Configure Segment Routing for IS-IS Protocol


This module provides the configuration information used to enable segment routing for IS-IS.

For additional information on implementing IS-IS on your Cisco ASR 9000 Series Router, see the Implementing IS-IS module in the Cisco ASR 9000 Series Aggregation Services Router Routing Configuration Guide.

**Note**
- Enabling Segment Routing for IS-IS Protocol, on page 1
- Configuring a Prefix-SID on the IS-IS Enabled Loopback Interface, on page 3

**Enabling Segment Routing for IS-IS Protocol**

Segment routing on the IS-IS control plane supports the following:

- IPv4 and IPv6 control plane
- Level 1, level 2, and multi-level routing
- Prefix SIDs for host prefixes on loopback interfaces
- Adjacency SIDs for adjacencies
- MPLS penultimate hop popping (PHP) and explicit-null signaling

This task explains how to enable segment routing for IS-IS.

**Before you begin**

Your network must support the MPLS Cisco IOS XR software feature before you enable segment routing for IS-IS on your router.
You must enter the commands in the following task list on every IS-IS router in the traffic-engineered portion of your network.

### SUMMARY STEPS

1. `configure`
2. `router isis instance-id`
3. `address-family { ipv4 | ipv6 } [ unicast ]`
4. `metric-style wide [ level { 1 | 2 }]
5. `mpls traffic-eng level`
6. `mpls traffic-eng router-id interface`
7. `router-id loopback loopback interface used for prefix-sid`
8. `segment-routing mpls`
9. `exit`
10. `mpls traffic-eng`
11. `commit`

### DETAILED STEPS

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<thead>
<tr>
<th>Command or Action</th>
<th>Purpose</th>
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<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td>configure</td>
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</table>
| **Step 2** | `router isis instance-id`  
*Example:*  
RP/0/RSP0/CPU0:router(config)# router isis isp | Enables IS-IS routing for the specified routing instance, and places the router in router configuration mode.  
*Note* You can change the level of routing to be performed by a particular routing instance by using the `is-type` router configuration command. |
| **Step 3** | `address-family { ipv4 | ipv6 } [ unicast ]`  
*Example:*  
RP/0/RSP0/CPU0:router(config-isis)# address-family ipv4 unicast | Specifies the IPv4 or IPv6 address family, and enters router address family configuration mode. |
| **Step 4** | `metric-style wide [ level { 1 | 2 }]
*Example:*  
RP/0/RSP0/CPU0:router(config-isis-af)# metric-style wide level 1 | Configures a router to generate and accept only wide link metrics in the Level 1 area. |
| **Step 5** | `mpls traffic-eng level`  
*Example:*  
RP/0/RSP0/CPU0:router(config-isis-af)# mpls traffic-eng level-2-only | Enables RSVP traffic engineering functionality. |
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<td><strong>Step 6</strong></td>
<td>mpls traffic-eng router-id interface</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>RP/0/RSP0/CPU0:router(config-isis-af)# mpls traffic-eng router-id Loopback0</td>
</tr>
<tr>
<td><strong>Sets the traffic engineering loopback interface.</strong></td>
<td></td>
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<tr>
<td><strong>Step 7</strong></td>
<td>router-id loopback interface used for prefix-sid</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>RP/0/config-isis-af)#router-id loopback0</td>
</tr>
<tr>
<td><strong>Configures router ID for each address-family (ipv4/ipv6).</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Step 8</strong></td>
<td>segment-routing mpls</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>RP/0/RSP0/CPU0:router(config-isis-af)# segment-routing mpls</td>
</tr>
<tr>
<td><strong>Segment routing is enabled by the following actions:</strong></td>
<td></td>
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<tr>
<td>• MPLS forwarding is enabled on all interfaces where IS-IS is active.</td>
<td></td>
</tr>
<tr>
<td>• All known prefix-SIDs in the forwarding plain are programmed, with the prefix-SIDs advertised by remote routers or learned through local or remote mapping server.</td>
<td></td>
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<tr>
<td>• The prefix-SIDs locally configured are advertised.</td>
<td></td>
</tr>
<tr>
<td><strong>Step 9</strong></td>
<td>exit</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>RP/0/RSP0/CPU0:router(config-isis-af)# exit</td>
</tr>
<tr>
<td><strong>Exit from configuration mode.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Step 10</strong></td>
<td>mpls traffic-eng</td>
</tr>
<tr>
<td><strong>Example:</strong></td>
<td>RP/0/RSP0/CPU0:router(config)# mpls traffic-eng</td>
</tr>
<tr>
<td><strong>Enables traffic engineering functionality on the node. The node advertises the traffic engineering link attributes in IGP which populates the traffic engineering database (TED) on the head-end. The RSVP-TE head-end requires the TED to calculate and validate the path of the RSVP-TE policy.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Step 11</strong></td>
<td>commit</td>
</tr>
</tbody>
</table>

**What to do next**
Configure the prefix SID.

**Configuring a Prefix-SID on the IS-IS Enabled Loopback Interface**

A prefix segment identifier (SID) is associated with an IP prefix. The prefix SID is manually configured from the segment routing global block (SRGB) range of labels. A prefix SID is configured under the loopback
interface with the loopback address of the node as the prefix. The prefix segment steers the traffic along the shortest path to its destination.

