

Segment Routing Commands

This chapter describes the commands used to configure and use Segment Routing.

To use commands of this module, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using any command, contact your AAA administrator for assistance.

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adjacency-sid

To manually allocate an adjacency segment ID (Adj-SID) on an interface, use the **adjacency-sid** command in IS-IS interface address family configuration mode. To remove the Adj-SID, use the **no** form of the command.

adjacency-sid {**index** *adj-sid-index* | **absolute** *adj-sid-value*} [**protected**]

Syntax Description

index *adj-sid-index*	Specifies the Adj-SID for each link based on the lower boundary of the SRLB + the index.
absolute *adj-sid-value*	Specifies the specific Adj-SID for each link within the SRLB.
protected	Specify if the Adj-SID is protected. For each primary path, if the Adj-SID is protected on the primary interface and a backup path is available, a backup path is installed. By default, manual Adj-SIDs are not protected.

Command Default

Adjacency SID is not protected.

Command Modes

IS-IS interface address-family configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

Segment routing must be configured on the IS-IS instance before configuring adjacency SID value.

Manually allocated Adj-SIDs are supported on point-to-point (P2P) interfaces.

Task ID

Task ID	Operations
isis	read, write

Examples

This example shows how to configure an Adj-SID.

```
RP/0/RSP0/CPU0:router # configure
RP/0/RSP0/CPU0:router(config)# router isis 100
RP/0/RSP0/CPU0:router(config-isis)# interface GigabitEthernet0/0/0/7
RP/0/RSP0/CPU0:router(config-isis-if)# point-to-point
RP/0/RSP0/CPU0:router(config-isis-if)# address-family ipv4 unicast
RP/0/RSP0/CPU0:router(config-isis-if-af)# adjacency-sid index 10
```

Related Commands

Command	Description
segment-routing local-block, on page 56	Configures the segment routing local block (SRLB).

bandwidth-metric flex-algo

To configure an application specific bandwidth metric for the interface, use the **bandwidth-metric** command in the IS-IS interface address-family submode.

bandwidth-metric **flex-algo** *value*

Syntax Description

bandwidth-metric		Configures an application specific bandwidth metric for the interface.
flex-algo	*value*	Flex-algo bandwidth metric for the interface. The value can range from 1 to 16777214.

Command Default

No default behavior or values

Command Modes

IS-IS interface address-family submode

Command History

Release	Modification
Release 24.4.1	This command was introduced.

Usage Guidelines

None

Task ID

Task ID	Operations
isis	read, write

Example

This example shows how to configure flex-algo bandwidth-mteric for an interface.

```
Router(config)#router isis 1
Router(config-isis)#interface GigabitEthernet 0/2/0/7
Router(config-isis-if)#address-family ipv4 unicast
Router(config-isis-if-af)#bandwidth-metric flex-algo 100
Router(config-isis-if-af)#commit
```

bgp best-path sr-policy

To select the best path, backup, or multipath resolving over nexthop using SR policies, use the **bgp best-path sr-policy** command in BGP configuration mode. To remove the configuration, use the **no** form of the command.

bgp best-path sr-policy { **force** | **prefer** }

Syntax Description

force	When force mode is enabled, only SR policy paths are considered for best path calculation.
prefer	When prefer mode is enabled, SR policy paths and eBGP non-color paths are eligible for best path calculation.

Command Default

None.

Command Modes

BGP configuration mode

Command History

Release	Modification
Release 7.5.2	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Example

The following example shows how to enable the force mode:

```
Router(config)#router bgp 100
Router(config-bgp)#bgp router-id 10.1.1.2
Router(config-bgp)#bgp best-path sr-policy force
```

clear segment-routing local-block discrepancy all

Clears segment routing local block (SRLB) label conflicts.

clear segment-routing local-block discrepancy all

Syntax Description

This command has no keywords or arguments.

Command Default

None

Command Modes

EXEC

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

When you define a new SRLB range, there might be a label conflict (for example, if labels are already allocated, statically or dynamically, in the new SRLB range). In this case, the new SRLB range will be accepted, but not applied (pending). The previous SRLB range (active) will continue to be in use until one of the following occurs:

- Reload the router to release the currently allocated labels and allocate the new SRLB
- Use the **clear segment-routing local-block discrepancy all** command to clear the label conflicts

Task ID

Task ID	Operation

This example shows how to clear SRLB label conflicts.

```
RP/0/RSP0/CPU0:router(config)# clear segment-routing local-block discrepancy all
```

Related Commands

Command	Description
show segment-routing local-block inconsistencies, on page 86	Displays SRLB label conflicts
segment-routing local-block, on page 56	Configures the SRLB

distribute link-state (IS-IS)

To configure filters for IS-IS advertisements to BGP-LS, use the **distribute link-state** command in the IS-IS configuration mode.

distribute link-state [**exclude-external exclude-interarea route-policy** *name*]

Table 1: Syntax Description:

Syntax	Description
exclude-external	Set filter to exclude information for external prefixes and specify a route-policy name to filter based on a set of destination prefixes.
exclude-interarea	Set filter to exclude information for interarea prefixes and specify a route-policy name to filter based on a set of destination prefixes.
route-policy*name*	Distribute prefixes based on the route policy name set.

Command Modes

IS-IS Configuration

Command History

Release	Modification
Release 7.10.1	New keywords were introduced under **distribute link-state**.

Example

This example shows how to configure different filters for IS-IS advertisements to BGP-LS:

```
Router#config
Router(config)#router isis 1
Router(config-isis)#distribute link-state exclude-external
Router(config-isis)#commit

Router#config
Router(config)#router isis 1
Router(config-isis)#distribute link-state exclude-interarea
Router(config-isis)#commit

Router# config
Router(config)# router isis 1
Router(config-isis)#distribute link-state route-policy isis-rp-1
Router(config-isis)#commit
```

encapsulation

To configure SRv6 encapsulation parameters, use **encapsulation** command in the `srv6 encap` configuration mode.

encapsulation source-address ipv6-addr hop-limit { *count* | **propagate** } **traffic-class** { *value* | **propagate** }

Syntax Description

encapsulation source-address	Source address of the outer encapsulating IPv6 header. The default source address for encapsulation is one of the loopback addresses.
encapsulation hop-limit { *count* | **propagate**}	The hop limit of outer-encapsulating IPv6 header. The range for count is from 1 to 255. The default value for hop-limit is 255. Use **propagate** to set the hop-limit value by propagation from incoming packet or frame.
encapsulation traffic-class { *value* | **propagate**}	The traffic-class field settings on the IPv6 header. Specify the value as 2 hexadecimal nibbles for traffic class; valid values are from 0x0 to 0xff. Use **propagate** to set the traffic-class value by propagation from incoming packet or frame.

Command Default

None

Command Modes

srv6-encap mode

Command History

Release	Modification
Release 7.3.1	This command was introduced.

Task ID

Task ID	Operation
system	read and write

The following example shows how to configure optional SRv6 encapsulation parameters.

```
Router(config)# segment-routing srv6 encapsulation
Router(config-srv6-encap)# source-address 1::1
Router(config-srv6-encap)# hop-limit 60
Router(config-srv6-encap)# traffic-class propagate
Router(config-srv6-encap)# exit
Router(config-srv6)#
```

encapsulation-type srv6 relax-sid

To configure the BGP signaling for coexistence of IP routes with or without SRv6 SID over an SRv6-enabled core network use **encapsulation-type srv6 relax-sid** command in XR Config mode.

encapsulation-type srv6 relax-sid

Syntax Description

encapsulation-type srv6 relax-sid	Enables coexistence of IP routes with or without SRv6 SID.

Syntax Description

This command has no keywords or arguments.

Command Default

The BGP signaling for coexistence of IP routes with or without SRv6 SID over an SRv6-enabled core network is enabled.

Command Modes

Multicast routing VRF address family configuration

Command History

Release	Modification
Release 24.3.1	This command was introduced.

Task ID

Task ID	Operation
system	read and write

Example

The following example shows how to enable BGP signaling for coexistence of IP routes with or without SRv6 SID over an SRv6-enabled core network:

```
Router(config)# router bgp 2
Router(config-bgp)# neighbor-group srv6-core-relax
Router(config-bgp-nbr)# address-family ipv4 unicast
Router(config-bgp-nbr-af)# encapsulation-type srv6 relax-sid
Router(config-bgp-nbr-af)# exit
```

extra-padding

To configure probe padding information, use **extra-padding** command in probe configuration submode.

```
extra-padding  ber-detection  pattern  value  local  size  value
```

Syntax Description

ber-detection	Enables bit error detection and bit error rate measurement.
pattern*value*	Specifies a custom padding pattern for the probe using a sequence of 1 to 30 hexadecimal byte values, each in the range 0x0 to 0xff) This pattern will be used to fill the extra padding content in the probe packets.
patternlocal	Specifies that the defined padding pattern is local to the device and will not be included in the probe packet transmitted over the network. This means the pattern is used only for local processing and is not visible to remote devices.
size*value*	Specifies the size (in bytes) of the extra padding content to be added to the probe packet. The value must be an integer in the range of 4 to 9060.

Command Default

This command is disabled by default.

Command Modes

probe configuration submode

Command History

Release	Modification
Release 26.1.1	This command was introduced.

Usage Guidelines

- You need to configure BER detection under the `extra-padding` sub-mode.
- Padding data validation is disabled unless you explicitly enable it. If validation is enabled, the default pattern is `0xFF00`.
- You can configure a pattern without configuring a size, but the router does not apply the pattern or display it in operational output unless padding is enabled.
- When you enable the `local` option, the sender omits the padding TLV from the packet. The reflector uses its locally configured expected pattern to detect bit errors.

Task ID

Task ID	Operation
system	read and write

This example shows how to enable BER detection on the sender:

```
Router(config)# performance-measurement
Router(config-perf-meas)#delay-profile interfaces default
Router(config-pm-dm-intf)#probe
```

```
Router(config-pm-dm-intf-probe)#extra-padding
Router(config-pm-intf-profile-padding)#size 1500
Router(config-pm-intf-profile-padding)#pattern 0xDE local
Router(config-pm-intf-profile-padding)# ber-detection
Router(config-pm-intf-profile-padding)#exit
```

fast-reroute

To enable Topology Independent Loop Free Alternate (TI-LFA) path using the IP Fast Reroute (FRR) mechanism, use the **fast-reroute** command in interface configuration mode. To return to the default behavior, use the **no** form of this command.

fast-reroute per-prefix ti-lfa

Syntax Description

per-prefix	Specifies an alternate path for every prefix on the specified interface.
ti-lfa	Enables link-protecting TI-LFA.

Command Default

FRR is disabled.

Link protection is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

When a protected link used by the fast-reroutable label switched path (LSP) fails, the traffic is rerouted to a previously assigned backup tunnel. Configuring FRR on the tunnel informs all the nodes that the LSP is traversing that this LSP desires link/bandwidth protection.

You must verify the redundancy is ready after an RP switchover before triggering FRR on standby RP to synchronize with the active RP (verified using the **show redundancy** command). All TE tunnels must be in the recovered state and the database must be in the ready state for all ingress and egress line cards. To verify this information, use the **show mpls traffic-eng tunnels** and **show mpls traffic-eng fast-reroute database** commands.



Note We recommend that you wait approximately 60 seconds before triggering FRR after verifying the database state.

If the priority associated with the specified tiebreaker is higher than any other tiebreakers, then the specified post-convergence backup path will be selected, if it is available.

Task ID

Task ID	Operations
isis ospf	read, write

Examples

The following example shows how to enable FRR on an interface:

```
RP/0/RSP0/CPU0:R1(config)# router isis 1
RP/0/RSP0/CPU0:R1(config-isis)# interface TenGigE0/0/0/2/1
RP/0/RSP0/CPU0:R1(config-isis-if)# point-to-point
RP/0/RSP0/CPU0:R1(config-isis-if)# address-family ipv4 unicast
RP/0/RSP0/CPU0:R1(config-isis-if)# fast-reroute per-prefix
RP/0/RSP0/CPU0:R1(config-isis-if)# fast-reroute per-prefix ti-lfa
RP/0/RSP0/CPU0:R1(config-isis-if)# exit
```

generic-metric flex-algo

To configure an application-specific user-defined generic metric for IS-IS interfaces, use the **generic-metric flex-algo** command in the IS-IS interface address-family submode.

generic-metric flex-algo type *type value*

Syntax Description

type <*type*>	Specify the generic metric type. The range is 128–255.
<*value*>	Specify the flex-algo generic metric value. The range is 1–16777214.

Command Default

By default, the generic metric is not used.

Command Modes

IS-IS interface address-family submode.

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

None.

Task ID

Task ID	Operations
isis	read, write

Example

The following example shows how to configure a user-defined application-specific generic metric for an interface:

```
Router(config)#router isis 1
Router(config-isis)#interface GigabitEthernet 0/2/0/7
Router(config-isis-if)#address-family ipv4 unicast
Router(config-isis-if-af)#generic-metric flex-algo type 128 100
Router(config-isis-if-af)#commit
```

group-mode

To enable interface group mode for bandwidth metric computation, use the **group-mode** command in the IS-IS flex-algo auto-cost submode. This command facilitates the cumulative bandwidth metric calculation for parallel links.

group-mode

Syntax Description

group-mode	Enables interface group mode for bandwidth metric computation.

Command Default

Group mode is disabled.

Command Modes

IS-IS flex-algo auto-cost submode

Command History

Release	Modification
Release 24.4.1	This command was introduced.

Usage Guidelines

None

Task ID

Task ID	Operations
isis	read, write

Example

This example shows how to enable group mode for bandwidth metric computation.

```
Router(config)#router isis 1
Router(config-isis)#flex-algo 131
Router(config-isis-flex-algo)#auto-cost reference
Router(config-isis-flex-algo-af-auto-cost)#group-mode
Router(config-isis-flex-algo-af-auto-cost)#commit
```

hw-module profile segment-routing srv6 mode

To enable Segment Routing over IPv6, use the **hw-module profile segment-routing srv6** command in XR Config mode.



Note Use the mandatory keyword **mode** from release 7.7.1 onwards.

hw-module profile segment-routing srv6 mode [{ **base** *f1* } | { **micro-segment format** *f3216* } | [**path-mtu**]]

Syntax Description

Mode	Defines the SRV6 format that are supported: • Base: f1 (represents the base format 1). • Micro-segment format: f3216 (represents the format 3216, which is 32-bit block and 16-bit IDs).
path-mtu	Enables Path MTU Discovery over Ingress, Egress, and P or Transit nodes (with IPv6 role).

