



MVPN ingress replication over SRv6

This document describes MVPN Ingress Replication (IR) over SRv6.

- [Feature Information for MVPN ingress replication over SRv6, on page 1](#)
- [MVPN Ingress Replication over SRv6, on page 1](#)
- [How MVPN Ingress Replication over SRv6 works, on page 2](#)
- [Partitioned MDT profiles, on page 3](#)
- [Configure MVPN ingress replication over SRv6 , on page 3](#)
- [Configure SRv6 MVPN multicast, on page 4](#)
- [Verify and monitor MVPN ingress replication over SRv6, on page 6](#)
- [Appendix: configuration reference, on page 17](#)

Feature Information for MVPN ingress replication over SRv6

The table below provides the feature history for MVPN ingress replication over SRv6.

Table 1:

Feature	Release	Description
MVPN Ingress Replication (IR) over SRv6	Cisco IOS XE 17.18.1a	This feature enables the transport of IPv4 Multicast traffic across an SRv6 network. It simplifies multicast deployment by using the existing SRv6 unicast infrastructure as the underlay. With this feature, the ingress PE router receives multicast traffic and creates a separate unicast SRv6-encapsulated copy for each egress PE router in the multicast group.

MVPN Ingress Replication over SRv6

This document describes MVPN Ingress Replication (IR) over SRv6, a feature that

- enables the transport of IPv4 Multicast traffic across an SRv6 network,
- leverages the existing SRv6 unicast infrastructure
- simplifies multicast deployment by using SRv6 as the underlay transport.

The ingress PE router receives multicast traffic and creates a separate unicast SRv6-encapsulated copy for each egress PE router in the multicast group.

- Each packet is encapsulated using an SRv6 encapsulation that guides it to the intended egress PE.
- The core network simply forwards these SRv6 packets based on their segment routing headers; no multicast state is maintained in the core.
- The egress PE receives and decapsulates the outer SRv6 encapsulation, and then forwards the multicast data in corresponding VPN.

How MVPN Ingress Replication over SRv6 works

This feature primarily supports IPv4 MVPN over an SRv6 network, specifically implementing the SRv6 End.DTMC4 behavior. Key capabilities and benefits include:

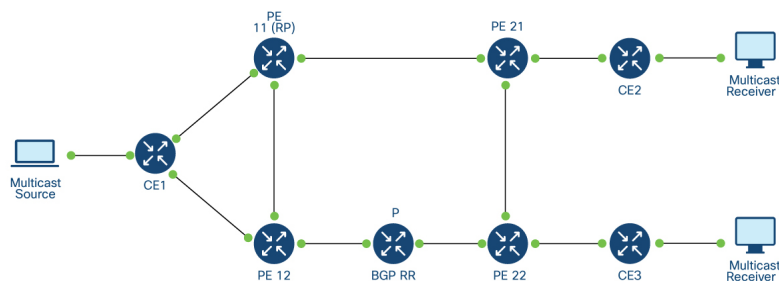
Summary

The key components involved in the MVPN Ingress Replication over SRv6 process are:

- Ingress CE: The customer edge device that faces the multicast source.
- Ingress PE: The provider edge router that receives multicast traffic, performs replication, and encapsulates it.
- Core Network (P routers): The underlying SRv6 fabric that forwards encapsulated packets without maintaining multicast state.
- Egress PE: The provider edge router that receives and decapsulates multicast traffic for receivers.
- Egress CE: The customer edge device that faces the multicast receiver.

MVPN Ingress Replication over SRv6 describes the end-to-end flow of IPv4 multicast traffic from source to receiver using SRv6 as the underlay, leveraging ingress replication at the PE routers.

Workflow



The MVPN Ingress Replication over SRv6 process involves the following stages:

1. The ingress CE faces the multicast source and forwards the multicast traffic to the Ingress PE. The Ingress PE performs replication based on learned multicast routes and encapsulates each replica in an IPv6 header. The Egress PE allocates a SID for MVPN per VRF, and the Ingress PE uses that SID for all multicast routes in the VRF for forwarding in the underlay. Each IPv6 packet is then forwarded to the appropriate Egress PE.
2. The Egress PE receives the unicast IPv6 packet destined for its locally allocated SRv6 SID, decapsulates the outer SRv6 header, and performs a multicast lookup in the associated VRF. The payload is then delivered to the Egress CE facing the multicast receiver.
3. The Provider Edge (PE) and Provider (P) routers form the SRv6 fabric, while PE devices act as SRv6 edge nodes.

Partitioned MDT profiles

In a partitioned MDT profile, only those egress PE routers with interested receivers are associated with that ingress PE. By using Partitioned MDT we limit the replication state in the Ingress PE to only include Egress PEs that contain receivers.

When a Partitioned MDT profile is used in PE-PE IR, egress PEs may need to identify traffic from ingress PEs, which uses an internal RPF-ID.

Configure MVPN ingress replication over SRv6

Enable MVPN Ingress Replication over SRv6 for the specified VRF, allowing multicast traffic transport over the SRv6 underlay.

SRv6 MVPN IR transports only IPv4 multicast traffic over an SRv6 network. Intra-as BGP auto-discovery for SRv6 and C-mroute overlay signalling are enabled by default. Strict RPF check is also enabled by default.

Before you begin

For more information on static RP and Auto RP configuration, refer [Configuring Basic IP Multicast](#)

Follow these steps to configure MVPN IR over SRv6.

Procedure

Step 1 Access the VRF definition configuration mode.

Example:

```
vrf definition BLUE
```

Step 2 Enter the address-family configuration mode for IPv4.

Example:

```
address-family ipv4
```

Step 3 Configure SRv6 multicast ingress replication.

Example:

```
srv6-mcast ingress-replication partitioned [data]
```

- partitioned: Specifies partitioned MDT.
- data: Specifies data MDT.

MVPN Ingress Replication over SRv6 is configured for the specified VRF, enabling multicast traffic transport over the SRv6 underlay.

Configure SRv6 MVPN multicast

To enable MVPN Ingress Replication over SRv6 for multicast traffic within a VRF.

Intra-as BGP auto-discovery for SRv6 and C-mroute overlay signaling are enabled by default. Strict RPF check is also enabled by default.

Before you begin

Follow these steps to enable MVPN Ingress Replication over SRv6 for multicast traffic within a VRF.

Procedure

Step 1 Enter the global configuration mode and access the VRF definition:

Example:

```
vrf definition <vrf-name>
```

Step 2 Configure the Route Distinguisher (RD) for the VRF.

Example:

```
rd <route-distinguisher>
```

Step 3 For IPv4 multicast, enter the address-family.

Example:

```
address-family ipv4
```

Step 4 Configure the route-target for the VRF's address-family.

Example:

```
route-target {import | export | both } <route-target-ext-community>
```

Step 5 Enable SRv6 multicast ingress replication:

Example:

```
srv6-mcast ingress-replication partitioned [data]
```

Step 6 Exit the IPv4 address-family configuration mode:

Example:

```
exit-address-family
```

The specified VRF is configured to use SRv6 for MVPN Ingress Replication.

Configure BGP MVPNv4 neighbor encapsulation

To specify the encapsulation type for MVPNv4 updates advertised to a BGP neighbor.

Before you begin

Follow these steps to specify the encapsulation type for MVPNv4 updates advertised to a BGP neighbor.

Procedure

Step 1 Enter the global configuration mode and access the BGP router configuration.

Example:

```
router bgp <autonomous-system-number>
```

Step 2 Enter the IPv4 MVPN address-family configuration mode.

Example:

```
address-family ipv4 mvpn
```

Step 3 Configure the encapsulation option for a specific neighbor.

Example:

```
address-family ipv4 mvpn
    neighbor <neighbor-address> activate
    neighbor <neighbor-address> send-community both
```

The BGP neighbor is configured to advertise MVPNv4 updates only for the specified encapsulation type.

BGP SRv6 configuration

To illustrate a sample BGP configuration for SRv6 in a multicast environment.