A prefix SID can be a node SID or an Anycast SID. A node SID is a type of prefix SID that identifies a specific node. An Anycast SID is a type of prefix SID that identifies a set of nodes, and is configured with n-flag clear. The set of nodes (Anycast group) is configured to advertise a shared prefix address and prefix SID. Anycast routing enables the steering of traffic toward multiple advertising nodes. Packets addressed to an Anycast address are forwarded to the topologically nearest nodes.

The prefix SID is globally unique within the segment routing domain.

This task explains how to configure prefix segment identifier (SID) index or absolute value on the IS-IS enabled Loopback interface.

**Before you begin**
Ensure that segment routing is enabled on the corresponding address family.

**SUMMARY STEPS**

1. `configure`
2. `router isis instance-id`
3. `interface Loopback instance`
4. `address-family { ipv4 | ipv6 } [ unicast ]`
5. `prefix-sid {index SID-index | absolute SID-value} [n-flag-clear] [explicit-null ]`
6. `commit`

### DETAILED STEPS

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</table>
| **Step 2** | `router isis instance-id`  
**Example:**

```plaintext
RP/0/RSP0/CPU0:router(config)# router isis 1
```
| Enables IS-IS routing for the specified routing instance, and places the router in router configuration mode.  
• You can change the level of routing to be performed by a particular routing instance by using the `is-type` router configuration command. |
| **Step 3** | `interface Loopback instance`  
**Example:**

```plaintext
RP/0/RSP0/CPU0:router(config-isis)# interface Loopback0
```
| Specifies the loopback interface and instance. |
| **Step 4** | `address-family { ipv4 | ipv6 } [ unicast ]`  
**Example:**  
The following is an example for ipv4 address family:

```plaintext
RP/0/RSP0/CPU0:router(config-isis-if)# address-family ipv4 unicast
```
<p>| Specifies the IPv4 or IPv6 address family, and enters router address family configuration mode. |</p>
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<td><strong>Step 5</strong></td>
<td>Configures the prefix-SID index or absolute value for the interface.</td>
</tr>
<tr>
<td>prefix-sid {index SID-index</td>
<td>absolute SID-value} [n-flag-clear] [explicit-null]</td>
</tr>
<tr>
<td>Example:</td>
<td>Specify <strong>absolute SID-value</strong> for each node to create a specific prefix SID within the SRGB.</td>
</tr>
<tr>
<td>RP/0/RSP0/CPU0:router(config-isis-if-af)# prefix-sid index 1001</td>
<td>By default, the n-flag is set on the prefix-SID, indicating that it is a node SID. For specific prefix-SID (for example, Anycast prefix-SID), enter the <strong>n-flag-clear</strong> keyword. IS-IS does not set the ( N ) flag in the prefix-SID sub Type Length Value (TLV).</td>
</tr>
<tr>
<td>RP/0/RSP0/CPU0:router(config-isis-if-af)# prefix-sid absolute 17001</td>
<td>To disable penultimate-hop-popping (PHP) and add explicit-Null label, enter <strong>explicit-null</strong> keyword. IS-IS sets the ( E ) flag in the prefix-SID sub TLV.</td>
</tr>
</tbody>
</table>

**Step 6**

**commit**

Verify the prefix-SID configuration:

```
RP/0/RSP0/CPU0:router# show isis database verbose
```

```
IS-IS 1 (Level-2) Link State Database
LSPID LSP Seq Num LSP Checksum LSP Holdtime ATT/P/OL
router.00-00 * 0x0000039b 0xfc27 1079 0/0/0
Area Address: 49.0001
NLPID: 0xcc
NLPID: 0x8e
MT: Standard (IPv4 Unicast)
MT: IPv6 Unicast 0/0/0
Hostname: router
IP Address: 10.0.0.1
IPv6 Address: 2001:0db8:1234::0a00:0001
Router Cap: 10.0.0.1, D:0, S:0
Segment Routing: I:1 V:1, SRGB Base: 16000 Range: 8000
SR Algorithm:
  Algorithm: 0
<...>
Metric: 0  IP-Extended 10.0.0.1/32
  Prefix-SID Index: 1001, Algorithm:0, R:0 N:1 P:0 E:0 V:0 L:0
<...>
```

**What to do next**

Configure the SR-TE policy.
Configuring a Prefix-SID on the IS-IS Enabled Loopback Interface