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes XR Config

Command History

Release	Modification
Release 24.1.1	The **path-mtu** keyword was introduced.
Release 7.7.1	**Mode** keyword is mandatory from release 7.7.1 onwards.
Release 6.6.1	This command was introduced.

Usage Guidelines Use the mandatory keyword **mode** from release 7.7.1 onwards.

Do not use the keyword **mode** prior to release 7.7.1.

The router must be reloaded for the **hw-module profile segment-routing srv6** feature to be functional.

Task ID

Task ID	Operation
system	read, write

Example

The following example shows how to enable Segment Routing over IPv6 for micro-segment format, from release 7.7.1 onwards:

```
Router(config)# hw-module profile segment-routing srv6 mode base f1
Router(config-srv6)# encapsulation
Router(config-srv6-encap)# l2-traffic
Router(config-srv6-encap-l2)# traffic-class propagate
In order to activate/deactivate this srv6 profile, you must manually reload the chassis/all
 line cards
```

The following example shows how to enable Segment Routing over IPv6 for base, from release 7.7.1 onwards:

```
Router(config)# hw-module profile segment-routing srv6 mode micro-segment format f3216
Router(config-srv6)# encapsulation
Router(config-srv6-encap)# l3-traffic
Router(config-srv6-encap-l3)# traffic-class policy-map
In order to activate/deactivate this srv6 profile, you must manually reload the chassis/all
 line cards
```

The following example shows how to enable Segment Routing over IPv6, prior to release 7.7.1:

```
Router# configure
Router(config)# hw-module profile segment-routing srv6
```

isis prefix-attributes n-flag-clear

To set the N-flag in the Prefix Attribute Flags sub-TLV to 0, use the **isis prefix-attributes n-flag-clear** command.

isis prefix-attributes n-flag-clear [**level-1** | **level-2**]

Syntax Description

level-1	Clears the N-flag for level-1.
level-2	Clears the N-flag for level-2.

Command Default

The N-flag is set to 1 for host prefixes (/32 for IPv4 and /128 for IPv6).

Command Modes

Interface configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

The Prefix Attributes Flag sub Type Length Value (TLV) supports the advertisement of attribute flags associated with prefix advertisements. By default, the N-flag is set by IS-IS when advertising a SID that is associated with a loopback address. The advertising router may choose to not set this flag. When the N-flag is cleared, the N-flag is set to 0 in the Prefix Attribute Flags sub-TLV.

Prefix attributes are only added when wide metric is used.

Task ID

Task ID	Operation

This example shows how to clear the N-flag:

```
RP/0/RSP0/CPU0:router # configure
RP/0/RSP0/CPU0:router(config)# interface loopback0
RP/0/RSP0/CPU0:router(config-if)# isis prefix-attributes n-flag-clear
```

l2-adjacency sid

To manually configure a Layer 2 adjacency segment ID (Adj-SID) on an interface, use the **l2-adjacency sid** in adjacency SID interface address-family configuration mode. To remove the Layer 2 Adj-SID, use the **no** form of this command.

l2-adjacency sid {**index** *adj-SID-index* | **absolute** *adj-SID-value*} [**next-hop** *ipv4_address*]

Syntax Description

index *adj-SID-index*	Specifies the Adj-SID for each link based on the lower boundary of the SRLB + the index.
absolute *adj-SID-value*	Specifies the specific Adj-SID for each link within the SRLB.
next-hop *ipv4_address*	(Optional) Specifies the next-hop neighbor IPv4 address.

Command Default

None

Command Modes

Adjacency SID interface address-family

Command History

Release	Modification
Release 7.0.14	This command was introduced.

Usage Guidelines

For point-to-point interfaces, you are not required to specify a next-hop. However, if you do specify the next-hop, the Layer 2 Adj-SID will be used only if the specified next-hop matches the neighbor address.

For LAN interfaces, you must configure the next-hop IPv4 address. If you do not configure the next-hop, the Layer 2 Adj-SID will not be used for LAN interface.

Task ID

Task ID	Operation

Example

This example shows how to configure a Layer 2 Adj-SID on an interface:

```
RP/0/RP0/CPU0:ios(config)# segment-routing
RP/0/RP0/CPU0:ios(config-sr)# adjacency-sid
RP/0/RP0/CPU0:ios(config-sr-adj)# interface gigabitEthernet 0/0/0/3
RP/0/RP0/CPU0:ios(config-sr-adj-intf)# address-family ipv4 unicast
RP/0/RP0/CPU0:ios(config-sr-adj-intf-af)# l2-adjacency-sid index 300 next-hop 1.1.1.4
```

metric-type bandwidth

To use the bandwidth of the links as a metric for flexible algorithm calculation, use the **metric-type bandwidth** command in the IS-IS flexible algorithm configuration mode.

metric-type bandwidth

Syntax Description

metric-type bandwidth	Use bandwidth metric for flex-algo calculation.

Command Default

No default behavior or values

Command Modes

IS-IS flexible algorithm configuration submode

Command History

Release	Modification
Release 24.4.1	This command was introduced.

Usage Guidelines

None

Task ID

Task ID	Operations
isis	read, write

Example

This example shows how to associate and advertise the bandwidth metric to a Flexible Algorithm Definition.

```
Router(config)#router isis 1
Router(config-isis)#flex-algo 131
Router(config-isis-flex-algo)#metric-type bandwidth
Router(config-isis-flex-algo)#advertise-definition
Router(config-isis-flex-algo)#commit
```

metric-type generic

To use the user-defined generic metrics as a metric for Flexible Algorithm Definition (FAD), use the **metric-type generic** command in the IS-IS flexible algorithm configuration mode.

metric-type generic *type*

Syntax Description

<*type*>	Specify the generic metric type. The range is 128–255.

Command Default

By default, the generic metric is not used.

Command Modes

IS-IS Flex Algo.

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

If a user-defined generic metric is enabled, the router advertises and uses the metrics for flexible algorithm computation.

Task ID

Task ID	Operations
isis	read, write

Example

The following example shows how to associate or advertise the configured user-defined generic metric to a Flexible Algorithm Definition. The user-defined application-specific generic metric is configured for an interface using the **generic-metric flex-algo** command.

```
Router(config)#router isis 1
Router(config-isis)#flex-algo 128
Router(config-isis-flex-algo)#priority 254
Router(config-isis-flex-algo)#metric-type generic 177
Router(config-isis-flex-algo)#advertise-definition
```

microloop avoidance rib-update-delay

To set the Routing Information Base (RIB) update delay value to avoid microloops in the network, use the **microloop avoidance rib-update-delay** command. To disable the RIB update delay, use the **no** form of this command.

microloop avoidance rib-update-delay *delay-time*

Syntax Description

delay-time	Specifies the amount of time the node uses the microloop avoidance policy before updating its forwarding table. The *delay-time* is in milliseconds. The range is from 1-60000.

Command Default

The default value is 5000 milliseconds.

Command Modes

IPv4 address family configuration

Router configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

Use this command with the **microloop avoidance segment-routing** command to specify how long the path to the destination is used. After the RIB update delay timer expires, the path is replaced with regular forwarding paths.

Task ID

Task ID	Operation
ospf isis	read, write

Example

This example shows how to set the Routing Information Base (RIB) update delay value for OSPF:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# router ospf 1
RP/0/RSP0/CPU0:router(config-ospf)# microloop avoidance segment-routing
RP/0/RSP0/CPU0:router(config-ospf)# microloop avoidance rib-update-delay 3000
```

This example shows how to set the Routing Information Base (RIB) update delay value for IS-IS:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# router isis 1
RP/0/RSP0/CPU0:router(config-isis)# address-family ipv4 unicast
RP/0/RSP0/CPU0:router(config-isis-af)# microloop avoidance segment-routing
```

```
RP/0/RSP0/CPU0:router(config-isis-af)# microloop avoidance rib-update-delay 3000
```

microloop avoidance segment-routing

To enable the segment routing microloop avoidance and set the Routing Information Base (RIB) update delay value, use the **microloop avoidance** command. To disable segment routing microloop avoidance, use the **no** form of this command.

microloop avoidance segment-routing

Command Default

Disabled.

Command Modes

IPv4 address family configuration

Router configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

The Segment Routing Microloop Avoidance feature detects if microloops are possible following a topology change. If a node computes that a microloop could occur on the new topology, the node creates a loop-free path to the destination using a list of segments. After the RIB update delay timer expires, the path is replaced with regular forwarding paths.

Task ID

Task ID	Operation
ospf isis	read, write

Example

This example shows how to enable Segment Routing Microloop Avoidance for OSPF:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# router ospf 1
RP/0/RSP0/CPU0:router(config-ospf)# microloop avoidance segment-routing
RP/0/RSP0/CPU0:router(config-ospf)# microloop avoidance rib-update-delay 3000
```

This example shows how to enable Segment Routing Microloop Avoidance for IS-IS:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# router isis 1
RP/0/RSP0/CPU0:router(config-isis)# address-family ipv4 unicast
RP/0/RSP0/CPU0:router(config-isis-af)# microloop avoidance segment-routing
RP/0/RSP0/CPU0:router(config-isis-af)# microloop avoidance rib-update-delay 3000
```

override-rules (PCE)

To configure a Path Computation Element (PCE) override of Path Computation Client (PCC)-Initiated policies, use the **override-rules** command in the PCE configuration mode.

override-rules sequence *sequence-number* [**matching-criteria peer** { **all** | **access-list ipv4** *acl-name* }]
override-rules sequence *sequence-number* [**matching-criteria lsp** { **all** | **name** *lsp-name-regex* }]
override-rules sequence *sequence-number* [**matching-criteria colors** *color-range*]
override-rules sequence *sequence-number* [**override** { **metric-type** { **igp** | **te** | **latency** | **hopcount** } | **constraints** { **bandwidth** *value* } }]

Syntax Description

sequence *sequence-number*	Specifies the sequence number. LSP can be matched to one override sequence at a time. Lower sequence numbers have higher precedence.
matching-criteria { **peer** | **lsp** | **color** }	(Optional) Specifies the matching criteria in the PCC-initiated policies to override. You can use peer, lsp, or color as the matching criteria.
matching-criteria peer { **all** | **access-list ipv4** *acl-name* }	Specifies *all* available peers or the *access-list ipv4* name that matches your criteria to override the PCC initiated policies.
matching-criteria lsp { **all** | **name** *lsp-name-regex* }	Specifies the LSP, the PCE tunnel database by all or specific name as a matching criteria.
matching-criteria colors *color-range*	Specifies the color range as a matching criteria. Available color ranges are namely, 0-50, 55, and 70–80.
override	(Optional) Disables load balancing of SR multicast traffic across ECMP paths.
metric	Specifies the override metric for IGP, TE, latency, or hop-count.
constraints	Specifies the override constraints in bandwidth value.

Command Default

No default behavior or values.

Command Modes

PCE configuration

Command History

Release	Modification
Release 7.7.1	This command was introduced.

Example 1: PCE override of PCC-initiated SR-TE policies

This example shows PCE override rules.

```
router# configure
```

```
router(config)# pce
router(config-pce)# override-rules
router(config-pce-ovr-rule)# sequence 100
router(config-pce-ovr-rule-seq)# matching-criteria
router(config-pce-ovr-rule-crit)# peer
router(config-pce-ovr-rule-peer)# all
router(config-pce-ovr-rule-peer)# exit
 !
router(config-pce-ovr-rule-crit)# lsp colors 0-50
router(config-pce-ovr-rule-crit)# exit
    !
router(config-pce-ovr-rule-seq)# override constraints bandwidth 1000
!
```

partition-detect

Use **partition-detect** command for an area or domain partition detection. It is a new command under IS-IS address-family sub-mode.

partition-detect { track *IPv4 address | IPv6 address [external-id IPv4 -address | IPv6 address]*

Syntax Description

Keyword	Details
track*IPv4 address | IPv6 address [external-id IPv4 -address | IPv6 address]*	Tracks the reachability of the specific ABR or ASBR. This command is under the partition-detect sub-mode. • Only IPv4 address is allowed under IPv4 address-family sub-mode and only IPv6 address is allowed under IPv6 address-family sub-mode. • external-id is only used for ASBR tracking. External-id is the address of the ASBR, in other domain.

Command Default

None.

Command Modes

IS-IS interface address-family configuration

Command History

Release	Modification
Release 7.10.1	This command was introduced.

Task ID

Task ID	Operations
IS-IS	read, write

Examples

This example shows how to configure partition-detect.

```
Router(config)#router isis 1
Router(config-isis)#address-family ipv6 unicast
Router(config-isis-af)#router-id 2001:DB8:4::4
Router(config-isis-af)#partition-detect
Router(config-isis-af)#track 2001:DB8:1::1
Router(config-isis-af)#commit
```

performance-measurement delay-profile name

To detect the delay of an name, use the **performance-measurement delay-profile name** command in global configuration. To disable the delay-profile, use the **no** form of the command.

performance-measurement delay-profile name value probe [**flow-label** { **explicit value** | **from value to value increment value** } | **measurement-mode** { **one-way** | **two-way** | **loopback** } | **sweep destination ipv4** *ip-address* **range** *range-value* | **tos** { **dscp value** | **traffic-class value** } | **tx-interval** *value*]

Syntax Description

flow-label{**explicit** *value* | **from** *value* **to** *value* **increment**}	Specify explicit list of flow labels or specify the range. The range is from 1 to 28 flow labels.
measurement-mode {**one-way** | **two-way** | **loopback**}	Specify the delay measurement mode. There are three options: one-way: Measures the one way delay with timestamp 1 and 2. two-way: Measures the one way delay with timestamp 1, 2, 3 and 4 without clock synchronization. loopback: Measures the delay in loopback mode.
sweep destination ipv4*ip-address***range***value*	Specify the sweep IP destination addresses to perform ECMP hashing. The IPv4 adress range is 0 to 128.
tos {**dscp** *value* | **tos traffic-class** *value*}	Specify the delay probe type of service. The allowed range for DSCP is 0 to 63. specify the traffic class value to indicate the TOS level used by protocol PM MPLS. The range is from 0 to 7.
tx-interval *value*	Specify the transmission interval. The allowed range is from 30000 to 15000000 micro seconds.
probe	Enter probe configuration submode.

Command Default

The default measurement-mode is **one-way**.

The default ToS DSCP value is 48 for IP/UDP.