This example displays a BGP configuration that

- includes SRv6 locator and
- allocation mode settings, which are utilized by Multicast.

```
router bgp <autonomous-system-number>
    neighbor <neighbor-address> remote-as <remote-as-number>
    neighbor <neighbor-address> update-source <interface-type-and-number>
    segment-routing srv6
    locator <locator-name>
    exit-srv6
    address-family vpnv4
    neighbor <neighbor-address> activate
    neighbor <neighbor-address> send-community both
    segment-routing srv6
```

```
locator <locator-name>
alloc-mode per-vrf
exit-srv6
address-family ipv4 vrf <vrf-name>
segment-routing srv6
locator <locator-name>
alloc-mode per-vrf
exit-srv6
address-family ipv4 mvpn
neighbor <neighbor-address> activate
neighbor <neighbor-address> send-community both
```

Verify and monitor MVPN ingress replication over SRv6

To provide commands and examples for monitoring and verifying the operation of SRv6 MVPN.

These commands help you monitor and verify the operation of SRv6 MVPN.

•

The following example shows the output of the **show ip mroute** command on an Ingress PE router to display the multicast routing table for a specific VRF and group address.

```
PE12#show ip mroute vrf vpn-11 239.1.1.2 verbose
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
       L - Local, P - Pruned, R - RP-bit set, F - Register flag,
       T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
       X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
       U - URD, I - Received Source Specific Host Report,
       Z - Multicast Tunnel, z - MDT-data group sender,
       Y - Joined MDT-data group, y - Sending to MDT-data group,
       G - Received BGP C-Mroute, g - Sent BGP C-Mroute,
       N - Received BGP Shared-Tree Prune, n - BGP C-Mroute suppressed,
       Q - Received BGP S-A Route, q - Sent BGP S-A Route,
       V - RD & Vector, v - Vector, p - PIM Joins on route,
       x - VxLAN group, c - PFP-SA cache created entry,
       * - determined by Assert, # - iif-starg configured on rpf intf,
       e - encap-helper tunnel flag, l - LISP decap ref count contributor
Outgoing interface flags: H - Hardware switched, A - Assert winner, p - PIM Join
                        t - LISP transit group

Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode

(*, 239.1.1.2), 00:04:47/stopped, RP 11.11.11.11, flags: SP
  Incoming interface: Srvif1, RPF nbr A002::1
  Remote RD: 11:11 RPF-ID: 0xA002::1
  Outgoing interface list: Null

(11.1.0.2, 239.1.1.2), 00:04:47/00:02:07, flags: TyGq
  Incoming interface: GigabitEthernet2.11, RPF nbr 14.1.0.1
  MDT TX nr: 2097162 LSM-ID: 0x5E
  Outgoing interface list:
    Srvif1, LSM MDT: 5E (data), Forward/Sparse, 00:04:47/stopped, Pkts:0, flags:
```

The following output example displays multicast routing entry details and MVPN replication.

```
PE12#show ip mroute vrf vpn-11 239.1.1.2 11.1.0.2 verbose

(11.1.0.2, 239.1.1.2), 00:02:32/00:00:27, flags: TyGq
  Incoming interface: GigabitEthernet2.11, RPF nbr 14.1.0.1
```

```
MDT TX nr: 2097162  LSM-ID: 0x5E
Outgoing interface list:
  Srvif1, LSM MDT: 5E (data), Forward/Sparse, 00:02:32/00:00:27, Pkts:0, flags:
```

The following example shows the output of the **show ip mfib** command on an Ingress PE router, displaying the multicast forwarding information base (MFIB) for a specific VRF and group address.

```
PE12#show ip mfib vrf vpn-11 239.1.1.2
Entry Flags:      C - Directly Connected, S - Signal, IA - Inherit A flag,
                  ET - Data Rate Exceeds Threshold, K - Keepalive
                  DDE - Data Driven Event, HW - Hardware Installed
                  ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
                  MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
                  MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client,
                  e  - Encap helper tunnel flag.
I/O Item Flags:  IC - Internal Copy, NP - Not platform switched,
                  NS - Negate Signalling, SP - Signal Present,
                  A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
                  MA - MFIB Accept, A2 - Accept backup,
                  RA2 - MRIB Accept backup, MA2 - MFIB Accept backup

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   HW Pkt Count/FS Pkt Count/PS Pkt Count   Egress Rate in pps
VRF vpn-11
(*,239.1.1.2) Flags: C HW
  SW Forwarding: 0/0/0/0, Other: 0/0/0
  HW Forwarding:  0/0/0/0, Other: 0/0/0
  Srvif1, SRV6 LSM/5D, RPF-ID: 0xA002::1, Flags: A
(11.1.0.2,239.1.1.2) Flags: ET HW
  SW Forwarding: 0/0/0/0, Other: 0/0/0
  HW Forwarding: 607/2/200/3, Other: 27/27/0
  GigabitEthernet2.11 Flags: A
  Srvif1, SRV6 LSM/5E, RPF-ID: *, Flags: F
  Pkts: 0/0/0   Rate: 0 pps
```

The **show bgp ipv4 mvpn vrf vpn-11 detail** command displays detailed BGP MVPN routing table entries for VRF vpn-11.

```
PE12#show bgp ipv4 mvpn vrf vpn-11 detail

Route Distinguisher: 11:11 (default for vrf vpn-11)
BGP routing table entry for [1][11:11][A002::1]/24, version 3764603
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
  Local
    A002::1 (metric 20) from A005::1 (5.5.5.5)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      Extended Community: RT:11:11
      Originator: 2.2.2.2, Cluster list: 5.5.5.5
      rx pathid: 0, tx pathid: 0x0
      Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [1][11:11][A003::1]/24, version 3764604
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
  Local
    A003::1 (metric 30) from A005::1 (5.5.5.5)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      Extended Community: RT:11:11
      Originator: 3.3.3.3, Cluster list: 5.5.5.5
      rx pathid: 0, tx pathid: 0x0
      Updated on Aug 4 2025 05:52:41 UTC
BGP routing table entry for [1][11:11][A004::1]/24, version 3764605
```

```

Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Advertised to update-groups:
  23
Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (4.4.4.4)
  Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
  Extended Community: RT:11:11
  rx pathid: 0, tx pathid: 0x0
  Updated on Jul 30 2025 04:45:12 UTC
BGP routing table entry for [1][11:11][A006::1]/24, version 3764606
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A006::1 (metric 30) from A005::1 (5.5.5.5)
  Origin incomplete, metric 0, localpref 100, valid, internal, best
  Extended Community: RT:11:11
  Originator: 6.6.6.6, Cluster list: 5.5.5.5
  rx pathid: 0, tx pathid: 0x0
  Updated on Aug 4 2025 05:52:41 UTC
BGP routing table entry for [3][11:11][*][*][A002::1]/26, version 3764768
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A002::1 (metric 20) from A005::1 (5.5.5.5)
  Origin incomplete, metric 0, localpref 100, valid, internal, best
  Extended Community: RT:11:11
  Originator: 2.2.2.2, Cluster list: 5.5.5.5
  PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
identifier: < Tunnel Endpoint: A002::1 >
  rx pathid: 0, tx pathid: 0x0
  Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [3][11:11][*][*][A003::1]/26, version 3764769
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A003::1 (metric 30) from A005::1 (5.5.5.5)
  Origin incomplete, metric 0, localpref 100, valid, internal, best
  Extended Community: RT:11:11
  Originator: 3.3.3.3, Cluster list: 5.5.5.5
  PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
identifier: < Tunnel Endpoint: A003::1 >
  rx pathid: 0, tx pathid: 0x0
  Updated on Aug 4 2025 05:52:41 UTC
BGP routing table entry for [3][11:11][*][*][A004::1]/26, version 3764770
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Advertised to update-groups:
  23
Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (4.4.4.4)
  Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
  Extended Community: RT:11:11
  PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
identifier: < Tunnel Endpoint: A004::1 >
  rx pathid: 0, tx pathid: 0x0
  Updated on Jul 30 2025 04:45:12 UTC
BGP routing table entry for [3][11:11][*][*][A006::1]/26, version 3764771
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2

