Bundle EVI**

- Configure a VLAN-aware bundle EVI
- Verify a VLAN-aware bundle EVI

### **5. EVPN—Multihoming Configuration and Type 4 Routes**

- Configure a CE and two PEs to take part in a multihomed EVPN
- Describe the contents of the Type 4 Ethernet Segment route
- Explain how the Type 4 route prevents layer 2 loops, using the designated forwarder election

### **6. EVPN—Multihoming Features Using Type 1 Routes**

- Describe Type 1 Ethernet Auto-Discovery Per-Ethernet Segment routes
- Explain how Type 1 Per-Ethernet Segment routes prevent layer 2 loops
- Describe how Type 1 Per-EVI routes are different from Per-ES routes

### **7. EVPN—MAC Mobility and IRB Interfaces**

- Configure and verify the EVPN MAC Mobility feature
- Configure and verify Automatic Gateway MAC-IP Synchronization
- Configure and verify Manual Gateway MAC-IP Synchronization
- Configure and verify EVPN Virtual Gateway Addresses

## **Classroom Live Labs**

- Lab 1: BGP-Signaled Layer 2 VPNs
- Lab 2: L2VPNs—Advanced Concepts
- Lab 3: LDP-Signaled L2Circuits
- Lab 4: FEC 129 Pseudowires (Optional)
- Lab 5: VPLS

- Lab 6: EVPN

# JUNOS LAYER 2 VPNS (JL2V)

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VIRTUAL CLASSROOM LIVE

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- Lab 3: LDP-Signaled L2Circuits
- Lab 4: FEC 129 Pseudowires (Optional)

- Lab 5: VPLS
- Lab 6: EVPN

Visit us at [www.globalknowledge.com](http://www.globalknowledge.com) or call us at 1-866-716-6688.

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