Command Modes

XR Config

Command History

Release	Modification
Release 7.4.1	This command was introduced.
Release 7.6.1	The **name** *name* keyword was deprecated. Use the **performance-measurement delay-profile name** command to create a named profile.
Release 24.2.11	The command is modified to include the **flow-label** keyword.

Example

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

```
Router(config)# performance-measurement
Router(config-perf-meas)# delay-profile endpoint default
Router(config-pm-dm-ep)# probe
Router(config-pm-dm-ep-probe)# measurement-mode one-way
```

The following example shows how to configure flow label for delay profile.

performance-measurement endpoint

To enable endpoint for the performance measurement, use the **performance-measurement endpoint** command in global configuration mode. To disable the endpoint, use the **no** form of the command.

performance-measurement endpoint ipv4 | **ipv6** *endpoint_ip_addr* [**vrf** *name*] [**delay-measurement** [**delay-profile name** *profile_name*] | **description** *description* | **liveness-detection** [**liveness-profile name** *profile_name*] | **segment-list name** *sidlist_name* | **source-address ipv4** | **ipv6** *source_ip_addr*]

Syntax Description

endpoint_ip_addr	IPv4 and IPv6 address of the endpoint.
vrf *name*	The name of the VRF instance.
delay-measurement	Enable delay-measurement on the endpoint.
delay-profile name *profile_name*	Specify an optional delay profile name.
description *description*	Specify a description for the endpoint.
liveness-detection	Enable liveness-detection on the endpoint.
liveness-profile name *profile_name*	Specify an optional liveness profile name.
segment-list name *sidlist_name*	Specify a segment list for the endpoint.
source-address ipv4 *source_ip_addr*	IPv4 address of the sender.
source-address ipv6 *source_ip_addr*	IPv6 address of the sender.

Command Default

None

Command Modes

XR Config

Command History

Release	Modification
Release 24.2.11	The command was modified to include IPv6 endpoint.
Release 7.4.1	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The following example show how to enable IPv4 endpoint for the delay measurement.

```
Router(config)# performance-measurement
Router(config-perf-meas)# endpoint ipv4 10.10.1.5
Router(config-pm-ep)# source-address ipv4 10.10.1.1
Router(config-pm-ep)# delay-measurement
```

The following example show how to configure IPv6 endpoint for liveness.

```
Router(config)#performance-measurement
Router(config-perf-meas)#source-address ipv6 FCBB:0:1::
Router(config-perf-meas)#endpoint ipv6 FCBB:0:5::
Router(config-pm-ep)#exit
Router(config-perf-meas)#liveness-profile endpoint default
```

performance-measurement interface

This command helps you configure the target interface with probe packets that transit Interface ID and timestamp templates within a network.

Starting from Cisco IOS XR Release 24.4.1, the command can be used to enable delay measurement for GRE or IP-in-IP interfaces.

performance-measurement interface { **tunnel-ip** *{0-131070}* | **GigE 0 / 1 / 0 / 1** **path-tracing** { **interface-id** *<1-4095>* | **timestamp template** { **st0** | **st1** | **st2** | **st3** } } | **delay-measurement advertise-delay fallback** *<1-16777215>* }

Syntax Description

path-tracing	Enables path-tracing for the interface for tracing short timestamp, interface-id and interface load on source, midpoint and sink nodes in PT probes.
interface-id	Enter interface ID that is between 1-4095. Default value is none. Interface ID value 0 is used internally to indicate PT is disabled on the interface.
Timestamp template *{st0 | st1 | st2 | st3}*	Enter the Timestamp template you want to configure. You can apply global template type for short timestamp to st1 to overwrite the default value.
tunnel-ip	Enable the GRE or IP-in-IP tunnel interface.
{0-131070}	Enter the GRE or IP-in-IP tunnel interface. The range is 0 to 131070.
delay-measurement	Configure delay measurement on the interface and enter the delay mesurement submode.
advertise-delay fallback	Advertise the configured delay fallback value for interfaces when the computed delay metric is not available.
<1-16777215>	Specify the fallback delay value in microseconds. The range is 1-16777215.

Command Default

Path tracing is disabled by default.

The default value for Interface ID is set to None.

The default value for timestamp template is set to st2.

Command Modes

XR Config

Command History

Release	Modification
Release 24.4.1	The **advertise-delay fallback** keyword is introduced. The **tunnel-ip** keyword is now supported.
Release 7.8.1	This command was introduced.

Usage Guidelines

Enable path-tracing for the interface for tracing short timestamp, interface-id and interface load on source, midpoint and sink nodes in PT probes.

Examples

This example shows how to configure Path Tracing midpoint with InterfaceID and time-stamp:

```
Router(config)# performance-measurement
Router(config-pm)# interface FourHundredGigE0/0/0/1
Router(config-pm-interf)# path-tracing
Router(config-pm-interf-interf-id)# interface-id 200
Router(config-pm-interf-time)# timestamp template st3
Router(config-pm-interf-time)# exit
```

This example shows how to configure delay measurement for a specific GRE tunnel interface:

```
Router(config)#performance-measurement
Router(config-perf-meas)#interface tunnel-ip 23
Router(config-pm-intf)#delay-measurement
Router(config-pm-intf-dm)#commit
```

The following example shows how to configure and advertise the interface fallback delay value when the computed delay metric is not available.

```
Router#config
Router(config)#performance-measurement
Router(config-perf-meas)#interface GigabitEthernet 0/2/0/0
Router(config-pm-intf)#delay-measurement
Router(config-pm-intf-dm)#advertise-delay fallback 1000
Router(config-pm-intf-dm)#commit
```

performance-measurement liveness-detection

To apply an SR performance measurement liveness profile to an SR-TE or an SRv6-TE policy, use the **performance-measurement liveness-detection** command in the SR-TE policy configuration mode. To disassociate the profile from the SR-TE policy, use the **no** form of the command.

performance-measurement liveness-detection [**liveness-profile** [**backup**] **name** *profile* | **validation-cp minimum-active segment-lists** [*1-128* | **all**] **probe** { **burst-interval** *value* | **tx-interval** *interval* }]

Syntax Description

liveness-profile [**backup**] **name** *profile*	(Optional) Specifies the liveness profile that is to be associated with the SR-TE policy. The **name** *profile* command form specifies the liveness profile, and the **backup name** *profile* command form specifies the backup liveness profile.
validation-cp minimum-active	(Optional) Validates the activeness of the candidate-path based on minimum number of active segment-lists.
segment-lists	Indicates the number of active segment-lists.
1-128 | **all**	• 1-128: Indicates the minimum number of segment-lists to have the PM liveness session up. • all: Indicates that all the segment-lists should be active to have the PM liveness session up.
probe	Enter endpoint liveness detection probe submode.
burst-interval *interval*	Specify the interval for sending probe packet. The range is from 30 to 15000 milliseconds.
tx-interval *value*	Specify the transmission interval. The allowed range is from 30000 to 15000000 micro seconds.
tos dscp *value*	Type of Service DSCP. The range is from 0 to 63.

Command Default

The Default performance measurement liveness profile is associated with an SR-TE policy.

Command Modes

SR-TE policy configuration (config-sr-te-policy)
On-Demand SR-TE policy configuration (config-sr-te-color)

Command History

Release	Modification
Release 7.11.1	The validation-cp minimum-active segment-lists option was introduced.
Release 7.10.1	The **burst-interval** *interval* keyword was deprecated.
Release 7.4.2	The **backup** keyword was added to the command.

Release	Modification
Release 7.3.1	This command was introduced.

Usage Guidelines

Path protection policies do not fully support PCE reporting of the standby LSP.

Example

This example shows how to associate a liveness profile to an SR-TE policy:

```
Router(config)#segment-routing traffic-eng
Router(config-sr-te)#policy TRST2
Router(config-sr-te-policy)#color 40 end-point ipv4 20.20.20.20
Router(config-sr-te-policy)#performance-measurement liveness-detection liveness-profile
name profile3

Router(config)#segment-routing traffic-eng
Router(config-sr-te)#on-demand color 30
Router(config-sr-te-color)#performance-measurement liveness-detection liveness-profile name
 profile3
Router(config-sr-te-color)#commit
```

This example shows how to associate a backup liveness profile to an SR-TE policy:

```
RP/0/RSP0/CPU0:ios# configure
RP/0/RSP0/CPU0:ios(config)#segment-routing traffic-eng
RP/0/RSP0/CPU0:ios(config-sr-te)#policy foo
RP/0/RSP0/CPU0:ios(config-sr-te-policy)# color 10 end-point ipv4 192.168.0.3
RP/0/RSP0/CPU0:ios(config-sr-te-policy)# performance-measurement
RP/0/RSP0/CPU0:ios(config-sr-te-policy-perf-meas)# liveness-detection
RP/0/RSP0/CPU0:ios(config-sr-te-policy-live-detect)# liveness-profile name profile-WORKING

RP/0/RSP0/CPU0:ios(config-sr-te-policy-live-detect)# liveness-profile backup name
profile-PROTECT
RP/0/RSP0/CPU0:ios(config-sr-te-policy-live-detect)# commit
```

This example shows how to activate two segment-lists to have the PM liveness session up:

```
Router(config)#segment-routing
Router(config-sr)#traffic-eng
Router(config-sr-te)#policy po-103
Router(config-sr-te-policy)#performance-measurement
Router(config-sr-te-policy-perf-meas)#liveness-detection
Router(config-sr-te-policy-live-detect)#validation-cp minimum-active segment-lists 2
```

performance-measurement liveness-profile

To create a unique Segment Routing performance measurement liveness profile, use the **performance-measurement liveness-profile** command in global configuration mode. To remove the profile, use the **no** form of the command.

performance-measurement liveness-profile [**name** [**name npu-offload enable**] | **probe flow-label** [**explicit** | **from**]]

Table 2: Syntax Description

Syntax	Description
name *name*	Specifies the Segment Routing performance measurement liveness profile name.
npu-offload	Enables performance measurement liveness hardware (NPU) offload feature in the SR
probe	Enter the liveness detection probe sub mode.
flow-label	Indicates the flow labels associated with SRv6 header.
explicit | **from**	Specify explicit flow label values or enter a range of flow labels that you want to configure. You can configure flow labels in the 0 to 1048575 range.

Command Default

No user created performance measurement liveness profile exists.

Command Modes

Global configuration (config)

Command History

Release	Modification
Release 7.11.1	This command was introduced on Cisco 8011-2X2XP4L PLE Service Endpoint Router.
Release 7.11.1	The **flow-label** keyword was introduced.

Usage Guidelines

The **performance-measurement** command is also available in SR-TE specific configuration.

Example

This example shows how to create a unique Segment Routing performance measurement liveness profile:

```
Router(config)# performance-measurement liveness-profile name profile1
Router(config)# commit
```

This example shows how to configure flow labels in the SRv6 header:

```
Router#configure
Router(config)#performance-measurement
```

```
Router(config-perf-meas)#liveness-profile name profile-sweeping
Router(config-pm-ld-profile)# flow-label from 0 to 1000000 increment 12345
Routerconfig-pm-ld-profile)#commit
```

This example shows how to configure a range of flow labels in the SRv6 header:

```
Router#configure
Router(config)#performance-measurement
Router(config-perf-meas)#liveness-profile name name1
Router(config-pm-ld-profile)# probe flow-label from 0 to 1000000 increment 10
Routerconfig-pm-ld-profile)#commit
```

This example shows how to explicitly configure flow labels in the SRv6 header:

```
Router#configure
Router(config)#performance-measurement
Router(config-perf-meas)#liveness-profile name name1
Router(config-pm-ld-profile)# probe flow-label explicit 100 200 300 400 500
Routerconfig-pm-ld-profile)#commit
```

performance-measurement delay-profile

To create a unique Segment Routing performance measurement delay profile, use the **performance-measurement delay-profile** command in global configuration mode.

performance-measurement delay-profile { **sr-policy default** } { **endpoint default** } { **interfaces default** } { **name** *string name* } **advertisement** { **anomaly-loss** } { **anomaly-check** } **upper-bound** *<1-99>* **lower-bound** *<number lower than the upper bound (0-98)>*



Note Synthetic Loss Measurement is an inbuilt feature of delay measurement. To get the packet loss information for delay-measurement sessions, you only need to configure the delay sessions. No additional configuration is required for Synthetic Loss Measurement.

Syntax Description

name *string name*	(Optional) Specifies the Segment Routing performance measurement delay profile name.
sr-policy default	(Optional) Specifies the Segment Routing performance measurement default sr-policy name.
endpoint default	(Optional) Specifies the Segment Routing performance measurement default endpoint name.
interfaces default	(Optional) Specifies the Segment Routing performance measurement default interface.
advertisement	Specifies the Segment Routing performance measurement advertisement you want to configure.
anomaly-check	(optional) It checks the delay metrics, for example if the min delay changes exceed the configured threshold, it advertises ANOM-MIN-DYN; if you configured the anomaly-check and the static delay, and the configured static delay exceed the threshold, it advertises ANOM-MIN-STA. You can configure the anomaly loss with **upper-bound** and **lower-bound** values. • **upper-bound** specifies the upper limit for the anomaly check. It must be between 2-200000 • **lower-bound** specifies the lower limit for the anomaly check. It must be between 1-199999 and lower than the **upper-bound** value.

anomaly-loss	(optional) Once the packet loss exceed the configured threshold, it advertises ANOM-PKT-LOSS. You can configure the anomaly loss with **upper-bound** and **lower-bound** values. • **upper-bound** specifies the upper limit for the anomaly loss. It must be between 1-99 • **lower-bound** specifies the lower limit for the anomaly loss. It must be between 0-98 and lower than the **upper-bound** value. If both **anomaly-check** and **anomaly-loss** are triggered, then it advertises for anomaly-check, because it has a higher priority than anomaly-loss • min delay changes = current min delay - previous min delay • packet loss = (expected packet number - received packet number) / expect packet number * 100%
anomaly-ber	You can configure interface delay profile advertisement anomaly BER boundary. It helps define the acceptable BER anomaly thresholds for performance measurement on the interface delay profile advertisement. The anomaly BER advertisement boundaries in the interface delay profile advertisement context are configured using the following parameters: • **upper-bound:** Specifies the upper limit for the anomaly BER advertisement. The valid range is from 1 to 1,000,000 parts per million (PPM). • **lower-bound:** Specifies the lower limit for the anomaly BER advertisement. The valid range is from 0 to 990,000 PPM

Command Default

No user created performance measurement delay profile exists.

