



Segment Routing—IS-IS v4 node SID

The Segment Routing—ISIS v4 node SID feature provides support for segment routing on Cisco Intermediate System-to-Intermediate System (IS-IS) networks.

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Information About Segment Routing IS-IS v4 Node SID

Segment Routing IS-IS v4 Node SID

Segment Routing relies on a small number of extensions to Cisco Intermediate System-to-Intermediate System (IS-IS) and Open Shortest Path First (OSPF) protocols. There are two levels of configuration required to enable segment routing for a routing protocol instance. The top level segment routing configuration which is managed by segment routing infrastructure component enables segment routing, whereas, segment routing configuration at the router level enables segment routing for a specific address-family of a routing protocol instance. There are three segment routing states:

- SR_NOT_CONFIGURED
- SR_DISABLED
- SR_ENABLED

Segment routing configuration under the IGPs is allowed only if the SR state is either SR_DISABLED or SR_ENABLED. The SR_ENABLED state indicates that there is at least a valid SRGB range reserved through the MFI successfully. You can enable segment routing for IGPs under the router configuration sub mode, through commands. However, IGP segment routing are enabled only after the global SR is configured.

The SR_ENABLED is a necessary state for any protocol to enable SR, however, it is not a sufficient for enabling SR for a protocol instance. The reason being that the IS-IS still does not have any information about segment routing global block (SRGB) information. When the request to receive information about the SRGB is processed successfully, the IS-IS SR operational state is enabled.

Segment Routing requires each router to advertise its segment routing data-plane capability and the range of MPLS label values that are used for segment routing in the case where global SIDs are allocated. Data-plane

capabilities and label ranges are advertised using the SR-capabilities sub-TLV inserted into the IS-IS Router Capability TLV-242 that is defined in RFC4971.

ISIS SR-capabilities sub TLV includes all reserved SRGB ranges. However, the Cisco implementation supports only one SRGB range. The supported IPv4 prefix-SID sub TLV are TLV-135 and TLV-235.

How to Configure Segment Routing —IS-IS v4 Node SID

Configuring Segment Routing

Before you begin

Before configuring IS-IS to support segment routing you must first configure the segment routing feature in global configuration mode.

SUMMARY STEPS

1. enable
2. configure terminal
3. segment-routing mpls
4. connected-prefix-sid-map
5. address-family ipv4
6. 10.1.1.1/32 index 100 range 1
7. exit-address-family

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	enable Example: Device# enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	segment-routing mpls Example: Device(config-sr)# segment-routing mpls	Enables the segment feature using the MPLS data plane.

	Command or Action	Purpose
Step 4	connected-prefix-sid-map Example: <pre>Device(config-srmppls)# connected-prefix-sid-map</pre>	Enters a sub-mode where you can configure address-family specific mappings for local prefixes and SIDs.
Step 5	address-family ipv4 Example: <pre>Device(config-srmppls-conn)# address-family ipv4</pre>	Specifies IPv4 address prefixes.
Step 6	10.1.1.1/32 index 100 range 1 Example: <pre>Device(config-srmppls-conn-af)# 10.1.1.1/32 100 range 1</pre>	Associates SID 100 with the address 10.1.1.1/32.
Step 7	exit-address-family Example: <pre>Device(config-srmppls-conn-af)# exit-address-family</pre>	Exits the address family.

Configuring Segment Routing on an IS-IS Network

Before you begin

Before you configure segment routing on IS-IS network, IS-IS must be enabled on your network.

SUMMARY STEPS

1. **router isis**
2. **net network-entity-title**
3. **metric-style wide**
4. **segment-routing mpls**
5. **exit**
6. **show isis segment-routing**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	router isis Example: <pre>Device(config-router)# router isis</pre>	Enables the IS-IS routing protocol and enters router configuration mode.

	Command or Action	Purpose
Step 2	net network-entity-title Example: <pre>Device(config-router)# net 49.0000.0000.0003.00</pre>	Configures network entity titles (NETs) for the routing instance.
Step 3	metric-style wide Example: <pre>Device(config-router)# metric-style wide</pre>	Configures the device to generate and accept only wide link metrics.
Step 4	segment-routing mpls Example: <pre>Device(config-router)# segment-routing mpls</pre>	Configures segment routing operation state.
Step 5	exit Example: <pre>Device(config-router)# exit</pre>	Exits segment routing mode and returns to the configuration terminal mode.
Step 6	show isis segment-routing Example: <pre>Device# show is-is segment-routing</pre>	Displays the current state of the IS-IS segment routing.