```

```

Local
  A006::1 (metric 30) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 6.6.6.6, Cluster list: 5.5.5.5
    PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A006::1 >
    rx pathid: 0, tx pathid: 0x0
    Updated on Aug 4 2025 05:52:41 UTC
BGP routing table entry for [3][11:11][*][224.0.1.39][A002::1]/30, version 3764772
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
Local
  A002::1 (metric 20) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 2.2.2.2, Cluster list: 5.5.5.5
    PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A002::1 >
    rx pathid: 0, tx pathid: 0x0
    Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [3][11:11][*][224.0.1.40][A002::1]/30, version 3764773
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
Local
  A002::1 (metric 20) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 2.2.2.2, Cluster list: 5.5.5.5
    PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A002::1 >
    rx pathid: 0, tx pathid: 0x0
    Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [3][11:11][11.1.0.2][239.1.1.2][A004::1]/34, version 3764774
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    23
  Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (4.4.4.4)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    Extended Community: RT:11:11
    PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A004::1 >
    rx pathid: 0, tx pathid: 0x0
    Updated on Aug 7 2025 09:22:19 UTC
BGP routing table entry for [4][3][11:11][*][*][A002::1]/26[A004::1]/44, version 3739440
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    23
  Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (4.4.4.4)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    IPv6-Extended Community: RT::A002::1:0
    PMSI Attribute: Flags: 0x0, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A004::1 >
    srv6 in-sid: F:F128:4:E000::
    rx pathid: 3, tx pathid: 0x0
    Updated on Aug 8 2025 01:30:45 UTC
BGP routing table entry for [4][3][11:11][*][224.0.1.39][A002::1]/30[A004::1]/48, version
3666900

```

```

Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Advertised to update-groups:
  23
Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (4.4.4.4)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    IPv6-Extended Community: RT::A002::1:0
    PMSI Attribute: Flags: 0x0, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A004::1 >
    srv6 in-sid: F:F128:4:E000::
    rx pathid: 3, tx pathid: 0x0
    Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [4]([3][11:11][*][224.0.1.40][A002::1]/30)[A004::1]/48, version 3666901
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    23
  Refresh Epoch 1
  Local
    0.0.0.0 from 0.0.0.0 (4.4.4.4)
      Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
      IPv6-Extended Community: RT::A002::1:0
      PMSI Attribute: Flags: 0x0, Tunnel type: IR, length 16, label:exp-null tunnel
    identifier: < Tunnel Endpoint: A004::1 >
      srv6 in-sid: F:F128:4:E000::
      rx pathid: 3, tx pathid: 0x0
      Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [5][11:11][11.1.0.2][239.1.1.2]/18, version 3598737
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    23
  Refresh Epoch 1
  Local
    0.0.0.0 from 0.0.0.0 (4.4.4.4)
      Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
      Extended Community: RT:11:11
      rx pathid: 0, tx pathid: 0x0
      Updated on Aug 7 2025 09:22:12 UTC
BGP routing table entry for [7][11:11][100][11.1.0.2/32][239.1.1.2/32]/22, version 3730109
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
  Local
    A006::1 (metric 30) from A005::1 (5.5.5.5)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      Extended Community: RT:4.4.4.4:3
      Originator: 6.6.6.6, Cluster list: 5.5.5.5
      rx pathid: 0, tx pathid: 0x0
      Updated on Aug 8 2025 00:54:16 UTC

```

Use the **show mvpn ipv4 vrf vpn-11 auto-discovery detail** command to display a summary of the MVPN auto-discovery routes.

```

PE12#show mvpn ipv4 vrf vpn-11 auto-discovery detail
I-PMSI - Intra-AS Inclusive-PMSI, S-PMSI - Selective-PMSI
* - Indicates Wildcard source or group address

```

```

[I-PMSI][11:11][A002::1], Joined
Orig: Remote Uptime: 2w5d Type: NONE

[I-PMSI][11:11][A003::1], Joined
Orig: Remote Uptime: 18:31:19 Type: NONE

```

```
[I-PMSI][11:11][A006::1], Joined
Orig: Remote Uptime: 18:31:19 Type: NONE

[S-PMSI][11:11][*][*][A002::1], Joined
Orig: Remote Uptime: 6d00h Type: IR SRV6

[S-PMSI][11:11][*][*][A003::1],
Orig: Remote Uptime: 18:31:19 Type: IR SRV6

[S-PMSI][11:11][*][*][A006::1],
Orig: Remote Uptime: 18:31:19 Type: IR SRV6

[S-PMSI][11:11][*][224.0.1.39][A002::1], Joined
Orig: Remote Uptime: 6d00h Type: IR SRV6

[S-PMSI][11:11][*][224.0.1.40][A002::1], Joined
Orig: Remote Uptime: 6d00h Type: IR SRV6

[I-PMSI][11:11][A004::1], Joined
Orig: Local Uptime: 5d19h Type: NONE

[S-PMSI][11:11][*][*][A004::1], Joined
Orig: Local Uptime: 5d19h Type: IR SRV6

[S-PMSI][11:11][11.1.0.2][239.1.1.2][A004::1], Joined
Orig: Local Uptime: 00:01:04 Type: IR SRV6
```

Use the **show mvpn ipv4 vrf vpn-11 leaf-information detail** command to display a summary of the MVPN leaf-information details.

```
PE12#show mvpn ipv4 vrf vpn-11 leaf-information detail
```

```
Route-Type: 1 - Intra-AS Inclusive-PMSI, 3 - Selective-PMSI
```

```
* - Indicates Wildcard source or group address
```

```
[3][11:11][*][*][A004::1], Joined
Remote Orig: A003::1 UMH: 0.0.0.0 Uptime: 00:01:41 Type: IR SRV6
Remote SID:{F:F128:3:E024::, pl:0 bl:32 nl:16 fl:16 al:0 st:0 bhv:76} IR-address: A003::1
Replication-Id: 200000

[3][11:11][*][*][A004::1], Joined
Remote Orig: A006::1 UMH: 0.0.0.0 Uptime: 00:01:24 Type: IR SRV6
Remote SID:{F:F128:6:E024::, pl:0 bl:32 nl:16 fl:16 al:0 st:0 bhv:76} IR-address: A006::1
Replication-Id: 200000

[3][11:11][11.1.0.2][239.1.1.2][A004::1], Joined
Remote Orig: A003::1 UMH: 0.0.0.0 Uptime: 00:01:33 Type: IR SRV6
Remote SID:{F:F128:3:E024::, pl:0 bl:32 nl:16 fl:16 al:0 st:0 bhv:76} IR-address: A003::1
Replication-Id: 20000A

[3][11:11][11.1.0.2][239.1.1.2][A004::1], Joined
Remote Orig: A006::1 UMH: 0.0.0.0 Uptime: 00:01:24 Type: IR SRV6
Remote SID:{F:F128:6:E024::, pl:0 bl:32 nl:16 fl:16 al:0 st:0 bhv:76} IR-address: A006::1
Replication-Id: 20000A

[3][11:11][*][*][A002::1], Joined
Local Orig: A004::1 UMH: A002::1 Uptime: 00:01:41 Type: IR SRV6
Local SID:{F:F128:4:E000::, pl:64 bl:32 nl:16 fl:16 al:0 st:0 bhv:76} IR-address: A004::1
IR-Egress-PSM-Id: 41947810

[3][11:11][*][224.0.1.39][A002::1], Joined
Local Orig: A004::1 UMH: A002::1 Uptime: 5d19h Type: IR SRV6
Local SID:{F:F128:4:E000::, pl:64 bl:32 nl:16 fl:16 al:0 st:0 bhv:76} IR-address: A004::1
IR-Egress-PSM-Id: 41947810
```

```
[3][11:11][*][224.0.1.40][A002::1], Joined
Local Orig: A004::1 UMH: A002::1 Uptime: 5d19h Type: IR SRV6
Local SID:{F:F128:4:E000::, pl:64 bl:32 nl:16 fl:16 al:0 st:0 bhv:76} IR-address: A004::1
IR-Egress-PSM-Id: 41947810
```

To view information on the replication branches, including remote SIDs, for the specified multicast LSM ID use the command below.