Command Modes

Global configuration (config)

Command History

	Modification
Release 24.1.1	This command was introduced.

Task ID

Task ID	Operation
performance-measurement	write/read

Usage Guidelines

The **performance-measurement** command is also available in SR-TE specific configuration.

Example

This example shows how to create a unique Segment Routing performance measurement delay profile:

```
Router(config)# performance-measurement delay-profile sr-policy name profile1
Router(config)# commit
```



Note From release 24.2, the anomaly-loss configuration is modified and removed from sub-mode. Users must configure the upper-bound and lower-bound values before hitting commit.

This example shows the example of anomaly-loss:

```
Router(config)#performance-measurement
Router(config-perf-meas)#delay-profile sr-policy default
Router(config-pm-dm-srpolicy)#advertisement
Router(config-pm-dm-srpolicy-adv)#anomaly-loss upper-bound 30 lower-bound 20
Router(config-pm-dm-srpolicy-adv)#commit
```



Note From release 24.2, the anomaly-check configuration is modified and removed from sub-mode. Users must configure the upper-bound and lower-bound values before hitting commit.

This example shows the example of anomaly-check:

```
Router(config)#performance-measurement
Router(config-perf-meas)#delay-profile sr-policy default
Router(config-pm-dm-srpolicy)#advertisement
Router(config-pm-dm-srpolicy-adv)#anomaly-check upper-bound 2000 lower-bound 20
Router(config-pm-dm-srpolicy-adv)#commit
```

performance-measurement protocol twamp-light measurement delay

To configure the querier or responder nodes to accept packets from specific IP addresses on the network, use the **performance-measurement protocol twamp-light measurement delay** command in the global configuration mode. To remove the IP addresses, use the **no** form of the command.

performance-measurement protocol twamp-light measurement delay { **querier allow responder address** { **ipv4** | **ipv6** } | **responder allow querier address** { **ipv4** | **ipv6** } | **unauthenticated** { **ipv4** | **ipv6** | **querier-dst-port** | **querier-src-port** } }

Syntax Description

querier	Enter the querier submode to configure the IP addresses on a querier node.
responder	Enter the responder submode to configure the IP address on a responder node.
allow responder	Specifies the allowed responder address on the querier node. The configuration is applicable to delay measurement sessions.
allow querier	Specifies the allowed querier addresses on the responder node. The configuration is applicable to delay measurement sessions.
address	Specifies the querier or responder IP addresses that are configured.
{ ipv4 | ipv6 }	Configure the allowed querier or responder ipv4 or ipv6 addresses. You can specify the prefix for the IP addresses.
unauthenticated	Enter the unauthenticated submode to configure the IP address timestamp or the source and destination UDP ports.
ipv4 | ipv6	Configure the timestamp for ipv4 or ipv6 addresses.
querier-dst-port	Configure the UDP port to process queries. By default, the TWAMP reserved UDP destination port is 862.
querier-src-port	UDP port on Route Processor used as source port in queries.

Command Default

None.

Command Modes

Global Configuration

Command History

Release	Modification
Release 7.11.1	The **querier** and **responder** keywords were introduced.
Release 7.0.1	This command was introduced.

Usage Guidelines

None.

This example shows how to configure the IP address of a querier on a responder node for delay measurement.

```
Router#configure
Router(config)#performance-measurement
Router(config-perf-meas)#protocol twamp-light
Router(config-pm-protocol)#measurement delay
Router(config-pm-proto-meas)#responder
Router(config-pm-proto-responder)#allow-querier
Router(config-pm-allowed-querier)#address ipv4 10.10.10.1
Router(config-sr-te-color)#commit
```

ping mpls nil-fec labels

To check network connectivity and identify LSP breakages, use the **ping mpls nil-fec labels** command.

ping mpls nil-fec labels {*label*[**,***label...*]} [**output** {**interface** *tx-interface*} [**nexthop** *next-hop-ip-address*]]

Syntax Description

labels *label*,*label...*	Specifies the label stack. Use commas to separate the each *label*.
ouput interface *tx-interface*	Specifies the output interface.
nexthop *next-hop-ip-address*	(Optional) Causes packets to go through the specified next-hop address.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

This example shows how to check connectivity for a known label stack using a specific output interface and next-hop address:

```
RP/0/RSP0/CPU0:router# ping mpls nil-fec labels 16005,16007 output interface GigabitEthernet
 0/2/0/1 nexthop 10.1.1.4 repeat 1
Sending 1, 72-byte MPLS Echos with Nil FEC labels 16005,16007,
     timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no label entry,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'd' - see DDMAP for return code,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.
```

```
!
Success rate is 100 percent (1/1), round-trip min/avg/max = 1/1/1 ms
 Total Time Elapsed 0 ms
```

Related Commands

Command	Description
traceroute mpls nil-fec labels, on page 94	Checks network connectivity and identifying LSP breakages.

ping sr-mpls

To check the connectivity of the segment routing control plane, use the **ping sr-mpls** command in XR EXEC mode mode.

ping sr-mpls { *ipv4-address/mask* | *ipv6-address/mask* [**fec-type** { **bgp** | **generic** | **igp** { **ospf** | **isis** } }] | **nil-fec** | **dataplane-only** { **labels** { *label1* [**,** *label2...*] *ipv4-address/mask* | *ipv6-address/mask* | **policy** } } { **output** { **interface** *interface-path-id* } } | { **nexthop** *next-hop-ip-address* } }

Syntax Description

ipv4-address/mask or *ipv6-address/mask*	Address prefix of the target and number of bits in the target address network mask.
fec-type	(Optional) Specifies the FEC type to be used. The default FEC type is generic. **bgp** Use FEC type as BGP. **generic** Use FEC type as generic **igp** Use FEC type as OSPF or IS-IS.
labels *label1, label2...*	Specifies the label stack. Use commas to separate each label.
dataplane-only	Specifies data plane validation without running actual traffic over LSPs.
output interface *interface-path-id*	Specifies the output interface where echo request packets are sent.
nexthop *next-hop-ip-address*	Causes packets to go through the specified IPv4 or IPv6 next-hop address.

Command Default

fec-type : generic

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 24.2.11	The **dataplane-only** keyword was introduced. Support for IPv6 next-hop address was added.
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Example

These examples show how to use segment routing ping to test the connectivity of the segment routing control plane. In the first example, the FEC type is not specified. You can also specify the FEC type as shown in the second example.

```
RP/0/RP0/CPU0:router# ping sr-mpls 10.1.1.2/32

Sending 5, 100-byte MPLS Echos to 10.1.1.2/32,
      timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/5 ms
```

```
RP/0/RP0/CPU0:router# ping sr-mpls 10.1.1.2/32 fec-type igp ospf

Sending 5, 100-byte MPLS Echos to 10.1.1.2/32,
      timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/2 ms
```

The following example shows how to use segment routing ping to validate SR-MPLS over IPv6-based LSPs:

```
Router#ping sr-mpls dataplane-only 2001:DB8::1/32
Tue Jan 16 15:05:19.120 EST

Sending 5, 100-byte MPLS Echos with Nil FEC to 2001:DB8::1/32,
      timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
```

```
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/8 ms
```

The following example shows how to use segment routing ping for SR-TE policies with IPv6-based LSPs:

```
Router#ping sr-mpls nil-fec policy name srte_c_40_ep_2001:DB8::1
Tue Feb  6 12:08:28.277 EST

Sending 5, 100-byte MPLS Echos with Nil FEC for SR-TE Policy srte_c_40_ep_2001:DB8::1,
      timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/2/3 ms
```

The following example shows how to use segment routing ping with labels using IPv6 LSPs:

```
Router#ping sr-mpls labels 18004 lsp-end-point 2001:DB8::1
Tue Feb  6 12:11:05.349 EST

Sending 5, 100-byte MPLS Echos with NIL FEC with lsp end point 2001:DB8::1, SID Label(s)
[18004],
      timeout is 2 seconds, send interval is 0 msec:

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 2/2/4 ms
```

prefix-sid

To specify or advertise prefix (node) segment ID (SID) on all routers, use the **prefix-sid** command in IS-IS interface address family or OSPF interface configuration mode. To stop advertising prefix SID, use the **no** form of this command.

prefix-sid [**strict-spf**] { **index** *sid-index* | **absolute** *sid-value* } [**n-flag-clear**] [**explicit-null**] [**php-disable**]

Syntax Description

strict-spf	Specifies that the prefix-SID should use the SPF path.
index *sid-index*	Specifies the prefix SID based on the lower boundary of the SRGB + the index.
absolute *sid-value*	Specifies the specific prefix SID value within the SRGB.
n-flag-clear	Specifies that the prefix-SID is not a node-SID by setting the N flag in the prefix-SID sub Type Length Value (TLV) to 0.
explicit-null	Adds an explicit-Null label by setting the E flag in the prefix-SID sub TLV to 1. Automatically disables penultimate-hop-popping (PHP) by setting the P flag (IS-IS) or NP flag (OSPF) to 1.
php-disable	Disables penultimate-hop-popping (PHP) by setting the P flag (IS-IS) to 1.

Command Default

Prefix SID is a node SID (N-flag is set to 1).

Explicit-Null label is not set (E-flag is set to 0).

Penultimate-hop-popping (PHP) is not set (P-flag is set to 0).

Command Modes

IS-IS interface address-family configuration

OSPF interface configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.
Release 7.5.4	The **php-disable** keyword was introduced for IS-IS.

Usage Guidelines

Segment routing must be configured on the ISIS instance or on the OSPF process, area, or interface before configuring prefix SID value.

Strict-SPF SIDs are used to forward traffic strictly along the SPF path. Strict-SPF SIDs are not forwarded to SR-TE policies. IS-IS advertises the SR Algorithm sub Type Length Value (TLV) (in the SR Router Capability SubTLV) to include both algorithm 0 (SPF) and algorithm 1 (Strict-SPF). When the IS-IS area or level is Strict-SPF TE-capable, Strict-SPF SIDs are used to build the SR-TE Strict-SPF tunnels. Strict-SPF SIDs are also used to program the backup paths for prefixes, node SIDs, and adjacency SIDs.

Note The same SRGB is used for both regular SIDs and strict-SPF SIDs.

The **explicit-null** keyword disables penultimate-hop-popping (PHP) and adds an explicit-Null label. Any upstream neighbor of the Prefix-SID originator replaces the Prefix-SID with a Prefix-SID having an Explicit NULL value.

The **php-disable** keyword disables penultimate-hop-popping (PHP) for IS-IS. The penultimate hop will not pop the Prefix-SID before delivering the packet to the node that advertised the Prefix-SID.

Task ID

Task ID	Operations
isis	read, write
ospf	

Examples

This example shows how to configure a prefix SID.

```
RP/0/RSP0/CPU0:router # configure
RP/0/RSP0/CPU0:router(config)# router isis 100
RP/0/RSP0/CPU0:router(config-isis)# interface loopback0
RP/0/RSP0/CPU0:router(config-isis-if)# address-family ipv4 unicast
RP/0/RSP0/CPU0:router(config-isis-if-af)# prefix-sid index 1001
```

This example shows how to configure an absolute prefix SID on an OSPF interface.

```
RP/0/RSP0/CPU0:router # configure
RP/0/RSP0/CPU0:router(config)# router ospf 1
RP/0/RSP0/CPU0:router(config-ospf)# area 0
RP/0/RSP0/CPU0:router(config-ospf-ar)# interface loopback0
RP/0/RSP0/CPU0:router(config-ospf-ar-if)# prefix-sid absolute 16041
```

Related Commands

Command	Description
segment-routing global-block, on page 54	Configures the segment routing global block (SRGB).

prefix-unreachable

Use this command for UPA advertisements by enabling individual control parameters.

The new **prefix-unreachable** command under IS-IS address-family submode includes several command-options that control various parameters for UPAs originated by the router.

prefix-unreachable { adv-lifetime <*value*> | **adv-metric** <*value*> | **adv-maximum** <*value*> | **rx-process-enable }**

Syntax Description

Keyword	Details
prefix-unreachable	Lists the control options of UPA.
adv-lifetime	• This command is optional. • Amount of time the UPA will be advertised after the prefix becomes unreachable. Range of values is 30–65535 seconds. • Default value is 180 seconds.
adv-metric	• This command is optional. • Metric used when advertising UPA. Range of values is 4261412865–4294967294 (0xFE000001 to 0xFFFFFFFE). • Default value is 4261412865 (0xFE000001).
adv-maximum	• This command is optional. UPAs that are leaked or propagated are not counted against this limit. • Maximum number of UPAs that the router is allowed to generate to any of its attached areas or domains. UPAs that are leaked, propagate, or redistributed are not counted against this limit. Range of values is 1–65535. • Default value is 32.
rx-process-enable	• This command is optional. • If enabled, the UPA received by the router is sent to RIB and is used to trigger the BGP PIC. • It is disabled by default.

Command Default

None.

Command Modes

IS-IS interface address-family configuration

Task ID

Task ID	Operations
IS-IS	read, write

Examples

This example shows how to configure UPA.

```
Router(config)#router isis 1
Router(config-isis)#address-family ipv6 un
Router(config-isis-af)#prefix-unreachable
Router(config-isis-prefix-unreachable)#adv-lifetime 500
Router(config-isis-prefix-unreachable)#adv-metric 4261412866
Router(config-isis-prefix-unreachable)#adv-maximum 77
Router(config-isis-prefix-unreachable)#rx-process-enable
Router(config-isis-prefix-unreachable)#commit
```

reference-bandwidth

To use the automatic bandwidth metric calculation, use the **reference-bandwidth** command in the IS-IS flex-algo auto-cost submode.

reference-bandwidth *bandwidth-value* **granularity** *granularity-value*

Syntax Description

reference-bandwidth*bandwidth-value*	Specifies the reference-bandwidth configuration for auto-cost. The *bandwidth-value* is specified in kbits/s and the value can range from 1 to 4294967295.
granularity*granularity-value*	Specifies the granularity configuration for auto-cost. The *granularity-value* is specified in kbits/s and the value can range from 1 to 4294967295.

Command Default

No default behavior or values

Command Modes

IS-IS flex-algo auto-cost submode

Command History

Release	Modification
Release 24.4.1	This command was introduced.

