Junos Segment Routing with SRv6 Micro-SIDs

COURSE OVERVIEW

This three-day course provides an in-depth introduction to segment routing (SR), otherwise known as Source Packet Routing in Networking (SPRING). The course focuses on using IS-IS and BGP to deploy SRv6 micro-SIDs, which encodes multiple instructions into a single IPv6 address in the data plane.

After exploring the features and use cases for SRv6 with micro-SIDs, students are introduced to the fundamentals of a segment-routed network. This includes locator blocks, locator prefixes, and a variety of BGP service functions such as uDT4 and uDT6 segments. This also includes VPN configuration, with a focus on Layer 3 VPNs and the MPLS label transposition process.

Students are then taught how an SRv6 micro-SID network can encode multiple segments into a single address, and the segment popping process that takes place across a path. Students configure End and End. X transport segments to test this, which acts as a starting point to deploy a variety of backup paths with Topology-Independent Loop-Free Alternate (TI-LFA). Finally, students consider multitopology designs with Flex Algo, including Classful Transport and the BGP color community. A brief self-study section then follows that considers classic SRv6.

Students also briefly learn the most fundamental concepts of SR-MPLS. This knowledge enables students to compare and contrast the two SR methods.

This course is based on Junos OS Release 25.2R1.8.

COURSE LEVEL

Junos Segment Routing with SRv6 Micro-SIDs is an advanced-level course, but will also appeal to students who have strong intermediate knowledge.

AUDIENCE

The primary audiences for this course include:

- Individuals who work with routers that run Junos OS.
- Individuals involved in the service provider industry, the data center industry, or who work in large enterprise networks.
- Operators who use BGP and IS-IS, and who may previously have used MPLS to create transport paths across their networks.

PREREQUISITES

The prerequisites for this course include:

- Mandatory: Advanced routing knowledge; the Advanced Junos Service Provider Routing course or equivalent knowledge is recommended.
- Mandatory: Intermediate Junos CLI experience.
- Mandatory: Fundamental knowledge of MPLS transport functions, including LDP and RSVP, and the BGP prefix resolution process in such environments; the Junos MPLS Fundamentals course or equivalent knowledge is recommended.
- Recommended: Basic knowledge of Layer 3 VPNs in an MPLS environment.

RELATED CERTIFICATION

JNCIP-SP Certification | Juniper Networks US

JNCIE-SP Certification | Juniper Networks US

RELATED JUNIPER PRODUCTS

ACX Series
Junos OS
MX Series
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OBJECTIVES

After successfully completing this course, the students should be able to:

- Explain the basic philosophy of segment routing.
- Describe some of the exciting features offered by segment routing.
- Explain some fundamentals segment routing concepts, such as segment IDs, global segments, and local segments.
- Demonstrate how SRv6 micro-SIDs can enable a BGP-free core.
- Demonstrate how to deploy and verify uSID locator blocks and locator prefixes in Junos OS.
- Describe the variety of function types you can deploy in an SRv6 network.
- Demonstrate how to configure internal and external BGP in preparation for generating SRv6 micro-SIDs.
- Demonstrate how to deploy uDT4, uDT6, and uDT46 micro-SIDs.
- Demonstrate how to override the default Junos OS micro-SID Local ID Block (LIB) range.
- Configure and verify Layer 3 VPNs in an SRv6 micro-SID network.
- Explain the micro-SID popping process and the Segment Routing Header (SRH).
- Explain how TI-LFA backup paths can radically reduce downtime during link or node failure.
- Demonstrate how to configure and verify TI-LFA link protection in a Junos OS SRv6 network.
- Demonstrate how to configure and verify TI-LFA node protection in a Junos OS SRv6 network.
- Explain how the BGP color community can automatically map prefixes to a specific SR policy.
- Describe how Junos transport classes offer advantages in a network with color-based traffic engineering.
- Describe the advantages and operation of Flex Algo.
- Demonstrate how to configure and verify Flex Algo for SRv6 micro-SIDs on a Junos OS device.
- Describe the process by which Junos OS calculates a uSID stack for TI-LFA backup paths.

COURSE CONTENTS

DAY 1

Module 1: Introducing Segment Routing

- Explain how a segment is like an instruction to forward or process a packet in a particular way
- Describe the high-level difference between SR-MPLS, classic SRv6, and micro-SIDs
- Demonstrate at a high level how segments are advertised inside your IGP

Module 2: The Features Enabled by Segment Routing

- Explain how segment routing enables both shortest paths and traffic engineered paths
- Describe some exciting features offered by segment routing, such as Flex Algo and TI-LFA

Module 3: Segments in the Data Plane - SR-MPLS

- Describe how SR-MPLS creates stacks of segments
- Demonstrate how SR-MPLS encodes global and local segments with an MPLS label

Module 4: Segments in the Data Plane - SRv6 Micro-SIDs

- Explain how micro-SIDs compress one SID into a single IPv6 hextet
- Describe how the SRv6 locator enables shortest-path routing to a remote node
- Describe how the SRv6 function encodes an instruction for a local router to process