Note The LSM MDT: <value> field from the above **show ip mroute** output, for instance 5E in this example, provides the LSM ID value of the below **show mvpn replication** command.

```
PE12#show mvpn replication lsm-id 5E
```

```
Repl ID : 20000A   LSM ID : 5E   Uptime : 00:03:03
Path Set ID      : 2800FD6
Replication branches: 2
  IR (A003::1)
    Uptime       : 00:03:03      Refcount   : 1
    Remote SID: F:F128:3:E024::
  IR (A006::1)
    Uptime       : 00:02:54      Refcount   : 1
    Remote SID: F:F128:6:E024::
```

Use the following command to display detailed BGP MVPN information for the specified VRF.

```
PE22#show bgp ipv4 mvpn vrf vpn-11 detail
```

```
Route Distinguisher: 11:11 (default for vrf vpn-11)
BGP routing table entry for [1][11:11][A002::1]/24, version 1865054
Paths: (1 available, best #1, table MVPNV4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A002::1 (metric 30) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 2.2.2.2, Cluster list: 5.5.5.5
    rx pathid: 0, tx pathid: 0x0
    Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [1][11:11][A003::1]/24, version 1865055
Paths: (1 available, best #1, table MVPNV4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A003::1 (metric 20) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 3.3.3.3, Cluster list: 5.5.5.5
    rx pathid: 0, tx pathid: 0x0
    Updated on Aug 4 2025 05:52:41 UTC
BGP routing table entry for [1][11:11][A004::1]/24, version 1865056
Paths: (1 available, best #1, table MVPNV4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A004::1 (metric 30) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 4.4.4.4, Cluster list: 5.5.5.5
    rx pathid: 0, tx pathid: 0x0
    Updated on Aug 7 2025 17:53:45 UTC
```

```

BGP routing table entry for [1][11:11][A006::1]/24, version 1865057
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    9
  Refresh Epoch 1
  Local
    0.0.0.0 from 0.0.0.0 (6.6.6.6)
      Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
      Extended Community: RT:11:11
      rx pathid: 0, tx pathid: 0x0
      Updated on Jul 16 2025 15:42:02 UTC
BGP routing table entry for [3][11:11][*][*][A002::1]/26, version 1865219
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
  Local
    A002::1 (metric 30) from A005::1 (5.5.5.5)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      Extended Community: RT:11:11
      Originator: 2.2.2.2, Cluster list: 5.5.5.5
      PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A002::1 >
      rx pathid: 0, tx pathid: 0x0
      Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [3][11:11][*][*][A003::1]/26, version 1865220
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
  Local
    A003::1 (metric 20) from A005::1 (5.5.5.5)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      Extended Community: RT:11:11
      Originator: 3.3.3.3, Cluster list: 5.5.5.5
      PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A003::1 >
      rx pathid: 0, tx pathid: 0x0
      Updated on Aug 4 2025 05:52:41 UTC
BGP routing table entry for [3][11:11][*][*][A004::1]/26, version 1865221
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Not advertised to any peer
  Refresh Epoch 2
  Local
    A004::1 (metric 30) from A005::1 (5.5.5.5)
      Origin incomplete, metric 0, localpref 100, valid, internal, best
      Extended Community: RT:11:11
      Originator: 4.4.4.4, Cluster list: 5.5.5.5
      PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A004::1 >
      rx pathid: 0, tx pathid: 0x0
      Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [3][11:11][*][*][A006::1]/26, version 1865222
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    9
  Refresh Epoch 1
  Local
    0.0.0.0 from 0.0.0.0 (6.6.6.6)
      Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
      Extended Community: RT:11:11
      PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A006::1 >
      rx pathid: 0, tx pathid: 0x0
      Updated on Jul 16 2025 15:42:02 UTC
BGP routing table entry for [3][11:11][*][*][224.0.1.39][A002::1]/30, version 1865223

```

```

Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A002::1 (metric 30) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 2.2.2.2, Cluster list: 5.5.5.5
    PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
identifier: < Tunnel Endpoint: A002::1 >
  rx pathid: 0, tx pathid: 0x0
  Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [3][11:11][*][224.0.1.40][A002::1]/30, version 1865224
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A002::1 (metric 30) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 2.2.2.2, Cluster list: 5.5.5.5
    PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
identifier: < Tunnel Endpoint: A002::1 >
  rx pathid: 0, tx pathid: 0x0
  Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [3][11:11][11.1.0.2][239.1.1.2][A004::1]/34, version 1865225
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Not advertised to any peer
Refresh Epoch 2
Local
  A004::1 (metric 30) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 4.4.4.4, Cluster list: 5.5.5.5
    PMSI Attribute: Flags: 0x1, Tunnel type: IR, length 16, label:exp-null tunnel
identifier: < Tunnel Endpoint: A004::1 >
  rx pathid: 0, tx pathid: 0x0
  Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [4][3][11:11][*][*][A002::1]/26[A006::1]/44, version 1848708
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Advertised to update-groups:
  9
Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (6.6.6.6)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    IPv6-Extended Community: RT::A002::1:0
    PMSI Attribute: Flags: 0x0, Tunnel type: IR, length 16, label:exp-null tunnel
identifier: < Tunnel Endpoint: A006::1 >
  srv6 in-sid: F:F128:6:E024::
  rx pathid: 3, tx pathid: 0x0
  Updated on Aug 8 2025 00:54:16 UTC
BGP routing table entry for [4][3][11:11][*][*][A004::1]/26[A006::1]/44, version 1848705
Paths: (1 available, best #1, table MVPNv4-BGP-Table)
Advertised to update-groups:
  9
Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (6.6.6.6)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    IPv6-Extended Community: RT::A004::1:0
    PMSI Attribute: Flags: 0x0, Tunnel type: IR, length 16, label:exp-null tunnel
identifier: < Tunnel Endpoint: A006::1 >
  srv6 in-sid: F:F128:6:E024::

```

```

    rx pathid: 3, tx pathid: 0x0
    Updated on Aug 8 2025 00:54:16 UTC
BGP routing table entry for [4]{{[3][11:11][*][224.0.1.39][A002::1]/30}[A006::1]/48, version
1822559
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    9
  Refresh Epoch 1
  Local
    0.0.0.0 from 0.0.0.0 (6.6.6.6)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    IPv6-Extended Community: RT::A002::1:0
    PMSI Attribute: Flags: 0x0, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A006::1 >
    srv6 in-sid: F:F128:6:E024::
    rx pathid: 3, tx pathid: 0x0
    Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [4]{{[3][11:11][*][224.0.1.40][A002::1]/30}[A006::1]/48, version
1822560
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    9
  Refresh Epoch 1
  Local
    0.0.0.0 from 0.0.0.0 (6.6.6.6)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    IPv6-Extended Community: RT::A002::1:0
    PMSI Attribute: Flags: 0x0, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A006::1 >
    srv6 in-sid: F:F128:6:E024::
    rx pathid: 3, tx pathid: 0x0
    Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [4]{{[3][11:11][11.1.0.2][239.1.1.2][A004::1]/34}[A006::1]/52,
version 1848706
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    9
  Refresh Epoch 1
  Local
    0.0.0.0 from 0.0.0.0 (6.6.6.6)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    IPv6-Extended Community: RT::A004::1:0
    PMSI Attribute: Flags: 0x0, Tunnel type: IR, length 16, label:exp-null tunnel
  identifier: < Tunnel Endpoint: A006::1 >
    srv6 in-sid: F:F128:6:E024::
    rx pathid: 3, tx pathid: 0x0
    Updated on Aug 8 2025 00:54:16 UTC
BGP routing table entry for [5][11:11][11.1.0.2][239.1.1.2]/18, version 1822081
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Flag: 0x100
  Not advertised to any peer
  Refresh Epoch 2
  Local
    A004::1 (metric 30) from A005::1 (5.5.5.5)
    Origin incomplete, metric 0, localpref 100, valid, internal, best
    Extended Community: RT:11:11
    Originator: 4.4.4.4, Cluster list: 5.5.5.5
    rx pathid: 0, tx pathid: 0x0
    Updated on Aug 7 2025 17:53:45 UTC
BGP routing table entry for [6][11:11][100][11.11.11.11/32][239.1.1.2/32]/22, version 1848709

  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    9

```

```

Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (6.6.6.6)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    Extended Community: RT:2.2.2.2:3
    rx pathid: 3, tx pathid: 0x0
    Updated on Aug 8 2025 00:54:16 UTC
BGP routing table entry for [7][11:11][100][11.1.0.2/32][239.1.1.2/32]/22, version 1848707
  Paths: (1 available, best #1, table MVPNv4-BGP-Table)
  Advertised to update-groups:
    9
Refresh Epoch 1
Local
  0.0.0.0 from 0.0.0.0 (6.6.6.6)
    Origin incomplete, localpref 100, weight 32768, valid, sourced, local, best
    Extended Community: RT:4.4.4.4:3
    rx pathid: 3, tx pathid: 0x0
    Updated on Aug 8 2025 00:54:16 UTC