Usage Guidelines

None

Task ID

Task ID	Operations
isis	read, write

Example

This example shows how to configure the parameters for automatic bandwidth metric calculation using the **reference-bandwidth** command in the IS-IS flex-algo auto-cost submode.

```
Router(config)#router isis 1
Router(config-isis)#flex-algo 131
Router(config-isis-flex-algo)#auto-cost reference
Router(config-isis-flex-algo-af-auto-cost)#reference-bandwidth 10000000 granularity 2000
```

segment-routing bundle-member-adj-sid

To program the dynamic Layer 2 Adj-SIDs, and advertise either manual and dynamic Layer 2 Adj-SIDs, use the **segment-routing bundle-member-adj-sid** in IS-IS interface address-family configuration mode. To disable this command, use the **no** form of this command.

segment-routing bundle-member-adj-sid

Syntax Description

This command has no keywords or arguments.

Command Default

None

Command Modes

IS-IS interface address-family configuration

Command History

Release	Modification
Release 7.0.14	This command was introduced.

Usage Guidelines

This command is not required to program manual L2 Adj-SID, but is required to program the dynamic Layer 2 Adj-SIDs and to advertise either manual and dynamic Layer 2 Adj-SIDs.

If manual Adj-SIDs are configured on the bundle interface members, IS-IS advertises the manual Adj-SID.

If manual Adj-SIDs are not configured for the bundle member interface, IS-IS advertises the dynamic Adj-SID.

Example

This example shows how to program the dynamic Layer 2 Adj-SIDs, and advertise either manual and dynamic Layer 2 Adj-SIDs:

```
RP/0/RP0/CPU0:ios(config)# router isis 1
RP/0/RP0/CPU0:ios(config-isis)# address-family ipv4 unicast
RP/0/RP0/CPU0:ios(config-isis-af)# segment-routing bundle-member-adj-sid
RP/0/RP0/CPU0:ios(config-isis-af)#
```

segment-routing global-block

To configure the segment routing global block (SRGB), use the **segment-routing global-block** command in XR Config mode.

segment-routing global-block index *starting_value ending_value*

Syntax Description

starting_value ending_value	Specifies the block of segment routing IDs that are allocated for the routers in the network. Ranges from 16000 to 1048574.
index	Specifies the value used for ordering the SRGB. Ranges from 1 to 7.

Command Default

Default SRGB range is 16000 to 23999.

Command Modes

XR Config mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.
Release 25.3.1	The command was modified to include the **index** keyword.

Usage Guidelines

To keep the segment routing configuration simple and to make it easier to troubleshoot segment routing issues, we recommend that you use the default SRGB range on each node in the domain. However, there are instances when you might need to define a different range:

- The nodes of another vendor support a label range that is different from the default SRGB, and you want to use the same SRGB on all nodes.
- The default range is too small.
- To specify separate SRGBs for IS-IS and OSPF protocols, as long as the ranges do not overlap.

Because the values assigned from the range have domain-wide significance, we recommend that all routers within the domain be configured with the same range of values.

Starting from Cisco IOS XR Release 25.3.1, the command is modified to include the **index** keyword. Each SRGB configured locally on the router is associated with an index. The index determines the order in which SRGBs are used.

The SRGB with the implicit index 0 is configured using the existing global-block command. If the SRGB at index 0 is not configured, it defaults to the range 16000-23999.

Task ID

Task ID	Operation
mpls-te	read, write

Example

This example shows how to configure the SRGB range:

```
RP/0/RSP0/CPU0:router(config)# segment-routing global-block 17000 20000
```

This example shows how to configure additional local SRGBs using the **index** keyword.

```
Router# configure
Router(config)# segment-routing global-block 16000 80000
Router(config)# global-block index 1 100000 163999
Router(config)# global-block index 2 200000 223999
```

Related Commands

Command	Description
prefix-sid, on page 48	Configures the segment ID (SID).

segment-routing local-block

To configure the segment routing local block (SRLB), use the **segment-routing local-block** command inXR Config mode.

segment-routing local-block *starting_value ending_value*

Syntax Description

starting_value ending_value	Specifies the block of labels that are reserved for manual allocation of adjacency segment IDs (Adj-SIDs). Ranges from 15000 to 1048574.

Command Default

Default SRLB range is 15000 to 15999.

Command Modes

XR Config mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

When you define a new SRLB range, there might be a label conflict (for example, if labels are already allocated, statically or dynamically, in the new SRLB range). In this case, the new SRLB range will be accepted, but not applied (pending). The previous SRLB range (active) will continue to be in use until one of the following occurs:

- Reload the router to release the currently allocated labels and allocate the new SRLB
- Use the **clear segment-routing local-block discrepancy all** command to clear the label conflicts

The SRLB size cannot be more than 262,143.

To keep the segment routing configuration simple and to make it easier to troubleshoot segment routing issues, we recommend that you use the default SRLB range on each node in the domain. However, there are instances when you might need to define a different range:

- The nodes of another vendor support a label range that is different from the default SRLB, and you want to use the same SRLB on all nodes.
- The default range is too small.

Because the values assigned from the range have domain-wide significance, we recommend that all routers within the domain be configured with the same range of values.

Task ID

Task ID	Operation
mpls-te	read, write

This example shows how to configure the SRLB range:

```
RP/0/RSP0/CPU0:router(config)# segment-routing local-block 18000 19999
```

Related Commands

Command	Description
clear segment-routing local-block discrepancy all, on page 6	Clears SRLB label conflicts
show segment-routing local-block inconsistencies, on page 86	Displays SRLB label conflicts

segment-routing mapping-server

To configure the segment routing mapping server (SRMS), use the **segment-routing mapping-server** command in XR Config mode.

segment-routing mapping-server prefix-sid-map address-family {**ipv4** | **ipv6**} *ip_address*/*subnet_mask* *SID_start_value* **range** *range*

Syntax Description

address-family {**ipv4** | **ipv6**}	Configures the address family for IS-IS.
ip_address/*subnet_mask*	Specifies the prefix and mask.
SID_start_value	Specifies the first prefix SID in the range.
range *range*	Specifies the size of the range.

Command Default

None

Command Modes

XR Config mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

The position of the mapping server in the network is not important. However, since the mapping advertisements are distributed in IGP using the regular IGP advertisement mechanism, the mapping server needs an IGP adjacency to the network.

The role of the mapping server is crucial. For redundancy purposes, you should configure multiple mapping servers in the networks.

Task ID

Task ID	Operation
mpls-te	read, write

Example

This example shows how to configure the mapping server and add prefix-SID mapping entries in the active local mapping policy:

```
RP/0/RSP0/CPU0:router(config)# segment-routing mapping-server prefix-sid-map address-family
 ipv4 10.1.1.1/32 17000 range 100
```

Related Commands

Command	Description
segment-routing prefix-sid-map advertise-local, on page 61	Enables the router to advertise the SRMS entries that are locally configured.
segment-routing prefix-sid-map receive disable, on page 63	Disables mapping client functionality.
show segment-routing mapping-server prefix-sid-map, on page 87	Displays the active and backup prefix-to-SID mappings for IS-IS.
show ospf segment-routing prefix-sid-map, on page 77	Displays the active and backup prefix-to-SID mappings for OSPF.
show segment-routing mapping-server prefix-sid-map, on page 87	Displays the locally configured prefix-to-SID mappings.

segment-routing mpls

To enable segment routing for IPv4 addresses with MPLS data plane, use the **segment-routing mpls** command in IPv4 address family configuration mode. To disable segment routing, use the **no** form of this command.

segment-routing mpls

Syntax Description

mpls	Enables segment routing for IPv4 addresses with MPLS data plane.

Command Default

No default behavior or values.

Command Modes

IPv4 address family configuration

Router configuration

Area configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

This example shows how to enable segment routing with MPLS data plane.

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# router isis 100
RP/0/RSP0/CPU0:router(config-isis)# address-family ipv4 unicast
RP/0/RSP0/CPU0:router(config-isis-af)# segment-routing mpls
```

segment-routing prefix-sid-map advertise-local

To enable the router to advertise the segment routing mapping server (SRMS) entries that are locally configured, use the **segment-routing prefix-sid-map advertise-local** command. In addition to advertising these local SRMS entries, these mapping entries are also used to calculate segment ID (SID).

segment-routing prefix-sid-map advertise-local

Syntax Description

advertise-local	Advertises the SRMS mapping entries that are locally configured.

Command Default

Disabled.

Command Modes

IPv4 address family configuration

Router configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
ospf isis	read, write

Example

This example shows how to enable the router to advertise the locally configured SRMS entries:

```
RP/0/RSP0/CPU0:router# configure
RP/0/RSP0/CPU0:router(config)# router ospf 1
RP/0/RSP0/CPU0:router(config-ospf)# segment-routing prefix-sid-map advertise-local
```

Related Commands

Command	Description
segment-routing mapping-server, on page 58	Configures the segment routing mapping server (SRMS).
segment-routing prefix-sid-map receive disable, on page 63	Disables mapping client functionality.
show isis segment-routing prefix-sid-map, on page 67	Displays the active and backup prefix-to-SID mappings for IS-IS.

Command	Description
show ospf segment-routing prefix-sid-map, on page 77	Displays the active and backup prefix-to-SID mappings for OSPF.
show segment-routing mapping-server prefix-sid-map, on page 87	Displays the locally configured prefix-to-SID mappings.

segment-routing prefix-sid-map receive disable

To disable mapping client functionality, use the **segment-routing prefix-sid-map receive disable** command. To reenable client functionality, use the **segment-routing prefix-sid-map receive** command.

segment-routing prefix-sid-map receive [**disable**]

Syntax Description

receive	Only remote SRMS mapping entries are used for SID calculation.
disable	Disable remote SRMS mapping entries received by flooding.

Command Default

Enabled.

Command Modes

IPv4 address family configuration

Router configuration

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

The mapping client functionality is enabled by default. When you disable client functionality, the SRMS active policy is calculated without remote SRMS entries.

You can use this command with the **segment-routing prefix-sid-map advertise-local** command simultaneously.

Task ID

Task ID	Operation
ospf	read, write
isis	

Example

This example shows how to disable the mapping server client functionality:

```
RP/0/RSP0/CPU0:router(config)# router isis 1
RP/0/RSP0/CPU0:router(config-isis)# address-family ipv4 unicast
RP/0/RSP0/CPU0:router(config-isis-af)# segment-routing prefix-sid-map receive disable
```

Related Commands

Command	Description
segment-routing mapping-server, on page 58	Configures the segment routing mapping server (SRMS).

Command	Description
segment-routing prefix-sid-map advertise-local, on page 61	Enables the router to advertise the SRMS entries that are locally configured.
show isis segment-routing prefix-sid-map, on page 67	Displays the active and backup prefix-to-SID mappings for IS-IS.
show ospf segment-routing prefix-sid-map, on page 77	Displays the active and backup prefix-to-SID mappings for OSPF.
show segment-routing mapping-server prefix-sid-map, on page 87	Displays the locally configured prefix-to-SID mappings.

segment-routing traffic-eng explicit

To detect the liveness of the reverse path of the segment list and the configure the segment list, use the **segment-routing traffic-eng explicit** command in performance measurement configuration mode. To disable the reverse path, use the **no** form of the command.

segment-routing traffic-eng explicit { **reverse-path segment-list name** *segment-list-name* | **segment-list name** *segment-list-name* **reverse-path segment-list name** *segment-list-name* }

Syntax Description

reverse-path	Specifes the return path on the endpoint for liveness detection.
segment-listname *segment-list-name*	Specifes the segment list on the endpoint for liveness detection and delay.

Command Default

None

Command Modes

Performance measurement endpoint submode

Command History

Release	Modification
Release 24.2.11	This command was introduced.

Usage Guidelines

The default reverse path configured under endpoint submode is only used for sessions with segment list. The endpoint session without a segment list does not support reverse path configuration and will not use this reverse path.

The **reverse-path** under the **performance-measurement endpoint** is used as the default reverse path if there are no reverse paths configured under a segment list.

Use the **reverse-path** under the **performance-measurement endpoint segment-routing traffic-eng explicit segment-list name fwd-path** to configure reverse path under a segment list.

The reverse type must be the same as the forward path. Using different types for forward and reverse paths is not supported. For example, uSID forward path and uSID reverse path; MPLS forward path and MPLS reverse path.

User-configured segment-list can also represent the reverse path (reflector to sender) when probe is configured in liveness detection mode. Up to 128 segment-lists can be configured under a probe. An additional PM session is created for each segment-list. Segment-lists are configured under **segment-routing traffic-eng segment-list** submode. See SR-TE Policy with Explicit Path for details about configuring segment lists.

The following example shows how to configure liveness of the reverse path of the segment list:

The following example shows how to configure liveness reverse path under segment list and under endpoint:

```
Router(config)#performance-measurement
Router(config-perf-meas)#endpoint ipv6 ff::2

/* Configure reverse path segment-list with forward segment-list*\
Router(config-pm-ep)#segment-routing traffic-eng explicit segment-list name fwd-path
```

```
Router(config-pm-ep-sl)#reverse-path segment-list name rev-path
Router(config-pm-ep-sl)#exit

/* Configure reverse-path segment list on the endpoint*\
Router(config-pm-ep)# segment-routing traffic-eng explicit reverse-path segment-list name
rev-path-name
```

show isis segment-routing prefix-sid-map

To verify the active and backup prefix-to-SID mappings for IS-IS, use the **show isis segment-routing prefix-sid-map** command in XR EXEC mode.

show isis segment-routing prefix-sid-map [**active-policy** | **backup-policy**]

Syntax Description

active-policy	(Optional) Specifies the active mapping policy.
backup-policy	(Optional) Specifies the backup mapping policy.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
isis	read

Example

The example shows how to verify the active mapping policy on IS-IS:

```
RP/0/0/CPU0:router# show isis segment-routing prefix-sid-map active-policy

IS-IS 1 active policy
Prefix               SID Index    Range        Flags
1.1.1.100/32         100          20
1.1.1.150/32         150          10

Number of mapping entries: 2
```

The example shows how to verify the backup mapping policy on IS-IS:

```
RP/0/0/CPU0:router# show isis segment-routing prefix-sid-map backup-policy

IS-IS 1 backup policy
Prefix               SID Index    Range        Flags
1.1.1.100/32         100          20
1.1.1.150/32         150          10
```