Module 5: SRv6 Micro-SID Locators - Configuration and Verification

- Explain the design of the test network used throughout this course
- Describe how to choose and deploy a uSID locator block
- Configure a uSID locator prefix in Junos OS
- Verify uSID locator blocks and prefixes in Junos OS

Lab 1: Enabling Locators and Shortest-Path Tunnels in an SRv6 Micro-SID Network

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Module 6: SRv6 Micro-SID Functions

- Explain the purpose and meaning of End.DT4, End.DT6, and End.DT46 functions in SRv6
- Demonstrate the importance of maintaining separate blocks of uSID values for global and local segments

Module 7: SRv6 Micro-SIDs - Initial EBGP and IBGP Configuration

- Configure IPv6 EBGP sessions to advertise IPv4 prefixes with IPv4 next-hops
- Configure IBGP to process SRv6 SIDs and to advertise IPv4 prefixes with IPv6 next-hops
- Demonstrate how to verify that your IBGP network is ready to host uSIDs

Lab 2: Configuring the Underlying EBGP and IBGP Settings for SRv6 Micro-SIDs

DAY 2

Module 8: uDT4 and uDT6 Micro-SIDs - Configuration and Verification

- Configure uDT4, uDT6, and uDT46 micro-SIDs in the default Junos OS routing tables
- Verify BGP micro-SID prefix resolution on the Junos OS CLI

Lab 3: Tagging BGP Prefixes with uDT4 and uDT6 Micro-SIDs for IP Prefix Resolution

Module 9: Customizing the Micro-SID Local ID Block

- Configure Junos OS to allocate a range of micro-SID values for manual allocation
- Configure Junos OS to allocate a larger range of micro-SID values to the LIB

Module 10: SRv6 Micro-SIDs and Layer 3 VPNs

- Describe the transposition process of using MPLS labels in BGP Updates to efficiently advertise SRv6 SIDs
- Demonstrate how to deploy a Layer 3 VPN that uses the SRv6 micro-SID data plane
- Describe the function types required in a variety of Layer 2 VPNs, such as EVPN and VPLS

Lab 4: SRv6 Micro-SID Block Customization and VPN Micro-SIDs

Module 11: Micro-SID Stacks, SID Popping, and the Segment Routing Header (SRH)

- Explain how transport micro-SIDs can be popped along a defined path
- Describe the format and behavior of the segment routing header
- Configure and verify End.X segments for direct next-hop transport instructions

Lab 5: Enabling SRv6 Micro-SID Transport Segments for Traffic-Engineered Paths

Module 12: Topology-Independent Loop-Free Alternate - Theory

- Explain how TI-LFA creates loop-free backup paths with full topology coverage
- Explain the concepts of the pre-convergence and post-convergence topologies
- Describe the difference between link protection and node protection in TI-LFA

DAY 3

Module 13: TI-LFA Link Protection - Configuration

- Configure Junos OS for TI-LFA with link protection
- Verify how Junos creates SRv6 TI-LFA SID stacks to route around pre-convergence loops

Module 14: TI-LFA Node Protection - Configuration

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- Configure Junos OS for TI-LFA with loose node protection
- Configure Junos OS for TI-LFA with strict node protection
- Explain what types of traffic are eligible for local repair

Lab 6: Topology-Independent Loop-Free Alternate

Module 15: Color-Based Traffic Engineering and the BGP Color Community

- Describe the format of the BGP color community
- Demonstrate how to configure an SR policy with a color
- Explain why Junos offers two different methods of enabling color-aware prefix resolution

Module 16: Flex Algo, Part 1

- Explain the advantage of using Flex Algo to create multiple topologies with their own unique SPF metric
- Explain the meaning of algos 0, 1, and 128 to 255
- Configure the elements used to build a unique Flexible Algorithm Definition

Module 17: Color-Based Traffic Engineering with Classful Transport

- Explain the advantages of resolving color-tagged prefixes using the Classful Transport method
- Configure automatic and manual transport classes
- Verify whether IP unicast prefixes have resolved using a transport class
- Verify whether VPN prefixes have resolved using a transport class

Lab 7: Enabling Classful Transport in Junos OS

Module 18: Flex Algo, Part 2

- Configure a Flex Algo topology using the Classful Transport method of resolution
- Verify and troubleshoot a Junos OS Flex Algo deployment
- Describe some important design considerations when deploying Flex Algo

Lab 8: Flex Algo for SRv6 Micro-SIDs

Self-Study Modules

Module 19: Topology-Independent Loop-Free Alternate - The Micro-SID Stack

- Explain how P space and extended P space find loop-free backup paths
- Demonstrate how Q space can be used to tunnel backup paths across topological loops
- Describe how adjacency segments can bridge gaps between P space and Q space

Module 20: Classic SRv6

- Describe the behavior of the original method of using classic SRv6 to create locators and functions
- Configure and verify a basic classic SRv6 network

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