```

The following example shows the output of the **show ip rpf** command on an Egress PE router, displaying the RPF ID (strict RPF check) of multicast routing table for a specific VRF and multicast group address.

```

PE22#show ip rpf vrf vpn-11 11.1.0.2
RPF information for ? (11.1.0.2)
  RPF interface: Srvif1
  RPF neighbor: ? (A004::1)
  RPF route/mask: 11.1.0.0/16
  RPF type: unicast (bgp 100)
  Doing distance-preferred lookups across tables
  RPF topology: ipv4 multicast base, originated from ipv6 unicast base

```

The following example shows the output of the **show ip mfib** command on an Egress PE router, displaying multicast forwarding information for a specific VRF and multicast group address.

```

PE22#show ip mfib vrf vpn-11 239.1.1.2
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
              ET - Data Rate Exceeds Threshold, K - Keepalive
              DDE - Data Driven Event, HW - Hardware Installed
              ME - MoFRR ECMP entry, MNE - MoFRR Non-ECMP entry, MP - MFIB
              MoFRR Primary, RP - MRIB MoFRR Primary, P - MoFRR Primary
              MS - MoFRR Entry in Sync, MC - MoFRR entry in MoFRR Client,
              e - Encap helper tunnel flag.
I/O Item Flags: IC - Internal Copy, NP - Not platform switched,
                NS - Negate Signalling, SP - Signal Present,
                A - Accept, F - Forward, RA - MRIB Accept, RF - MRIB Forward,
                MA - MFIB Accept, A2 - Accept backup,
                RA2 - MRIB Accept backup, MA2 - MFIB Accept backup

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:      Total/RPF failed/Other drops
I/O Item Counts:   HW Pkt Count/FS Pkt Count/PS Pkt Count   Egress Rate in pps
VRF vpn-11
(*,239.1.1.2) Flags: C HW
  SW Forwarding: 0/0/0/0, Other: 0/0/0
  HW Forwarding: 0/0/0/0, Other: 0/0/0
  Srvif1, SRV6 LSM/0, RPF-ID: 0xA002::1, Flags: A
  GigabitEthernet3.11 Flags: F NS
    Pkts: 0/0/0   Rate: 0 pps
(11.1.0.2,239.1.1.2) Flags: HW
  SW Forwarding: 0/0/0/0, Other: 0/0/0
  HW Forwarding: 654/2/200/3, Other: 0/0/0
  Srvif1, SRV6 LSM/0, RPF-ID: 0xA004::1, Flags: A
  GigabitEthernet3.11 Flags: F NS
    Pkts: 0/0/0   Rate: 0 pps

```

The following example output displays detailed SID multicast information.

```
PE22# show segment-routing srv6 sid F:F128:6:E024:: detail

SID: F:F128:6:E024::      Type: DYNAMIC
Behavior: End.DTMC4 (76)
Context:
  interface: (not-set)
  vrf: (not-set), v4-topo-id: 0xFFFF, v6-topo-id: 0xFFFF
  next-hop: (not-set)
  policy: (not-set)
  distinguisher: (not-set)
  protected: n/a
  MCAST Instance: 1
    vrf v4: vpn-11, topo-id: 0x3
    ps_fwd_id: 41943073
Stats:
  Packets: 12392565   Bytes: 2471022400
User:
  User:Refcount                      Locator:Refcount
  -----
  bgp-mvpn(2):1                      F128:1
User Event history:
  Timestamp                          Client                      Event type
  -----
  07-16 15:41:51.677                bgp-mvpn(2)                ALLOC
```

Appendix: configuration reference

SRv6 configuration for PE11

This section details the configuration of PE11, a Provider Edge router, focusing on its role in an SRv6 enabled network with advanced traffic engineering and VPN services

```
hostname PE11

vrf definition vpn-11
  rd 11:11
  route-target export 11:11
  route-target import 11:11
  !
  address-family ipv4
    srv6-mcast ingress-replication partitioned data
    route-target export 11:11
    route-target import 11:11
  exit-address-family
  !
  address-family ipv6
    route-target export 11:11
    route-target import 11:11
  exit-address-family
  !
ip multicast-routing vrf vpn-11 distributed

bfd-template single-hop bfd_tmp
  interval microseconds min-tx 7000 min-rx 7000 multiplier 3
  !
  !
  !
```

```

!
!
!
crypto ikev2 keyring gre_key
  peer gre
    address ::/0
    pre-shared-key cisco123
!
!
!
crypto ikev2 profile gre_profile
  match identity remote address ::/0
  authentication remote pre-share
  authentication local pre-share
  keyring local gre_key
!
!
crypto ipsec transform-set gre_transet esp-aes esp-sha-hmac
  mode transport
!
!
crypto ipsec profile gre_profile
  set transform-set gre_transet
  set ikev2-profile gre_profile
!
!
!
!
!
!
!
!
interface Loopback0
  ip address 2.2.2.2 255.255.255.255
  ip router isis 1
  ipv6 address A002::1/128
  ipv6 router isis 1
!
interface Loopback11
  vrf forwarding vpn-11
  ip address 11.11.11.11 255.255.255.255
  ip pim sparse-mode
!
interface Tunnel231
  description pe11_pe21_tunnel1
  ip address 23.11.0.2 255.255.0.0
  ip router isis 1
  ipv6 address 2311::2/64
  ipv6 router isis 1
  mpls traffic-eng tunnels
  bfd template bfd_tmp
  tunnel source GigabitEthernet3.1
  tunnel mode gre ipv6
  tunnel destination 2301::3
  tunnel path-mtu-discovery
  isis bfd
  isis ipv6 bfd
!
interface Tunnel232
  description pe11_p21_tunnel2
  ip address 23.12.0.2 255.255.0.0
  ip router isis 1
  ipv6 address 2312::2/64
  ipv6 router isis 1

```

```
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.2
tunnel mode gre ipv6
tunnel destination 2302::3
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-128
!
!
interface Tunnel233
description pe11_p21_tunnel3
ip address 23.13.0.2 255.255.0.0
ip router isis 1
ipv6 address 2313::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.3
tunnel mode gre ipv6
tunnel destination 2303::3
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-129
!
!
interface Tunnel234
description pe11_p21_tunnel4
ip address 23.14.0.2 255.255.0.0
ip router isis 1
ipv6 address 2314::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.4
tunnel mode gre ipv6
tunnel destination 2304::3
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-130
!
!
interface Tunnel235
description pe11_p21_tunnel5
ip address 23.15.0.2 255.255.0.0
ip router isis 1
ipv6 address 2315::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.5
tunnel mode gre ipv6
tunnel destination 2305::3
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-131
```

```

!
!
interface Tunnel236
description pe11_p21_tunnel6
ip address 23.16.0.2 255.255.0.0
ip router isis 1
ipv6 address 2316::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.6
tunnel mode gre ipv6
tunnel destination 2306::3
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-132
!
!
interface Tunnel237
description pe11_p21_tunnel7
ip address 23.17.0.2 255.255.0.0
ip router isis 1
ipv6 address 2317::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.7
tunnel mode gre ipv6
tunnel destination 2307::3
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-133
!
!
interface Tunnel238
description pe11_p21_tunnel8
ip address 23.18.0.2 255.255.0.0
ip router isis 1
ipv6 address 2318::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.8
tunnel mode gre ipv6
tunnel destination 2308::3
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-134
!
!
interface Tunnel239
description pe11_p21_tunnel9
ip address 23.19.0.2 255.255.0.0
ip router isis 1
ipv6 address 2319::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp

```

```
tunnel source GigabitEthernet3.9
tunnel mode gre ipv6
tunnel destination 2309::3
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-135
!
!
interface GigabitEthernet2.11
encapsulation dot1Q 11
vrf forwarding vpn-11
ip address 12.1.0.2 255.255.0.0
ip pim sparse-mode
!
interface GigabitEthernet3
description pe11_pe21
no ip address
negotiation auto
!
interface GigabitEthernet3.1
description pe11_pe21_subintf1
encapsulation dot1Q 4001
ip address 23.1.0.2 255.255.0.0
ipv6 address 2301::2/64
!
interface GigabitEthernet3.2
description pe11_pe21_subintf2
encapsulation dot1Q 4002
ip address 23.2.0.2 255.255.0.0
ipv6 address 2302::2/64
!
interface GigabitEthernet3.3
description pe11_pe21_subintf3
encapsulation dot1Q 4003
ip address 23.3.0.2 255.255.0.0
ipv6 address 2303::2/64
!
interface GigabitEthernet3.4
description pe11_pe21_subintf4
encapsulation dot1Q 4004
ip address 23.4.0.2 255.255.0.0
ipv6 address 2304::2/64
!
interface GigabitEthernet3.5
description pe11_pe21_subintf5
encapsulation dot1Q 4005
ip address 23.5.0.2 255.255.0.0
ipv6 address 2305::2/64
!
interface GigabitEthernet3.6
description pe11_pe21_subintf6
encapsulation dot1Q 4006
ip address 23.6.0.2 255.255.0.0
ipv6 address 2306::2/64
!
interface GigabitEthernet3.7
description pe11_pe21_subintf7
encapsulation dot1Q 4007
ip address 23.7.0.2 255.255.0.0
ipv6 address 2307::2/64
!
interface GigabitEthernet3.8
```

```

description pe11_pe21_subintf8
encapsulation dot1Q 4008
ip address 23.8.0.2 255.255.0.0
ipv6 address 2308::2/64
!
interface GigabitEthernet3.9
description pe11_pe21_subintf9
encapsulation dot1Q 4009
ip address 23.9.0.2 255.255.0.0
ipv6 address 2309::2/64
!
interface GigabitEthernet4
no ip address
negotiation auto
!
interface GigabitEthernet5
no ip address
negotiation auto
!
interface GigabitEthernet6
no ip address
speed 1000
no negotiation auto
!
interface GigabitEthernet7
description pe11_pe12
no ip address
speed 1000
no negotiation auto
!
interface GigabitEthernet7.1
description pe11_pe12_subintf1
encapsulation dot1Q 4011
ip address 24.1.0.2 255.255.0.0
ip router isis 1
ipv6 address 2401::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis metric 10 level-1
isis metric 10 level-2
isis bfd
isis ipv6 metric 10
isis ipv6 bfd
!
interface GigabitEthernet7.2
description pe11_pe12_subintf2
encapsulation dot1Q 4012
ip address 24.2.0.2 255.255.0.0
ip router isis 1
ipv6 address 2402::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-128
!
!
interface GigabitEthernet7.3
description pe11_pe12_subintf3

```

```
encapsulation dot1Q 4013
ip address 24.3.0.2 255.255.0.0
ip router isis 1
ipv6 address 2403::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-129
!
!
interface GigabitEthernet7.4
description pe11_pe12_subintf4
encapsulation dot1Q 4014
ip address 24.4.0.2 255.255.0.0
ip router isis 1
ipv6 address 2404::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-130
!
!
interface GigabitEthernet7.5
description pe11_pe12_subintf5
encapsulation dot1Q 4015
ip address 24.5.0.2 255.255.0.0
ip router isis 1
ipv6 address 2405::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-131
!
!
interface GigabitEthernet7.6
description pe11_pe12_subintf6
encapsulation dot1Q 4016
ip address 24.6.0.2 255.255.0.0
ip router isis 1
ipv6 address 2406::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-132
!
!
interface GigabitEthernet7.7
description pe11_pe12_subintf7
```

```

encapsulation dot1Q 4017
ip address 24.7.0.2 255.255.0.0
ip router isis 1
ipv6 address 2407::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-133
!
!
interface GigabitEthernet7.8
description pe11_pe12_subintf8
encapsulation dot1Q 4018
ip address 24.8.0.2 255.255.0.0
ip router isis 1
ipv6 address 2408::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-134
!
!
interface GigabitEthernet7.9
description pe11_pe12_subintf9
encapsulation dot1Q 4019
ip address 24.9.0.2 255.255.0.0
ip router isis 1
ipv6 address 2409::2/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-135
!
!
segment-routing srv6
sid holdtime 0
encapsulation
hop-limit propagate
traffic-class propagate
locators
locator loc1-pe11
prefix F:1:2::/48
format usid-f3216
locator F128
prefix F:F128:2::/48
format usid-f3216
algorithm 128
locator F129
prefix F:F129:2::/48
format usid-f3216
algorithm 129
locator F130

```

```
    prefix F:F130:2::/48
    format usid-f3216
    algorithm 130
locator F131
    prefix F:F131:2::/48
    format usid-f3216
    algorithm 131
locator F132
    prefix F:F132:2::/48
    format usid-f3216
    algorithm 132
locator F133
    prefix F:F133:2::/48
    format usid-f3216
    algorithm 133
locator F134
    prefix F:F134:2::/48
    format usid-f3216
    algorithm 134
locator F135
    prefix F:F135:2::/48
    format usid-f3216
    algorithm 135
!
router isis 1
net 49.0001.0000.0000.0002.00
is-type level-2-only
router-id Loopback0
metric-style wide
log-adjacency-changes
lsp-mtu 1418
nsf ietf
distribute link-state level-2
segment-routing mpls
segment-routing prefix-sid-map advertise-local
fast-reroute per-prefix level-2 all
fast-reroute remote-lfa level-2 mpls-ldp
fast-reroute ti-lfa level-2
microloop avoidance rib-update-delay 15000
affinity-map flexalgo-128 bit-position 128
affinity-map flexalgo-129 bit-position 129
affinity-map flexalgo-130 bit-position 130
affinity-map flexalgo-131 bit-position 131
affinity-map flexalgo-132 bit-position 132
affinity-map flexalgo-133 bit-position 133
affinity-map flexalgo-134 bit-position 134
affinity-map flexalgo-135 bit-position 135
flex-algo 128
    advertise-definition
    metric-type delay
    priority 100
    affinity
        include-any
        name flexalgo-128
        exit-fa-affinity-attr
!
!
flex-algo 129
    advertise-definition
    metric-type delay
    priority 100
    affinity
        include-any
        name flexalgo-129
```

```

        exit-fa-affinity-attr
    !
!
flex-algo 130
advertise-definition
metric-type delay
priority 100
affinity
    include-any
        name flexalgo-130
        exit-fa-affinity-attr
    !
!
flex-algo 131
advertise-definition
metric-type delay
priority 100
affinity
    include-any
        name flexalgo-131
        exit-fa-affinity-attr
    !
!
flex-algo 132
advertise-definition
metric-type delay
priority 100
affinity
    include-any
        name flexalgo-132
        exit-fa-affinity-attr
    !
!
flex-algo 133
advertise-definition
metric-type delay
priority 100
affinity
    include-any
        name flexalgo-133
        exit-fa-affinity-attr
    !
!
flex-algo 134
advertise-definition
metric-type delay
priority 100
affinity
    include-any
        name flexalgo-134
        exit-fa-affinity-attr
    !
!
flex-algo 135
advertise-definition
metric-type delay
priority 100
affinity
    include-any
        name flexalgo-135
        exit-fa-affinity-attr
    !
!
bfd all-interfaces

```

```

!
address-family ipv6
  bfd all-interfaces
  segment-routing srv6
    locator loc1-pe11
    locator F128
    locator F129
    locator F130
    locator F131
    locator F132
    locator F133
    locator F134
    locator F135
  fast-reroute per-prefix level-2 all
  fast-reroute ti-lfa level-2
  microloop avoidance segment-routing
  microloop avoidance rib-update-delay 15000
exit-address-family
mpls traffic-eng router-id Loopback0
mpls traffic-eng level-2
!
router bgp 100
  bgp router-id interface Loopback0
  bgp log-neighbor-changes
  bgp graceful-restart
  no bgp default ipv4-unicast
  neighbor A005::1 remote-as 100
  neighbor A005::1 update-source Loopback0
  !
  address-family ipv4
  exit-address-family
  !
  address-family ipv4 mvpn
    neighbor A005::1 activate
    neighbor A005::1 send-community extended
  exit-address-family
  !
  address-family vpv4
    neighbor A005::1 activate
    neighbor A005::1 send-community both
  exit-address-family
  !
  address-family ipv4 vrf vpn-11
    redistribute connected
    redistribute static
  !
  segment-routing srv6
    locator F128
    alloc-mode per-vrf
  exit-srv6
  !
exit-address-family
!
!
ip pim vrf vpn-11 autorp listener
ip pim vrf vpn-11 send-rp-announce Loopback11 scope 10
ip pim vrf vpn-11 send-rp-discovery Loopback11 scope 10
ip pim vrf vpn-11 ssm default

ip route vrf vpn-11 11.1.0.0 255.255.0.0 GigabitEthernet2.11 12.1.0.1

performance-measurement
  interface GigabitEthernet7.1