```
Number of mapping entries: 2
```

Related Commands

Command	Description
segment-routing mapping-server, on page 58	Configures the segment routing mapping server (SRMS).
segment-routing prefix-sid-map advertise-local, on page 61	Enables the router to advertise the SRMS entries that are locally configured.
segment-routing prefix-sid-map receive disable, on page 63	Disables mapping client functionality.
show ospf segment-routing prefix-sid-map, on page 77	Displays the active and backup prefix-to-SID mappings for OSPF.
show segment-routing mapping-server prefix-sid-map, on page 87	Displays the locally configured prefix-to-SID mappings.

show mrib nsf private

To display the state of nonstop forwarding (NSF) operation in the Multicast Routing Information Base (MRIB), use the **show mrib nsf private** command in the appropriate mode.

show mrib nsf private

Syntax Description

show mrib nsf private	Displays the state of NSF operation in the MRIB.

Command Default

None

Command Modes

XR EXEC mode

Table 3: Release History

Release	Modification
Release 7.10.1	This command was introduced.

Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes appropriate task IDs. If the user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

The **show mrib nsf private** command displays the current multicast NSF state for the MRIB. The state may be normal or activated for NSF. The activated state indicates that recovery is in progress due to a failure in MRIB or Protocol Independent Multicast (PIM). The total NSF timeout and time remaining are displayed until NSF expiration.

Table 4: Task ID

Release	Modification
multicast	read

Example

The example shows how to verify the Non Stop Forwarding:

```
Router#show mrib nsf private
IP MRIB Non-Stop Forwarding Status:
Multicast routing state: Normal
   NSF Lifetime:       00:03:00
   Respawn Count: 6
   Last NSF On triggered: Tue Jul 25 13:20:49 2023, 6d00h
   Last NSF Off triggered: Tue Jul 25 13:22:49 2023, 6d00h
   Last NSF ICD Notification sent: Tue Jul 25 13:22:49 2023, 6d00h
   Last Remote NSF On triggered: Tue Jul 25 13:10:18 2023, 6d00h
   Last Remote NSF Off triggered: Tue Jul 25 13:10:27 2023, 6d00h
   Last Label TE NSF On triggered: Tue Jul 25 13:10:18 2023, 6d00h
   Last Label TE NSF Off triggered: Tue Jul 25 13:10:27 2023, 6d00h
   Last Label mLDP NSF On triggered: Tue Jul 25 13:10:18 2023, 6d00h
   Last Label mLDP NSF Off triggered: Tue Jul 25 13:10:27 2023, 6d00h
```

```
   Last Label PIM NSF On triggered: Tue Jul 25 13:20:49 2023, 6d00h
   Last Label PIM NSF Off triggered: Tue Jul 25 13:22:49 2023, 6d00h
   Last Label PIM6 NSF On triggered: Tue Jul 25 13:31:22 2023, 5d23h
   Last Label PIM6 NSF Off triggered: Tue Jul 25 13:33:22 2023, 5d23h
   Last Label XTC NSF On triggered: Tue Jul 25 13:41:51 2023, 5d23h
   Last Label XTC NSF Off triggered: Tue Jul 25 13:41:52 2023, 5d23h

IP NSF :- Active: N, Assume N
MRIB connect timer: Inactive
NSF statistics:
   Enabled Cnt - 4, Disabled Cnt - 4
   Last Enabled: 6d00h, Last Disabled: 6d00h
Multicast COFO routing state: Normal
Current LMRIB clients: LDP RSVP_TE PIM PIM6 XTC
LMRIB NSF clients: LDP RSVP_TE PIM PIM6 XTC
Converged LMRIB clients: LDP RSVP_TE PIM PIM6 XTC
RP/0/RSP0/CPU0:tb8-R2#
```

show ospf route flex-algo

To display the OSPF routing table for flexible algorithm, use the **show ospf routes flex-algo** command in the EXEC mode.

show ospf routes flex-algo [**number**] [*prefix / prefix_len* | **route-type** { **external** | **inter** | **intra** }] [**backup-path**] [**detail**]

Syntax Description

number	Specifies the flexible algorithm number. The range is from 128 to 255.
IP address/prefix	Specifies IP address along with the subnet mask.
backup-path	Displays the backup-path information of the OSPF routes.
detail	Displays the detailed information of the OSPF routes.
route-typeexternal	Displays OSPF external routes.
route-typeinter	Display OSPF inter area routes.
route-typeintra	Displays OSPF intra area routes.

Command Default

None

Command Modes

EXEC mode

Command History

Release	Modification
Release 7.5.1	This command was introduced.

Usage Guidelines

Use the **show ospf routes flex-algo** command to display the OSPF private routing table for flexible algorithm (which contains only flexible algorithm routes calculated by OSPF). If there is something wrong with a route in the MPLS forwarding table and RIB, then it is useful to check the OSPF copy of the route to determine if it matches the RIB and MPLS forwarding entries. If it does not match, there is a synchronization problem between OSPF and the MPLS. If the routes match and the route is incorrect, OSPF has made an error in its routing calculation.

Example

This following show output displays the external route type configured:

```
Router#show ospf routes flex-algo 240 route-type external detail
Route Table of ospf-1 with router ID 192.168.0.2 (VRF default)

  Algorithm 240

  Route entry for 192.168.4.3/32, Metric 220, SID 536, Label 16536
   Priority : Medium

     Route type : Extern Type 1
```

```
Last updated : Apr 25 14:30:12.718
     Flags: Inuse

     Prefix Contrib Algo 240 SID 536
      From 192.168.0.4 Route-type 5
      Total Metric : 220 Base metric 20 FAPM 20
      Contrib Flags : Inuse, Reachable
      SID Flags : PHP off, Index, Global, Valid

      Path: 10.1.1.3, from 192.168.0.4, via GigabitEthernet0/2/0/2
       Out Label  : 16536
       Weight     : 0
       Area       : 0

      Path: 10.1.2.3, from 192.168.0.4, via GigabitEthernet0/2/0/3
       Out Label  : 16536
       Weight     : 0
       Area       : 0

      Path: 10.2.1.5, from 192.168.0.4, via GigabitEthernet0/2/0/4
       Out Label  : 16536
       Weight     : 0
       Area       : 0

  Route entry for 192.168.4.5/32, Metric 120, SID 556, Label 16556
   Priority : Medium

     Route type : Extern Type 1
     Last updated : Apr 25 14:30:12.724
     Flags: Inuse

     Prefix Contrib Algo 240 SID 556
      From 192.168.0.3 Route-type 5
      Total Metric : 120 Base metric 1 FAPM 20
      Contrib Flags : Inuse, Reachable
      SID Flags : PHP off, Index, Global, Valid

      Path: 10.1.1.3, from 192.168.0.3, via GigabitEthernet0/2/0/2
       Out Label  : 16556
       Weight     : 0
       Area       : 0

      Path: 10.1.2.3, from 192.168.0.3, via GigabitEthernet0/2/0/3
       Out Label  : 16556
       Weight     : 0
       Area       : 0
```

The following show output displays label information for flexible algorithm and its corresponding metric as added in RIB:

```
RP/0/RP0/CPU0:ios# show route 192.168.0.2/32 detail
Wed Apr  6 16:24:46.021 IST

Routing entry for 192.168.0.2/32
  Known via "ospf 1", distance 110, metric 2, labeled SR, type intra area
  Installed Apr  6 15:51:57.973 for 00:32:48
  Routing Descriptor Blocks
    10.10.10.2, from 192.168.0.2, via GigabitEthernet0/2/0/0, Protected
      Route metric is 2
      Label: 0x3 (3)
      Tunnel ID: None
      Binding Label: None
      Extended communities count: 0
      Path id:1       Path ref count:0
```

```
      NHID:0x1(Ref:1)
      Backup path id:65
      OSPF area: 1
    10.11.11.2, from 192.168.0.2, via GigabitEthernet0/2/0/1, Backup (Local-LFA)
      Route metric is 6
      Label: 0x3 (3)
      Tunnel ID: None
      Binding Label: None
      Extended communities count: 0
      Path id:65              Path ref count:1
      NHID:0x2(Ref:1)
      OSPF area:
  Route version is 0x12 (18)
  Local Label: 0x3ee6 (16102)
  Local Label Algo Set (ID, Label, Metric): (1, 16202, 0),(128, 17282, 2)
  IP Precedence: Not Set
  QoS Group ID: Not Set
  Flow-tag: Not Set
  Fwd-class: Not Set
  Route Priority: RIB_PRIORITY_NON_RECURSIVE_MEDIUM (7) SVD Type RIB_SVD_TYPE_LOCAL
  Download Priority 1, Download Version 38
  No advertising protos.
```

The following example shows the backup path for each path:

```
Router#show ospf routes flex-algo 240 route-type external backup-path


Route Table of ospf-1 with router ID 192.168.0.2 (VRF default)

  Algorithm 240

  192.168.4.3/32, Metric 220, SID 536, Label 16536
      10.1.1.3, from 192.168.0.4, via GigabitEthernet0/2/0/2
           Backup path:
              10.23.2.3, from 192.168.0.4, via GigabitEthernet0/2/0/3,
              Out Label: 16536
              Attributes: Metric: 220, Primary , Downstream, Interface Disjoint, SRLG
Disjoint
      10.1.2.3, from 192.168.0.4, via GigabitEthernet0/2/0/3
           Backup path:
              10.23.1.3, from 192.168.0.4, via GigabitEthernet0/2/0/2,
              Out Label: 16536
              Attributes: Metric: 220, Primary , Downstream, Interface Disjoint, SRLG
Disjoint
      10.1.1.5, from 192.168.0.4, via GigabitEthernet0/2/0/4
           Backup path:
              10.23.1.3, from 192.168.0.4, via GigabitEthernet0/2/0/2,
              Out Label: 16536
               Attributes: Metric: 220, Primary , Downstream, Node Protect, Interface Disjoint,
 SRLG Disjoint
  192.168.4.5/32, Metric 120, SID 556, Label 16556
      10.1.1.3, from 192.168.0.3, via GigabitEthernet0/2/0/2
           Backup path:
              10.23.2.3, from 192.168.0.3, via GigabitEthernet0/2/0/3,
              Out Label: 16556
              Attributes: Metric: 120, Primary , Downstream, Interface Disjoint, SRLG
Disjoint
      10.1.2.3, from 192.168.0.3, via GigabitEthernet0/2/0/3
           Backup path:
              10.1.1.3, from 192.168.0.3, via GigabitEthernet0/2/0/2,
              Out Label: 16556
              Attributes: Metric: 120, Primary , Downstream, Interface Disjoint, SRLG
Disjoint
```

The following example shows details of the route, but not the backup paths:

```
Router#show ospf routes flex-algo 240 route-type external detail

Route Table of ospf-1 with router ID 192.168.0.2 (VRF default)

  Algorithm 240

  Route entry for 192.168.4.3/32, Metric 220, SID 536, Label 16536
   Priority : Medium

     Route type : Extern Type 1
     Last updated : Apr 25 14:30:12.718
     Flags: Inuse

     Prefix Contrib Algo 240 SID 536
      From 192.168.0.4 Route-type 5
      Total Metric : 220 Base metric 20 FAPM 20
      Contrib Flags : Inuse, Reachable
      SID Flags : PHP off, Index, Global, Valid

      Path: 10.1.1.3, from 192.168.0.4, via GigabitEthernet0/2/0/2
       Out Label  : 16536
       Weight     : 0
       Area       : 0

      Path: 10.1.2.3, from 192.168.0.4, via GigabitEthernet0/2/0/3
       Out Label  : 16536
       Weight     : 0
       Area       : 0

      Path: 10.2.1.5, from 192.168.0.4, via GigabitEthernet0/2/0/4
       Out Label  : 16536
       Weight     : 0
       Area       : 0

  Route entry for 192.168.4.5/32, Metric 120, SID 556, Label 16556
   Priority : Medium

     Route type : Extern Type 1
     Last updated : Apr 25 14:30:12.724
     Flags: Inuse

     Prefix Contrib Algo 240 SID 556
      From 192.168.0.3 Route-type 5
      Total Metric : 120 Base metric 1 FAPM 20
      Contrib Flags : Inuse, Reachable
      SID Flags : PHP off, Index, Global, Valid

      Path: 10.1.1.3, from 192.168.0.3, via GigabitEthernet0/2/0/2
       Out Label  : 16556
       Weight     : 0
       Area       : 0

      Path: 10.1.2.3, from 192.168.0.3, via GigabitEthernet0/2/0/3
       Out Label  : 16556
       Weight     : 0
       Area       : 0
```

The following example shows details of the route and backup paths:

```
Router#show ospf routes flex-algo 240 route-type external backup-path detail
```

```
Route Table of ospf-1 with router ID 192.168.0.2 (VRF default)

  Algorithm 240

  Route entry for 192.168.4.3/32, Metric 220, SID 536, Label 16536
   Priority : Medium

     Route type : Extern Type 1
     Last updated : Apr 25 14:30:12.718
     Flags: Inuse

     Prefix Contrib Algo 240 SID 536
      From 192.168.0.4 Route-type 5
      Total Metric : 220 Base metric 20 FAPM 20
      Contrib Flags : Inuse, Reachable
      SID Flags : PHP off, Index, Global, Valid

      Path: 10.1.1.3, from 192.168.0.4, via GigabitEthernet0/2/0/2
       Out Label  : 16536
       Weight     : 0
       Area       : 0

           Backup path:
              10.1.2.3, from 192.168.0.4, via GigabitEthernet0/2/0/3,
              Out Label: 16536
              Attributes: Metric: 220, Primary , Downstream, Interface Disjoint, SRLG
Disjoint

      Path: 23.23.2.3, from 192.168.0.4, via GigabitEthernet0/2/0/3
       Out Label  : 16536
       Weight     : 0
       Area       : 0

           Backup path:
              10.1.1.3, from 192.168.0.4, via GigabitEthernet0/2/0/2,
              Out Label: 16536
              Attributes: Metric: 220, Primary , Downstream, Interface Disjoint, SRLG
Disjoint

      Path: 25.25.1.5, from 192.168.0.4, via GigabitEthernet0/2/0/4
       Out Label  : 16536
       Weight     : 0
       Area       : 0

           Backup path:
              10.1.1.3, from 192.168.0.4, via GigabitEthernet0/2/0/2,
              Out Label: 16536
             Attributes: Metric: 220, Primary , Downstream, Node Protect, Interface Disjoint,
 SRLG Disjoint

  Route entry for 192.168.4.5/32, Metric 120, SID 556, Label 16556
   Priority : Medium

     Route type : Extern Type 1
     Last updated : Apr 25 14:30:12.724
     Flags: Inuse

