

Junos Layer 3 VPNs

COURSE OVERVIEW

This three-day course is designed to provide students with MPLS-based Layer 3 VPN (L3VPN) knowledge and configuration examples. The course includes an overview of MPLS L3VPN concepts, scaling L3VPNs, Internet access, interprovider L3VPNs, and multicast for L3VPNs. This course also covers Junos operating system (OS) specific implementations of Layer 3 VPNs.

The concepts are put into practice with a series of hands-on labs, allowing participants to gain experience configuring and monitoring L3VPNs on Junos OS devices. These hands-on labs utilize the Juniper Networks vMX Series devices using the Junos OS Release 22.1R1.10 and are also applicable to other MX Series devices.

COURSE LEVEL

Advanced

AUDIENCE

- Individuals responsible for configuring and monitoring devices running Junos OS

PREREQUISITES

- Intermediate-level networking knowledge and an understanding of OSPF, IS-IS, BGP, and Junos policy
- Experience configuring MPLS label-switched paths using Junos
- Completion of the *Introduction to the Junos Operating System*, *Junos Intermediate Routing*, and the *Junos MPLS Fundamentals* courses

RELEVANT JUNIPER PRODUCT

- M Series
- T Series
- MX Series
- PTX Series

RELATED CERTIFICATION

[JNCIP-SP](#)

OBJECTIVES

- Describe the purpose and functions of MPLS VPNs.
- Describe the differences between Layer 2 VPNs (L2VPNs) and Layer 3 VPNs (L3VPNs).
- Describe the roles of a customer edge (CE) device, provider edge (PE) router, and provider (P) router in a BGP Layer 3 VPN.
- Describe the format of the BGP routing information, including VPN-IPv4 addresses and route distinguishers.
- Describe the propagation of VPN routing information within an autonomous system (AS).
- List the BGP design constraints to enable L3VPNs within a provider network.
- Explain the operation of the L3VPN data plane within a provider network.
- Create a routing instance, assign interfaces to a routing instance, create routes in a routing instance, and import/export routes from a routing instance using route distinguishers/route targets.
- Describe the purpose of BGP extended communities, configure BGP extended communities, and use BGP extended communities.
- List the steps necessary for the proper operation of a PE-CE dynamic routing protocol.
- List the troubleshooting and monitoring techniques for routing instances.
- Explain the difference between the `bgp.l3vpn` table and the `inet.0` table of a routing instance.
- Monitor the operation of a CE-PE dynamic routing protocol.
- Describe ways to support communication between sites attached to a common PE router.
- Provision and troubleshoot hub-and-spoke L3VPNs.
- Describe the flow of control traffic and data traffic in a hub-and-spoke L3VPN.
- Describe the quality of service (QoS) mechanisms available in L3VPNs.
- Describe seamless MPLS fundamentals.
- Describe the carrier-of-carriers model.
- Configure the carrier-of-carriers and "Option C" configuration.
- Describe the flow of control traffic and data traffic in BGP MVPN.
- Describe the configuration steps for establishing a BGP MVPN.
- Monitor and verify the operations of BGP MVPNs.
- Describe the flow of control traffic and data traffic when using BGP MVPNs for Internet multicast.
- Describe the configuration steps for enabling Internet multicast using BGP MVPNs.
- Monitor and verify the operation of BGP MVPN Internet multicast.

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COURSE CONTENTS

DAY 1

1	Course Introduction
2	Refresher—VPNs and MPLS <ul style="list-style-type: none"> Contrast the differences between IPsec VPNs and MPLS VPNs Contrast the differences between L3VPNs and L2VPNs
3	Layer 3 VPNs—Overview <ul style="list-style-type: none"> Explain L3VPN terminology Define the VPN-IPv4 address structure
4	Layer 3 VPNs—Operational Characteristics <ul style="list-style-type: none"> Explain how the L3VPN control plane advertises VPN-IPv4 prefixes across a service provider network Explain how the L3VPN data plane transports traffic between sites, across a service provider's core
5	Layer 3 VPN—Configuration <ul style="list-style-type: none"> Describe the preliminary steps needed for configuring an L3VPN Describe the L3VPN PE configuration Lab 1: Layer 3 VPNs with Static and BGP Routing
6	Layer 3 VPN—Verification <ul style="list-style-type: none"> Describe how to verify L3VPN operations
7	OSPF as the PE-to-CE Protocol <ul style="list-style-type: none"> Configure and verify a basic L3VPN deployment, with OSPF to the CE router Explain the purpose of the BGP route type community and the domain ID
8	OSPF—Optimal Routing <ul style="list-style-type: none"> Explain and verify the use of the DN bit and the VPN route tag, which prevent control plane loops Configure and verify sham links to control routing decisions in networks with backdoor links
9	Route Leaking <ul style="list-style-type: none"> Describe route leaking in an L3VPN environment Lab 2: Route Redistribution

DAY 1 (contd.)

10	Hub-and-Spoke Topologies <ul style="list-style-type: none"> Describe hub-and-spoke L3VPN topologies
DAY 2	
11	Layer 3 VPN CoS <ul style="list-style-type: none"> Describe how to configure and use CoS with L3VPNs
12	Layer 3 VPN Protection Mechanisms <ul style="list-style-type: none"> Explain how BGP PIC edge works Define how provider edge link protection functions
13	Layer 3 VPN Scaling <ul style="list-style-type: none"> Describe different ways to improve L3VPN scaling Define L3VPN scaling guidelines
14	BGP Route Target Filtering <ul style="list-style-type: none"> Describe the purpose of BGP route target filtering
15	Layer 3 VPNs and Internet Access <ul style="list-style-type: none"> Explain the differences between the methods of providing Internet access within an L3VPN environment Demonstrate how to configure VRF Internet access with a single connection through a use case Lab 3: Additional L3VPN Scalability Techniques
16	Inter-AS Layer 3 VPNs <ul style="list-style-type: none"> Describe the functionality of Interprovider Options A, B, and C Configure and verify the Interprovider Option C method
17	Carrier-of-Carriers VPNs <ul style="list-style-type: none"> Describe and configure carrier-of-carriers VPNs Lab 4: Carrier-of-Carriers VPNs

COURSE CONTENTS (contd.)

DAY 3

18 Troubleshooting Layer 3 VPN—Overview

- Explain basic L3VPN troubleshooting steps
- Define PE-to-CE verification methods

19 Additional Layer 3 VPN Troubleshooting

- Explain how to troubleshoot MPLS-related problems in an L3VPN
- Explain how to troubleshoot BGP-related problems in an L3VPN
- Demonstrate how to troubleshoot forwarding plane related problems in an L3VPN
- Describe troubleshooting an L3VPN with a use case

Lab 5: Troubleshooting L3VPNs**20 Multicast Overview**

- Describe IP multicast traffic flow and multicast components
- Describe multicast addressing
- Describe the need for RPF check in multicast networks
- Describe multicast routing tables

21 Introduction to IGMP

- Explain the role of IGMP
- Describe the different versions of IGMP

22 Multicast Routing Protocols

- Discuss multicast routing
- Describe the different PIM messages

23 BGP MVPN Overview

- Describe the overall functionality of BGP MVPNs
- Explain how BGP MVPNs operate

24 Configuring BGP MVPNs

- Explain the configuration steps of BGP MVPNs
- Describe how to verify that a BGP MVPN is correctly working

Lab 6: MVPNs

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