```

```

delay-measurement
  advertise-delay 10
interface GigabitEthernet7.2
  delay-measurement
    advertise-delay 10
interface GigabitEthernet7.3
  delay-measurement
    advertise-delay 10
interface GigabitEthernet7.4
  delay-measurement
    advertise-delay 10
interface GigabitEthernet7.5
  delay-measurement
    advertise-delay 10
interface GigabitEthernet7.6
  delay-measurement
    advertise-delay 10
interface GigabitEthernet7.7
  delay-measurement
    advertise-delay 10
interface GigabitEthernet7.8
  delay-measurement
    advertise-delay 10
interface GigabitEthernet7.9
  delay-measurement
    advertise-delay 10
interface Tunnel231
  delay-measurement
    advertise-delay 10
interface Tunnel232
  delay-measurement
    advertise-delay 10
interface Tunnel233
  delay-measurement
    advertise-delay 10
interface Tunnel234
  delay-measurement
    advertise-delay 10
interface Tunnel235
  delay-measurement
    advertise-delay 10
interface Tunnel236
  delay-measurement
    advertise-delay 10
interface Tunnel237
  delay-measurement
    advertise-delay 10
interface Tunnel238
  delay-measurement
    advertise-delay 10
interface Tunnel239
  delay-measurement
    advertise-delay 10
!
```

SRv6 configuration for PE12

This section details the configuration of PE12, a Provider Edge router, focusing on its role in an SRv6 enabled network with advanced traffic engineering and VPN services.

```

version 17.19
hostname PE12
```

```
vrf definition vpn-11
 rd 11:11
  route-target export 11:11
  route-target import 11:11
 !
 address-family ipv4
  srv6-mcast ingress-replication partitioned data
  route-target export 11:11
  route-target import 11:11
 exit-address-family
 !
 address-family ipv6
  route-target export 11:11
  route-target import 11:11
 exit-address-family
 !
ip multicast-routing vrf vpn-11 distributed

bfd-template single-hop bfd_tmp
 interval microseconds min-tx 7000 min-rx 7000 multiplier 3
 !
crypto ikev2 keyring gre_key
 peer gre
  address ::/0
  pre-shared-key cisco123
 !
 !
crypto ikev2 profile gre_profile
 match identity remote address ::/0
 authentication remote pre-share
 authentication local pre-share
 keyring local gre_key

crypto ipsec transform-set gre_transet esp-aes esp-sha-hmac
 mode transport
 !
 !
crypto ipsec profile gre_profile
 set transform-set gre_transet
 set ikev2-profile gre_profile
 !
interface Loopback0
 ip address 4.4.4.4 255.255.255.255
 ip router isis 1
 ipv6 address A004::1/128
 ipv6 router isis 1
 !
interface Tunnel451
 ip address 45.11.0.4 255.255.0.0
 ip router isis 1
 ipv6 address 4511::4/64
 ipv6 router isis 1
 mpls traffic-eng tunnels
 bfd template bfd_tmp
 tunnel source GigabitEthernet3.1
 tunnel mode gre ipv6
 tunnel destination 4501::5
 tunnel path-mtu-discovery
 isis bfd
 isis ipv6 bfd
 !
interface Tunnel452
```

```

description pe12_p_tunnel2
ip address 45.12.0.4 255.255.0.0
ip router isis 1
ipv6 address 4512::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.2
tunnel mode gre ipv6
tunnel destination 4502::5
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-128
!
!
interface Tunnel453
description pe12_p_tunnel3
ip address 45.13.0.4 255.255.0.0
ip router isis 1
ipv6 address 4513::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.3
tunnel mode gre ipv6
tunnel destination 4503::5
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-129
!
!
interface Tunnel454
description pe12_p_tunnel4
ip address 45.14.0.4 255.255.0.0
ip router isis 1
ipv6 address 4514::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.4
tunnel mode gre ipv6
tunnel destination 4504::5
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-130
!
!
interface Tunnel455
description pe12_p_tunnel5
ip address 45.15.0.4 255.255.0.0
ip router isis 1
ipv6 address 4515::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.5
tunnel mode gre ipv6
tunnel destination 4505::5

```

```
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-131
!
!
interface Tunnel456
description pe12_p_tunnel6
ip address 45.16.0.4 255.255.0.0
ip router isis 1
ipv6 address 4516::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.6
tunnel mode gre ipv6
tunnel destination 4506::5
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-132
!
!
interface Tunnel457
description pe12_p_tunnel7
ip address 45.17.0.4 255.255.0.0
ip router isis 1
ipv6 address 4517::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.7
tunnel mode gre ipv6
tunnel destination 4507::5
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-133
!
!
interface Tunnel458
description pe12_p_tunnel8
ip address 45.18.0.4 255.255.0.0
ip router isis 1
ipv6 address 4518::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
tunnel source GigabitEthernet3.8
tunnel mode gre ipv6
tunnel destination 4508::5
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
    name flexalgo-134
!
!
interface Tunnel459
description pe12_p_tunnel9
ip address 45.19.0.4 255.255.0.0
```

```

ip router isis 1
ipv6 address 4519::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmpl
tunnel source GigabitEthernet3.9
tunnel mode gre ipv6
tunnel destination 4509::5
tunnel path-mtu-discovery
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-135
!
!
interface GigabitEthernet2
description pe12_fhr
vrf forwarding red
ip address 14.1.0.4 255.255.0.0
ip pim sparse-mode
negotiation auto
!
interface GigabitEthernet2.11
encapsulation dot1Q 11
vrf forwarding vpn-11
ip address 14.1.0.4 255.255.0.0
ip pim sparse-mode
!
interface GigabitEthernet3
description pe12_p
no ip address
negotiation auto
!
interface GigabitEthernet3.1
description pe12_p_subintf1
encapsulation dot1Q 4031
ip address 45.1.0.4 255.255.0.0
ipv6 address 4501::4/64
!
interface GigabitEthernet3.2
description pe12_p_subintf2
encapsulation dot1Q 4032
ip address 45.2.0.4 255.255.0.0
ipv6 address 4502::4/64
!
interface GigabitEthernet3.3
description pe12_p_subintf3
encapsulation dot1Q 4033
ip address 45.3.0.4 255.255.0.0
ipv6 address 4503::4/64
!
interface GigabitEthernet3.4
description pe12_p_subintf4
encapsulation dot1Q 4034
ip address 45.4.0.4 255.255.0.0
ipv6 address 4504::4/64
!
interface GigabitEthernet3.5
description pe12_p_subintf5
encapsulation dot1Q 4035
ip address 45.5.0.4 255.255.0.0
ipv6 address 4505::4/64
!
interface GigabitEthernet3.6

```

```
description pe12_p_subintf6
encapsulation dot1Q 4036
ip address 45.6.0.4 255.255.0.0
ipv6 address 4506::4/64
!
interface GigabitEthernet3.7
description pe12_p_subintf7
encapsulation dot1Q 4037
ip address 45.7.0.4 255.255.0.0
ipv6 address 4507::4/64
!
interface GigabitEthernet3.8
description pe12_p_subintf8
encapsulation dot1Q 4038
ip address 45.8.0.4 255.255.0.0
ipv6 address 4508::4/64
!
interface GigabitEthernet3.9
description pe12_p_subintf9
encapsulation dot1Q 4039
ip address 45.9.0.4 255.255.0.0
ipv6 address 4509::4/64
!
interface GigabitEthernet5
description pe12_p11
no ip address
speed 1000
no negotiation auto
!
interface GigabitEthernet5.1
description pe12_p11_subintf1
encapsulation dot1Q 4011
ip address 24.1.0.4 255.255.0.0
ip router isis 1
ipv6 address 2401::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
!
interface GigabitEthernet5.2
description pe12_p11_subintf2
encapsulation dot1Q 4012
ip address 24.2.0.4 255.255.0.0
ip router isis 1
ipv6 address 2402::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
name flexalgo-128
!
!
interface GigabitEthernet5.3
description pe12_p11_subintf3
encapsulation dot1Q 4013
ip address 24.3.0.4 255.255.0.0
ip router isis 1
ipv6 address 2403::4/64
```

```

    ipv6 router isis 1
    mpls traffic-eng tunnels
    bfd template bfd_tmp
    isis network point-to-point
    isis bfd
    isis ipv6 bfd
    isis affinity flex-algo
    name flexalgo-129
    !
!
interface GigabitEthernet5.4
    description pe12_p11_subintf4
    encapsulation dot1Q 4014
    ip address 24.4.0.4 255.255.0.0
    ip router isis 1
    ipv6 address 2404::4/64
    ipv6 router isis 1
    mpls traffic-eng tunnels
    bfd template bfd_tmp
    isis network point-to-point
    isis bfd
    isis ipv6 bfd
    isis affinity flex-algo
    name flexalgo-130
    !
!
interface GigabitEthernet5.5
    description pe12_p11_subintf5
    encapsulation dot1Q 4015
    ip address 24.5.0.4 255.255.0.0
    ip router isis 1
    ipv6 address 2405::4/64
    ipv6 router isis 1
    mpls traffic-eng tunnels
    bfd template bfd_tmp
    isis network point-to-point
    isis bfd
    isis ipv6 bfd
    isis affinity flex-algo
    name flexalgo-131
    !
!
interface GigabitEthernet5.6
    description pe12_p11_subintf6
    encapsulation dot1Q 4016
    ip address 24.6.0.4 255.255.0.0
    ip router isis 1
    ipv6 address 2406::4/64
    ipv6 router isis 1
    mpls traffic-eng tunnels
    bfd template bfd_tmp
    isis network point-to-point
    isis bfd
    isis ipv6 bfd
    isis affinity flex-algo
    name flexalgo-132
    !
!
interface GigabitEthernet5.7
    description pe12_p11_subintf7
    encapsulation dot1Q 4017
    ip address 24.7.0.4 255.255.0.0
    ip router isis 1
    ipv6 address 2407::4/64