     Prefix Contrib Algo 240 SID 556
      From 192.168.0.3 Route-type 5
      Total Metric : 120 Base metric 1 FAPM 20
      Contrib Flags : Inuse, Reachable
      SID Flags : PHP off, Index, Global, Valid

      Path: 10.1.1.3, from 192.168.0.3, via GigabitEthernet0/2/0/2
```

```
       Out Label  : 16556
       Weight     : 0
       Area       : 0

           Backup path:
              10.1.2.3, from 192.168.0.3, via GigabitEthernet0/2/0/3,
              Out Label: 16556
              Attributes: Metric: 120, Primary , Downstream, Interface Disjoint, SRLG
Disjoint

      Path: 10.1.2.3, from 192.168.0.3, via GigabitEthernet0/2/0/3
       Out Label  : 16556
       Weight     : 0
       Area       : 0

           Backup path:
              10.1.1.3, from 192.168.0.3, via GigabitEthernet0/2/0/2,
              Out Label: 16556
              Attributes: Metric: 120, Primary , Downstream, Interface Disjoint, SRLG
Disjoint
```

show ospf segment-routing prefix-sid-map

To verify the active and backup prefix-to-SID mappings for OSPF, use the **show ospf segment-routing prefix-sid-map** command in XR EXEC mode.

show ospf segment-routing prefix-sid-map [**active-policy** | **backup-policy**]

Syntax Description

active-policy	(Optional) Specifies the active mapping policy.
backup-policy	(Optional) Specifies the backup mapping policy.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
ospf	read

Example

The example shows how to verify the active mapping policy on OSPF:

```
RP/0/0/CPU0:router# show ospf segment-routing prefix-sid-map active-policy

        SRMS active policy for Process ID 1

Prefix               SID Index    Range        Flags
1.1.1.100/32         100          20
1.1.1.150/32         150          10

Number of mapping entries: 2
```

The example shows how to verify the backup mapping policy on OSPF:

```
RP/0/0/CPU0:router# show ospf segment-routing prefix-sid-map backup-policy

        SRMS backup policy for Process ID 1

Prefix               SID Index    Range        Flags
1.1.1.100/32         100          20
1.1.1.150/32         150          10
```

```
Number of mapping entries: 2
```

Related Commands

Command	Description
segment-routing mapping-server, on page 58	Configures the segment routing mapping server (SRMS).
segment-routing prefix-sid-map advertise-local, on page 61	Enables the router to advertise the SRMS entries that are locally configured.
segment-routing prefix-sid-map receive disable, on page 63	Disables mapping client functionality.
show isis segment-routing prefix-sid-map, on page 67	Displays the active and backup prefix-to-SID mappings for IS-IS.
show segment-routing mapping-server prefix-sid-map, on page 87	Displays the locally configured prefix-to-SID mappings.

show pce ipv4

To display the status of the path computation element (PCE) peer, prefix, tunnel, or topology, use the **show pce ipv4** command in EXEC mode.

show pce ipv4 {**peer** [**detail** | **private**] | **prefix** | **topology** [**summary**]}

Syntax Description

peer	Displays the PCE peer database.
detail	Displays detailed PCE peer information.
private	Displays detailed PCE peer information with additional PCEP events that can be used for troubleshooting.
prefix	Displays detailed PCE prefix information.
topology	Displays detailed PCE topology information.
summary	Displays a summary of the PCE topology information.

Command Default

No default behavior or values

Command Modes

EXEC

Command History

Release	Modification
Release 24.4.1	The command is enhanced to include the SR-P2MP capability and the number of SR-P2MP instances.
Release 6.2.1	This command was introduced.

Usage Guidelines

Task ID

Task ID	Operation
basic-services	READ

Example

This example shows how to display the PCE peer information:

```
RP/0/RSP0/CPU0:router# show pce ipv4 peer

PCE's peer database:
--------------------
Peer address: 192.168.0.1
  State: Up
  Capabilities: Stateful, Segment-Routing, Update
```

This example shows how to display detailed PCE peer information:

```
RP/0/RSP0/CPU0:router# show pce ipv4 peer detail
PCE's peer database:
--------------------
Peer address: 192.168.0.1
  State: Up
  Capabilities: Stateful, Segment-Routing, Update
  PCEP has been up for: 00:01:50
  PCEP session ID: local 0, remote 0
  Sending KA every 30 seconds
  Minimum acceptable KA interval: 20 seconds
  Peer timeout after 120 seconds
  Statistics:
    Keepalive messages: rx     4 tx     4
    Request messages:   rx     3 tx     0
    Reply messages:     rx     0 tx     3
    Error messages:     rx     0 tx     0
    Open messages:      rx     1 tx     1
    Report messages:    rx     4 tx     0
    Update messages:    rx     0 tx     2
    Initiate messages:  rx     0 tx     0
```

This example shows how to display the PCE prefix information:

```
RP/0/RSP0/CPU0:router# show pce ipv4 prefix

PCE's prefix database:
----------------------
Node 1
 TE router ID: 192.168.0.1
 Host name: rtrA
 ISIS system ID: 1921.6800.1001 level-1
  Advertised Prefixes:
   192.168.0.1

Node 2
 TE router ID: 192.168.0.2
 Host name: rtrB
 ISIS system ID: 1921.6800.1002 level-2
  Advertised Prefixes:
   192.168.0.2
```

This example shows how to display summary of the PCE topology information:

```
RP/0/RSP0/CPU0:router# show pce ipv4 topology summary

PCE's topology database summary:
--------------------------------

Topology nodes:                4
Prefixes:                      4
  Prefix SIDs:                 4
Links:                        12
  Adjacency SIDs:             24
```

In the following sample output, the **SR-P2MP Num Instances** field indicates the number of distinct paths that are currently active, and the **ASSOC-Type-List** field indicates the types of associations that the PCE has with peer devices. The PCEP extensions enable associating different types of LSPs or services through these association types.

```
Router#show pce ipv4 peer private

PCE's peer database:
--------------------
Peer address: 192.168.0.1
  State: Up
  Capabilities: Stateful, Segment-Routing, Update, Instantiation, SRv6, SR-P2MP
  PCEP has been up for: 06:04:36
  PCEP session ID: local 0, remote 0
  Sending KA every 30 seconds
  Minimum acceptable KA interval: 20 seconds
  Peer timeout after 120 seconds
  Maximum SID Depth: 10
  SR-P2MP Num Instances: 1
  ASSOC-Type-List: [2,3,5,6,9]
  Statistics:
    Keepalive messages: rx 729 tx 729
    Request messages:   rx     0 tx     0
    Reply messages:     rx     0 tx     0
    Error messages:     rx     0 tx     0
    Open messages:      rx     1 tx     1
    Report messages:    rx     3 tx     0
    Update messages:    rx     0 tx     1
    Initiate messages:  rx     0 tx     1
    Tx Queue:           curr   0 max    1
  UID: 5, LSP peer UID: 5
Event history (oldest first):
  No events
  Last PCError:
    Received: None
    Sent: None
```

show performance-measurement history

To display the history for delay-measurement, use the **performance-measurement history** show command in XR EXEC mode.

show performance-measurement history { **probe-computation** | **advertisement** | **aggregation** } { **interfaces** | **endpoint** | **rsvp-te** | **sr-policy** }

Syntax Description

probe-computation	(Optional) Displays information for the delay metric computation result within each probe interval.
advertisement	(Optional) Displays information for the delay metric computation result within each advertisement interval.
aggregation	(Optional) Displays information for the delay metric computation result within each aggregation interval.
interface	(Optional) Displays information on the specified interface.
endpoint	(Optional) Displays information on the specified endpoint.
rsvp-te	(Optional) Displays information on the specified Resource Reservation Protocol - Traffic Engineering (RSVP-TE).
sr-policy	(Optional) Displays information on the specified sr-policy.

Command Default

No default

Command Modes

XR EXEC

Command History

Release	Modification
Release 24.1.1	This command was updated with synthetic and anomaly loss information.
Release 7.3.1	This command was introduced.

Task ID

Task ID	Operation
performance-measurement	write/read

```
Router# show performance-measurement history probe-computation interfaces
Interface Name: GigabitEthernet0/2/0/0 (ifh: 0x1000020)
Delay-Measurement history (uSec):
  Probe Start Timestamp     Pkt(TX/RX)   Average       Min       Max
  Aug 01 2023 08:04:15.230       10/10       704       651       779

Router# show performance-measurement history probe-computation endpoint
Endpoint name: IPv4-192.168.0.4-vrf-default
  …
```

```
  Segment-List              : None
    Delay-Measurement history (uSec):
      Probe Start Timestamp     Pkt(TX/RX)   Average       Min       Max
      Aug 01 2023 08:26:48.823       10/10      3399      2962      3808
```

```
Router# show performance-measurement history aggregation rsvp-te
...
Delay-Measurement history (uSec):
      Aggregation Timestamp     Pkt(TX/RX)   Average       Min       Max
      Aug 01 2023 08:37:23.702       40/40      3372      3172      4109
```

```
Router# show performance-measurement history advertisement sr-policy
...
Delay-Measurement history (uSec):
          Advertisement Timestamp   Pkt(TX/RX)   Average       Min       Max        Reason
          Aug 01 2023 10:05:14.072       24/24      3408      3408      3408     ACCEL-MAX
```

Table 5: This table gives show performance-measurement history field descriptions:

Field	Description
TX	Number of packets sent.
RX	Number of packets received.
Average	Average delay of all the delay measures within one probe.
Max	Maximum delay of all the delay measures within one probe.
Min	Minimum delay of all the delay measures within one probe.

Reason	Provides the reason for the delay in packets:" • NONE : No advertisements occurred • PER-AVG : Periodic timer, average delay threshold crossed • PER-MIN : Periodic timer, min delay threshold crossed • PER-MAX : Periodic timer, max delay threshold crossed • ACCEL-AVG : Accelerated threshold crossed, average delay threshold crossed • ACCEL-MIN : Accelerated threshold crossed, min delay threshold crossed • ACCEL-MAX : Accelerated threshold crossed, max delay threshold crossed • ACCEL-UP-AVG : Accelerated threshold crossed, average delay upper-bound crossed • ACCEL-UP-MIN : Accelerated threshold crossed, min delay upper-bound crossed • ACCEL-UP-MAX : Accelerated threshold crossed, max delay upper-bound crossed • ANOM-MIN-DYN : Min delay A flag toggled and dynamic delay is in effect • ANOM-MIN-STA : Min delay A flag toggled and static delay is in effect • FIRST : First advertisement • NEW-SESSION : New child session • ENABLE : Advertisement enabled • DISABLE : Advertisement disabled • DELETE : Session deleted • EXEC-CLEAR : Cleared through exec command • ADV-CFG : Advertise delay config • ADV-UNCFG : Advertise delay unconfig • ERROR : Control code error • LINK-DOWN : Link state changed to down • SESSION-ERROR : Performance measurement session error • DYN-DM : Dynamic delay advertisement is in effect • PT-CFG : Path tracing config • PT-UNCFG : Path tracing unconfig • PT-INTF_READY : Path tracing interface ready • PKT-LOSS : Packet loss detected • ANOM-PKT-LOSS : PM session anomaly due to packet loss • N/A : Invalid advertisement reason

show segment-routing srv6 sid

You can use the **show segment-routing srv6 sid** command to verify the SRv6 global and locator configuration.

show segment-routing srv6 sid

Syntax Description This command has no keywords or arguments.

Command Default None

Command Modes XR EXEC mode

Command History

Release	Modification
Release 7.8.1	This command output was modified.
Release 7.0.12	This command was introduced.

Usage Guidelines The command displays SID information across locators. By default, only “active” (i.e. non-stale) SIDs are displayed.

From IOS XR Release 7.8.1, IOS XR nodes with SRv6 Micro-SID F3216 format will accept and allow service SIDs received from non-IOS XR node peers with SRv6 base F128. Non-IOS XR node peers can be without SID Struct TLV (SSTLV), or with an incompatible SSTLV having an SID that is F3216 compatible. This allows for interoperability without any IETF extension or configuration changes on the Non-IOS XR peer node.

The following example shows how to display detailed information on the remote side, with the allocation type:

```
Router# show segment-routing srv6 locator usid sid fccc:ccc1:1:e00f::
 Mon Dec 13 15:58:53.640 EST
 SID                         Behavior          Context                          Owner
           State  RW
 --------------------------  ----------------  ------------------------------
------------------  -----  --
 fccc:ccc1:1:e00f::          uDT46             '**iid'
rib_lib_test_xtf    InUse  Y
   SID Function: 0xe00f
   SID context: { '**iid' }
     App data: [0000000000000000]
   Locator: 'usid'
   Allocation type: Dynamic | Explicit
```

show segment-routing local-block inconsistencies

Displays any segment routing local block (SRLB) label inconsistencies.

show segment-routing local-block inconsistencies

Syntax Description

This command has no keywords or arguments.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

When a new SRLB range is defined, there might be a label conflict (for example, if labels are already allocated, statically or dynamically, in the new SRLB range). In this case, the new SRLB range will be accepted, but not applied (pending). The previous SRLB range (active) will continue to be in use until one of the following occurs:

- Reload the router to release the currently allocated labels and allocate the new SRLB
- Use the **clear segment-routing local-block discrepancy all** command to clear the label conflicts

Task ID

Task ID	Operation

Example

This example shows how to display the SRGB inconsistencies:

```
RP/0/RSP0/CPU0:router(config)# show segment-routing local-block inconsistencies
Tue Aug 15 13:53:30.555 EDT
SRLB inconsistencies range: Start/End: 30000/30009
```

Related Commands

Command	Description
clear segment-routing local-block discrepancy all	Clears SRLB label conflicts
segment-routing local-block	Configures the SRLB

show segment-routing mapping-server prefix-sid-map

To verify the locally configured prefix-to-SID mappings, use the **show segment-routing mapping-server prefix-sid-map** command in XR EXEC mode.

show segment-routing mapping-server prefix-sid-map [**ipv4** | **ipv6**] [*prefix*] [**detail**]

Syntax Description

ipv4	(Optional) Specifies an IPv4 address family.
ipv6	(Optional) Specifies an IPv6 address family.
prefix	(Optional) Specifies a prefix.
detail	(Optional) Displays detailed information on the prefix-to-SID mappings.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
	read

Example

The example shows how to verify the IPv4 prefix-to-SID mappings:

```
RP/0/0/CPU0:router# show segment-routing mapping-server prefix-sid-map ipv4
Prefix               SID Index    Range        Flags
20.1.1.0/24          400          300
10.1.1.1/32          10           200
Number of mapping entries: 2
```

The example shows how to display detailed information on the IPv4 prefix-to-SID mappings:

```
RP/0/0/CPU0:router# show segment-routing mapping-server prefix-sid-map ipv4 detail
Prefix
20.1.1.0/24
    SID Index:      400
    Range:          300
    Last Prefix:    20.2.44.0/24
    Last SID Index: 699
```

```
    Flags:
10.1.1.1/32
    SID Index:      10
    Range:          200
    Last Prefix:    10.1.1.200/32
    Last SID Index: 209
    Flags:
Number of mapping entries: 2
```

Related Commands

Command	Description
segment-routing mapping-server, on page 58	Configures the segment routing mapping server (SRMS).
segment-routing prefix-sid-map advertise-local, on page 61	Enables the router to advertise the SRMS entries that are locally configured.
segment-routing prefix-sid-map receive disable, on page 63	Disables mapping client functionality.
show isis segment-routing prefix-sid-map, on page 67	Displays the active and backup prefix-to-SID mappings for IS-IS.
show ospf segment-routing prefix-sid-map, on page 77	Displays the active and backup prefix-to-SID mappings for OSPF.

show segment-routing traffic-eng pcc

To monitor and troubleshoot the Path Computation Client (PCC) in SR-TE, use the **show segment-routing traffic-eng pcc** command in EXEC mode. Use the command to ensure proper operation and management of SR-TE paths in a network where PCC delegates path computation to a PCE.

show segment-routing traffic-eng pcc { *ipv4 ipv6* } **peer**

Syntax Description

pcc	Path computation client configuration details.
ipv4	Specifies that the information displayed includes the source and destination endpoints for SR-TE tunnels using IPv4 addresses.
ipv6	Specifies that the information displayed includes the source and destination endpoints for SR-TE tunnels using IPv6 addresses.
peer	Displays details of the PCE that communicates with the PCC.

Command Default

None

Command Modes

EXEC

Command History

Release	Modification
Release 24.4.1	The command is enhanced to include the SR-P2MP capability and the number of SR-P2MP instances.
Release 7.3.1	This command was introduced.

Usage Guidelines

None.

Task ID

Task ID	Operation
basic-services	READ

Example

The following output confirms that both the local and remote PCCs can handle SR-P2MP paths, each with one active instance.

```
Router#show segment-routing traffic-eng pcc ipv4 peer internal

PCC's peer database:
--------------------

PEER                          : 192.168.0.5
  State                       : up
  Handle                      : 1
  PCE group                   : ''
  Precedence                  : 255
  local stateful              : yes
```

```
remote stateful              : yes
local stateful U-flag        : yes
remote stateful U-flag       : yes
local segment-routing        : yes
remote segment-routing       : yes
local srv6                   : yes
remote srv6                  : yes
local instantiation cap      : yes
remote instantiation cap     : yes
local sr p2mp                : yes
remote sr p2mp               : yes
local maximum stack depth    : 10
remote maximum stack depth   : 0
local sr p2mp num instances  : 1
remote sr p2mp num instances : 1
local keepalive interval     : 30
remote keepalive interval    : 30
local deadtime interval      : 120
remote deadtime interval     : 120
Local PCEP session ID        : 1
Remote PCEP session ID       : 0
Remote PCEP conn addr        : 192.168.0.5
Local PCEP conn addr         : 192.168.0.4
KA messages rxed             : 721
KA messages txed             : 721
KA messages fail rxed        : 0
KA messages fail txed        : 0
PCReq messages rxed          : 0
PCReq messages txed          : 0
PCReq messages fail rxed     : 0
PCReq messages fail txed     : 0
PCRep messages rxed          : 0
PCRep messages txed          : 0
PCRep messages fail rxed     : 0
PCRep messages fail txed     : 0
PCRpt messages rxed          : 0
PCRpt messages txed          : 3
PCRpt messages fail rxed     : 0
PCRpt messages fail txed     : 0
PCUpd messages rxed          : 1
PCUpd messages txed          : 0
PCUpd messages fail rxed     : 0
PCUpd messages fail txed     : 0
Open messages rxed           : 1
Open messages txed           : 1
Open messages fail rxed      : 0
Open messages fail txed      : 5
PCErr messages rxed          : 0
PCErr messages txed          : 0
PCErr messages fail rxed     : 0
PCErr messages fail txed     : 0
PCNtf messages rxed          : 0
PCNtf messages txed          : 0
PCNtf messages fail rxed     : 0
PCNtf messages fail txed     : 0
EOS messages txed            : 1
EOS messages fail txed       : 0
Close messages rxed          : 0
Close messages txed          : 0
Close messages fail rxed     : 0
Close messages fail txed     : 0
Unexpected messages rxed     : 0
Corrupted messages rxed      : 0
Average reply time from peer : 0
```

```
Min reply time from peer     : 0
Max reply time from peer     : 0
Requests timed out           : 0
Local OK                     : yes
Remote OK                    : yes
Open retry                   : 0
Ref count                    : 3
Rx state                     : ready
Holddown count               : 0
Socket info
-----------
  file descriptor            : 119
  w_notify                   : no
  r_notify                   : yes
  refcnt                     : 1
  selected                   : no
  owner                      : 0
  client addr                : 192.168.0.4:16437
  server addr                : 192.168.0.5:4189
  Request list
------------
Timers
  Holddown timer             : Not running
  Dead timer                 : Running
  Redelegation timer         : Not running
```

summary-prefix

Use the exiting **summary-prefix** command for UPA advertisement.

summary-prefix *prefix/mask* **level** *1or 2* [**tag** *value*] [**adv-unreachable** { **unreachable-component-tag** *value* **partition-repair** }]

Syntax Description

Keyword	Details
level*1or 2*	Enter the border router values 1 or 2. To set the border router level for UPA.
tag*value*	Enter the tag value for which you want to enable the UPA.
adv-unreachable	The new keyword **adv-unreachable** controls the UPA advertisement for the components of the summary. The new **adv-unreachable** keyword is optional and disabled by default.
unreachable-component-tag*value*	The **unreachable-component-tag** is used to limit UPAs to those components of the summary that are advertised with a specific tag value. The **unreachable-component-tag** keyword is disabled by default and UPA is generated for all components of the summary if enabled by the **adv-unreachable** keyword.
partition-repair	In case the area (domain) partition is detected, the summary is suppressed, and more specific prefixes are advertised.

Command Default

None.

Command Modes

IS-IS address-family configuration

Command History

Release	Modification
Release 7.10.1	The **partition-repair** keyword was introduced.
Release 7.8.1	This command was introduced.

Usage Guidelines

New commands are added under the exiting IS-IS address-family sub-mode **summary-prefix** command.

Task ID

Task ID	Operations
IS-IS	read, write

Examples

This example shows how to configure Summary-Prefix for UPA.

```
Router(config)#router isis 1
Router(config)#router isis 1
Router(config-isis)#address-family ipv6 unicast
Router(config-isis-af)#router-id 2001:DB8:4::4
Router(config-isis-af)#summary-prefix 2001:DB8::/32 level 2 partition-repair
Router(config-isis-af)#summary-prefix 2001:DB9::/32 level 2 algorithm 128 partition-repair
```

traceroute mpls nil-fec labels

To check network connectivity and identify LSP breakages, use the **traceroute mpls nil-fec labels** command in XR EXEC mode.

traceroute mpls nil-fec labels {*label*[**,***label...*]} [**output** {**interface** *tx-interface*} [**nexthop** *next-hop-ip-address*]]

Syntax Description

labels *label,label...*	Specifies the label stack. Use commas to separate the each *label*.
ouput interface *tx-interface*	Specifies the output interface.
nexthop *next-hop-ip-address*	(Optional) Causes packets to go through the specified next-hop address.

Command Default

None

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operation
mpls-te	read, write

Example

This example shows how to check connectivity for a known label stack using a specific output interface and next-hop address:

```
RP/0/RSP0/CPU0:router# traceroute mpls nil-fec labels 16005,16007 output interface
GigabitEthernet 0/2/0/1 nexthop 10.1.1.4
Tracing MPLS Label Switched Path with Nil FEC labels 16005,16007, timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no label entry,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'd' - see DDMAP for return code,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.
```

```
  0 10.1.1.3 MRU 1500 [Labels: 16005/16007/explicit-null Exp: 0/0/0]
L 1 10.1.1.4 MRU 1500 [Labels: implicit-null/16007/explicit-null Exp: 0/0/0] 1 ms
L 2 10.1.1.5 MRU 1500 [Labels: implicit-null/explicit-null Exp: 0/0] 1 ms
! 3 10.1.1.7 1 ms
```

Related Commands

Command	Description
ping mpls nil-fec labels, on page 43	Checks network connectivity and identifying LSP breakages.

traceroute sr-mpls

To trace the routes to a destination in a segment routing network, use the **traceroute sr-mpls** command in XR EXEC mode.

traceroute sr-mpls { *ipv4-address/mask* | *ipv6-address/mask* [**fec-type** { **bgp** | **generic** | **igp** { **ospf** | **isis** } }] | **multipath** { *ipv4-address/mask* | *ipv6-address/mask* [**fec-type** { **bgp** | **generic** | **igp** { **ospf** | **isis** } } } | **nil-fec** | **dataplane-only** { **labels** { *label1* [**,** *label2...*] *ipv4-address/mask* | *ipv6-address/mask* | **policy** } } { **output** { **interface** *interface-path-id* } } { **nexthop** *next-hop-ip-address* } }

Syntax Description

ipv4 address/mask or *ipv6 address/mask*	Address prefix of the target and number of bits in the target address network mask.
fec-type	(Optional) Specifies FEC type to be used. Default FEC type is generic. **bgp** Use FEC type as BGP. **generic** Use FEC type as generic. **igp** Use FEC type as OSPF or ISIS.
labels *label,label...*	Specifies the label stack. Use commas to separate each label.
dataplane-only	Specifies data plane validation without running actual traffic over LSPs.
output interface *interface-path-id*	Specifies the output interface where echo request packets are sent.
nexthop *next-hop-ip-address*	Causes packets to go through the specified IPv4 or IPv6 next-hop address.

Command Default

fec-type : generic

Command Modes

XR EXEC mode

Command History

Release	Modification
Release 24.2.11	The **dataplane-only** keyword was introduced. Support for IPv6 next-hop address was added.
Release 7.0.12	This command was introduced.

Usage Guidelines

No specific guidelines impact the use of this command.

Task ID

Task ID	Operations
mpls-te	read, write

Example

These examples show how to use segment routing traceroute to trace the LSP for a specified IPv4 prefix segment routing id (SID). In the first example, FEC type is not specified. You can also specify the FEC type as shown in the second example. The third example uses multipath traceroute to discover all the possible paths for a IPv4 prefix SID.

```
RP/0/RP0/CPU0:router# traceroute sr-mpls 10.1.1.2/32

Tracing MPLS Label Switched Path to 10.1.1.2/32, timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

  0 10.12.12.1 MRU 1500 [Labels: implicit-null Exp: 0]
! 1 10.12.12.2 3 ms


RP/0/RP0/CPU0:router# traceroute sr-mpls 10.1.1.2/32  fec-type  igp ospf

Tracing MPLS Label Switched Path to 10.1.1.2/32, timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

  0 10.12.12.1 MRU 1500 [Labels: implicit-null Exp: 0]
! 1 10.12.12.2 2 ms


RP/0/RP0/CPU0:router# traceroute sr-mpls multipath 10.1.1.2/32

Starting LSP Path Discovery for 10.1.1.2/32

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0
```

```
Type escape sequence to abort.

!
Path 0 found,
 output interface GigabitEthernet0/0/0/2 nexthop 10.13.13.2
source 10.13.13.1 destination 127.0.0.0
!
Path 1 found,
 output interface Bundle-Ether1 nexthop 10.12.12.2
source 10.12.12.1 destination 127.0.0.0

Paths (found/broken/unexplored) (2/0/0)
Echo Request (sent/fail) (2/0)
Echo Reply (received/timeout) (2/0)
Total Time Elapsed 14 ms
```

The following example shows how to use segment routing traceroute to validate SR-MPLS over IPv6-based LSPs:

```
Router#traceroute sr-mpls dataplane-only 2001:DB8::1/32
Tue Jan 16 15:08:54.681 EST

Tracing MPLS Label Switched Path with Nil FEC to 2001:DB8::1/32, timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

  0 11:11:11::1 MRU 1500 [Labels: 18004/explicit-null Exp: 0/0]
L 1 11:11:11::2 MRU 1500 [Labels: implicit-null/explicit-null Exp: 0/0] 3 ms
! 2 15:15:15::4 3 ms
```

The following example shows how to use segment routing traceroute for SR-TE policies with IPv6-based LSPs:

```
Router#traceroute sr-mpls nil-fec policy name srte_c_40_ep_2001:DB8::1
Tue Feb  6 12:07:38.295 EST

Tracing MPLS Label Switched Path with Nil FEC for SR-TE Policy srte_c_40_ep_2001:DB8::1,
timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

  0 12:12:12::1 MRU 1500 [Labels: 26134/explicit-null Exp: 0/0]
L 1 12:12:12::3 MRU 1500 [Labels: implicit-null/explicit-null Exp: 0/0] 16 ms
! 2 16:16:16::4 16 ms
```

The following example shows how to use segment routing traceroute with labels using IPv6 LSPs:

```
Router#traceroute sr-mpls labels 18004 lsp-end-point 2001:DB8::1
Tue Feb  6 12:10:41.928 EST

Tracing MPLS Label Switched Path to NIL FEC with lsp end point 2001:DB8::1, SID Label(s)
[18004], timeout is 2 seconds

Codes: '!' - success, 'Q' - request not sent, '.' - timeout,
  'L' - labeled output interface, 'B' - unlabeled output interface,
  'D' - DS Map mismatch, 'F' - no FEC mapping, 'f' - FEC mismatch,
  'M' - malformed request, 'm' - unsupported tlvs, 'N' - no rx label,
  'P' - no rx intf label prot, 'p' - premature termination of LSP,
  'R' - transit router, 'I' - unknown upstream index,
  'X' - unknown return code, 'x' - return code 0

Type escape sequence to abort.

  0 11:11:11::1 MRU 1500 [Labels: 18004/explicit-null Exp: 0/0]
L 1 11:11:11::2 MRU 1500 [Labels: implicit-null/explicit-null Exp: 0/0] 7 ms
! 2 15:15:15::4 3 ms
```