Example

The following example displays output from the **show isis segment-routing state** command for the segment routing under IS-IS:

```
Device# show isis segment-routing

ISIS protocol is registered with MFI
ISIS MFI Client ID:0x63
Tag 1 - Segment-Routing:
  SR State:SR_ENABLED
  Number of SRGB:1
  SRGB Start:16000, Range:8000, srgb_handle:0x4500AED0, srgb_state: created
  Address-family IPv4 unicast SR is configured
  Operational state:Enabled
```

Configuring Prefix-SID for IS-IS

This section explains how to configure prefix segment identifier (SID) index under each interface.

Before you begin

Segment routing must be enabled on the corresponding address family.

SUMMARY STEPS

1. enable
2. configure terminal
3. segment-routing mpls
4. connected-prefix-sid-map
5. address-family ipv4
6. 10.1.1.1/32 index 100 range 1
7. exit

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	enable Example: Device# enable	Enables privileged EXEC mode.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	segment-routing mpls Example: Device(config)# segment-routing mpls	Configures segment routing mpls mode.
Step 4	connected-prefix-sid-map Example: Device(config-srmppls)# connected-prefix-sid-map	Enters a sub-mode where you can configure address-family specific mappings for local prefixes and SIDs.
Step 5	address-family ipv4 Example: Device(config-srmppls-conn)# address-family ipv4	Specifies the IPv4 address family and enters router address family configuration mode.
Step 6	10.1.1.1/32 index 100 range 1 Example: Device(config-srmppls-conn-af)# 10.1.1.1/32 100 range 1	Associates SID 100 with the address 10.1.1.1/32.
Step 7	exit Example:	Exits segment routing mode and returns to the configuration terminal mode.

	Command or Action	Purpose
	Device(config-router)# exit	

Configuring Prefix Attribute N-Flag

By default, a flag called N-flag is set by IS-IS when advertising an SID that is associated with a loopback address. To clear this flag add explicit configuration.

SUMMARY STEPS

1. enable
2. configure terminal
3. interface loopback3
4. isis prefix n-flag-clear

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	enable Example: Device# enable	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	interface loopback3 Example: Device(config)# interface loopback3	Specifies the interface loopback.
Step 4	isis prefix n-flag-clear Example: Device(config-if)# isis prefix n-flag-clear	Clears the prefix N-flag.

Configuring the Explicit Null Attribute

To disable penultimate-hop-popping (PHP) and add explicit-Null label, explicit-null option needs to be specified. Once the option is given, IS-IS sets the E flag in the prefix-SID sub TLV.

By default, a flag called E-flag (Explicit-Null flag) is set to 0 by ISIS when advertising a Prefix SID which is associated with a loopback address. If you wish to set this flag add explicit configuration.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **segment-routing mpls**
4. **set-attributes**
5. **address-family ipv4**
6. **explicit-null**
7. **exit-address-family**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	enable Example: <pre>Device# enable</pre>	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: <pre>Device# configure terminal</pre>	Enters global configuration mode.
Step 3	segment-routing mpls Example: <pre>Device(config)# segment-routing mpls</pre>	Configures segment routing mpls mode.
Step 4	set-attributes Example: <pre>Device(config-srmppls)# set-attributes</pre>	Sets the attribute.
Step 5	address-family ipv4 Example: <pre>Device(config-srmppls-attr)# address-family ipv4</pre>	Specifies the IPv4 address family and enters router address family configuration mode.
Step 6	explicit-null Example: <pre>Device(config-srmppls-attr-af)# explicit-null</pre>	Enables the explicit-null label.

	Command or Action	Purpose
Step 7	exit-address-family Example: Device(config-srmppls-attr-af)# exit-address-family	Exits the address family.

Configuration Examples for Segment Routing —IS-IS v4 Node SID

Example: Configuring Segment Routing on IS-IS Network

The following example shows how to configure prefix segment identifier (SID) index under each interface:

```
Device(config)#segment-routing mpls
Device(config-srmppls)#connected-prefix-sid-map
Device(config-srmppls-conn)#address-family ipv4
Device(config-srmppls-conn-af)#10.1.2.2/32 index 2 range 1
Device(config-srmppls-conn-af)#exit-address-family
Device(config-srmppls-conn-af)#end
```

Example: Configuring an Explicit Null Attribute

The following is an example of configuring an explicit null attribute:

```
Device(config)# segment-routing mpls
Device(config-srmppls)# set-attributes
Device(config-srmppls-attr)# address-family ipv4
Device(config-srmppls-attr-af)# explicit-null
Device (config-srmppls-attr-af)# exit-address-family
```

Additional References for Segment Routing-IS-IS v4 Node SID

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mcl/allreleasemcl/all-book.html
IP Routing ISIS commands	Cisco IOS IP Routing ISIS commands http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/mcl/allreleasemcl/all-book.html

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Segment Routing with IS-IS v4 Node SID

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <https://cfnng.cisco.com/>. An account on Cisco.com is not required.