```

```

ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
  name flexalgo-133
!
!
interface GigabitEthernet5.8
description pe12_p11_subintf8
encapsulation dot1Q 4018
ip address 24.8.0.4 255.255.0.0
ip router isis 1
ipv6 address 2408::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
  name flexalgo-134
!
!
interface GigabitEthernet5.9
description pe12_p11_subintf9
encapsulation dot1Q 4019
ip address 24.9.0.4 255.255.0.0
ip router isis 1
ipv6 address 2409::4/64
ipv6 router isis 1
mpls traffic-eng tunnels
bfd template bfd_tmp
isis network point-to-point
isis bfd
isis ipv6 bfd
isis affinity flex-algo
  name flexalgo-135
!
!
segment-routing srv6
sid holdtime 0
encapsulation
  hop-limit propagate
  traffic-class propagate
locators
  locator loc1-pe12
    prefix F:1:4::/48
    format usid-f3216
  locator F128
    prefix F:F128:4::/48
    format usid-f3216
    algorithm 128
  locator F129
    prefix F:F129:4::/48
    format usid-f3216
    algorithm 129
  locator F130
    prefix F:F130:4::/48
    format usid-f3216
    algorithm 130
  locator F131

```

```

    prefix F:F131:4::/48
    format usid-f3216
    algorithm 131
  locator F132
    prefix F:F132:4::/48
    format usid-f3216
    algorithm 132
  locator F133
    prefix F:F133:4::/48
    format usid-f3216
    algorithm 133
  locator F134
    prefix F:F134:4::/48
    format usid-f3216
    algorithm 134
  locator F135
    prefix F:F135:4::/48
    format usid-f3216
    algorithm 135
!
router isis 1
net 49.0001.0000.0000.0004.00
is-type level-2-only
router-id Loopback0
metric-style wide
log-adjacency-changes
lsp-mtu 1418
nsf ietf
distribute link-state level-2
segment-routing mpls
segment-routing prefix-sid-map advertise-local
fast-reroute per-prefix level-2 all
fast-reroute remote-lfa level-2 mpls-ldp
fast-reroute ti-lfa level-2
microloop avoidance rib-update-delay 15000
affinity-map flexalgo-128 bit-position 128
affinity-map flexalgo-129 bit-position 129
affinity-map flexalgo-130 bit-position 130
affinity-map flexalgo-131 bit-position 131
affinity-map flexalgo-132 bit-position 132
affinity-map flexalgo-133 bit-position 133
affinity-map flexalgo-134 bit-position 134
affinity-map flexalgo-135 bit-position 135
flex-algo 128
  advertise-definition
  metric-type delay
  priority 100
  affinity
    include-any
    name flexalgo-128
    exit-fa-affinity-attr
  !
!
flex-algo 129
  advertise-definition
  metric-type delay
  priority 100
  affinity
    include-any
    name flexalgo-129
    exit-fa-affinity-attr
  !
!
flex-algo 130

```

```
advertise-definition
metric-type delay
priority 100
affinity
include-any
name flexalgo-130
exit-fa-affinity-attr
!
!
flex-algo 131
advertise-definition
metric-type delay
priority 100
affinity
include-any
name flexalgo-131
exit-fa-affinity-attr
!
!
flex-algo 132
advertise-definition
metric-type delay
priority 100
affinity
include-any
name flexalgo-132
exit-fa-affinity-attr
!
!
flex-algo 133
advertise-definition
metric-type delay
priority 100
affinity
include-any
name flexalgo-133
exit-fa-affinity-attr
!
!
flex-algo 134
advertise-definition
metric-type delay
priority 100
affinity
include-any
name flexalgo-134
exit-fa-affinity-attr
!
!
flex-algo 135
advertise-definition
metric-type delay
priority 100
affinity
include-any
name flexalgo-135
exit-fa-affinity-attr
!
!
bfd all-interfaces
!
address-family ipv6
bfd all-interfaces
segment-routing srv6
```

```

locator loc1-pe12
locator F128
locator F129
locator F130
locator F131
locator F132
locator F133
locator F134
locator F135
fast-reroute per-prefix level-2 all
fast-reroute ti-lfa level-2
microloop avoidance segment-routing
microloop avoidance rib-update-delay 15000
exit-address-family
mpls traffic-eng router-id Loopback0
mpls traffic-eng level-2
!
router bgp 100
  bgp router-id interface Loopback0
  bgp log-neighbor-changes
  bgp graceful-restart
  no bgp default ipv4-unicast
  neighbor A005::1 remote-as 100
  neighbor A005::1 update-source Loopback0
  !
  address-family ipv4
  exit-address-family
  !
  address-family ipv4 mvpn
    neighbor A005::1 activate
    neighbor A005::1 send-community extended
  exit-address-family
  !
  address-family vpv4
    neighbor A005::1 activate
    neighbor A005::1 send-community both
  exit-address-family
  !
  address-family ipv4 vrf red
    redistribute connected
    redistribute static
  !
  segment-routing srv6
    locator loc1-pe12
    alloc-mode per-vrf
  exit-srv6
  !
  exit-address-family
  !
  address-family ipv4 vrf vpn-11
    redistribute connected
    redistribute static
  !
  segment-routing srv6
    locator F128
    alloc-mode per-vrf
  exit-srv6
  !
  exit-address-family
  !
ip pim vrf vpn-11 autorp listener
ip pim vrf vpn-11 ssm default

ip route vrf vpn-11 11.1.0.0 255.255.0.0 GigabitEthernet2.11 14.1.0.1

```

```
performance-measurement
interface GigabitEthernet5.1
  delay-measurement
    advertise-delay 10
interface GigabitEthernet5.2
  delay-measurement
    advertise-delay 10
interface GigabitEthernet5.3
  delay-measurement
    advertise-delay 10
interface GigabitEthernet5.4
  delay-measurement
    advertise-delay 10
interface GigabitEthernet5.5
  delay-measurement
    advertise-delay 10
interface GigabitEthernet5.6
  delay-measurement
    advertise-delay 10
interface GigabitEthernet5.7
  delay-measurement
    advertise-delay 10
interface GigabitEthernet5.8
  delay-measurement
    advertise-delay 10
interface GigabitEthernet5.9
  delay-measurement
    advertise-delay 10
interface Tunnel451
  delay-measurement
    advertise-delay 10
interface Tunnel452
  delay-measurement
    advertise-delay 10
interface Tunnel453
  delay-measurement
    advertise-delay 10
interface Tunnel454
  delay-measurement
    advertise-delay 10
interface Tunnel455
  delay-measurement
    advertise-delay 10
interface Tunnel456
  delay-measurement
    advertise-delay 10
interface Tunnel457
  delay-measurement
    advertise-delay 10
interface Tunnel458
  delay-measurement
    advertise-delay 10
interface Tunnel459
  delay-measurement
    advertise-delay 10
```

