

LTRIPV-2130-Lab Guide

Segment Routing -

How to Integrate and Migrate to SRv6

Senthil Palanisamy – Principal Architect

Harold Ritter- Sr Technical Leader

Sunil Pareek – Customer Delivery Architect

Table Of Contents

Learning Objectives or Table of Contents	4
Disclaimer	4
Scenario	4
Initial Lab Topology	5
Lab Topology Information	5
IP Addressing Schema.....	5
High Level Tasks.....	6
Final Lab Topology.....	7
Starting the Lab	8
Lab Topology Pre-Checks.....	11
Task 1: Configure and Verify IGP-ISIS for IPv6	12
Step 1: Configure ISIS for Address-family IPv6 on PE1	12
Step 2: Configure ISIS for Address-family IPv6 on P2	13
Step 3: Configure ISIS for Address-family IPv6 on PE3	14
Step 4: Configure ISIS for Address-family IPv6 on PE5-SRGW	15
Step 5: Verify ISIS for Address-family IPv6 on PE1	15
Step 6: Verify ISIS for Address-family IPv6 on P2.....	16
Step 7: Verify ISIS for Address-family IPv6 on PE3.....	17
Step 8: Verify ISIS for Address-family IPv6 on PE5-SRGW.....	18
Task 2: Configure and Verify BGP for IPV6	19
Step 1: Configure BGP on P2 and Enable BGP route-reflector functionality.	20
Step 2: Configure BGP for IPv6 on PE1	21
Step 3: Configure BGP for IPv6 on PE3	22
Step 4: Configure BGP for IPv6 on PE5-SRGW	22
Step 4: Configure BGP on P6	23
Step 5: Verify BGP Configurations on PE1, PE3 and P2-SRv6-RR.....	24
Task 3: Configure and Verify SRv6	26
Step 1: Configure SRv6 on PE1	26
Step 2: Configure SRv6 on P2-SRv6RR.....	27
Step 3: Configure SRv6 on PE3	28
Step 4: Configure SRv6 on PE5-SRGW	29
Step 5: Verify SRv6 Configuration.....	30

Step 6: Change BGP Local preference to Prefer IPv6 neighbors in SRv6 sub-domain	32
Task 4: Verify L3VPN Services in the SRv6 Sub-domain (for vrf XYZ)	34
Step 1 Verify prefixes on PE1 and PE3 for VRF XYZ	34
Step 2: Perform PING operations on PE1 and PE3 to verify end to end connectivity for VRF XYZ	36
Task 5: Configure and Verify L3VPN Services with Interworking Gateway (for vrf ABC)	37
Step 1: Configure Interworking Service Gateway on PE5-SRGW.....	37
Step 2: On PE1, Enable SRv6 for vrf ABC	39
Step 3: Verify prefixes on PE1 and PE8 for VRF ABC.....	39
Step 4: Perform PING operations on PE1 and PE8 to verify end to end connectivity for VRF ABC.....	41
Step 5: Verify Interworking Gateway Function.....	42
Task 6: Remove LDP from SRv6 Sub-domain and verify L3 VPN services	50
Step 1: Remove LDP from PE1	50
Step 2: Remove LDP from P2-SRv6-RR.....	51
Step 3: Remove LDP from PE3	51
Step 4: Verify the L3VPN services	51
Step 5: [Optional] Remove the IPv4 BGP peering from PE1 and PE3 to P6-MPLS-RR	51
Final Step: Ending the lab	52
Related Sessions at Cisco Live	52
Summary	53
Appendix – A	54
Final Lab Router Configurations	54
CE1 Router:	54
PE1 Router:.....	56
P2-SRv6-RR Router:	63
PE3 Router:.....	68
CE4 Router:	73
PE5-SRGW Router:.....	76
P6-MPLS-RR Router:	82
P7 Router:.....	87
PE8 Router.....	90
CE2 Router:	94

Learning Objectives or Table of Contents

Upon completion of this lab, you will be able to:

- Configure Segment Routing v6
- Migrate from MPLS LDP based network to Segment Routing v6 in a brown-field network
- Configure an Interworking Gateway to provide communication between SRv6 and MPLS sub-domains
- Verify different Segment Routing v6 operations from day 2 perspective.

Disclaimer

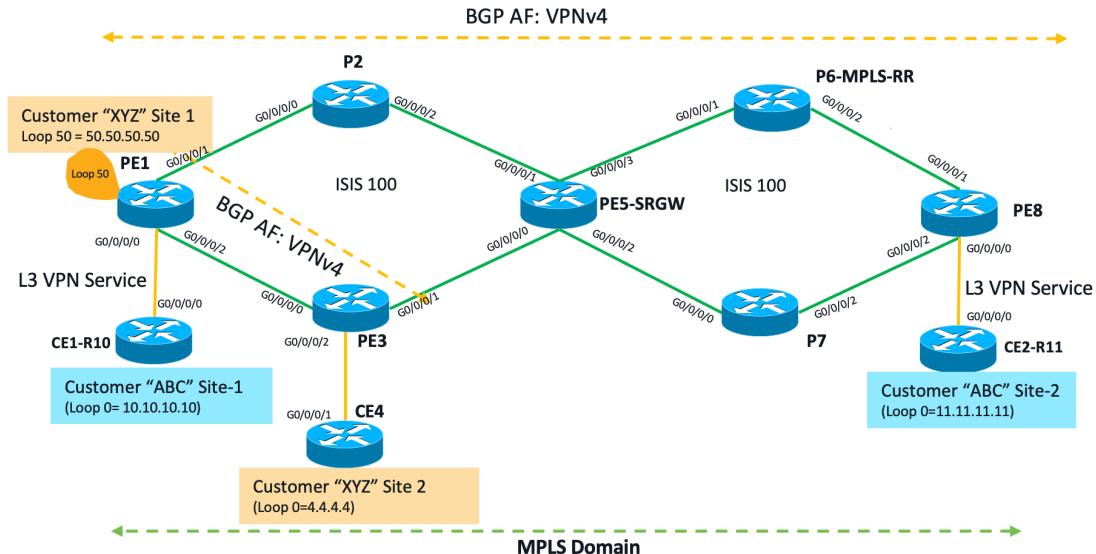
This training document is to familiarize with how to integrate and migrate to SRv6 in a brownfield MPLS network. Although the lab design and configuration examples could be used as a reference, it's not a real design, thus not all recommended features are used, or enabled optimally. For the design related questions, please contact your representative at Cisco, or a Cisco partner.

Scenario

In this lab activity, you will be given a existing MPLS based network (pre-configured) where a service provider is offering IP services like L3 VPN over an MPLS LDP network. Your task is to migrate the MPLS LDP based underlay to Segment Routing v6 in a phased manner. What we mean by phased manner is that not the whole domain is being migrated. Instead, you will migrate a section of the network to SRv6 and the remaining section of the network will still be in MPLS, thus forming a SRv6 sub-domain and a MPLS sub-domain. You will also configure “Interworking Gateway” to connect these two sub-domains to provide end to end communication across this network. During this course, we will learn how to migrate from LDP to SRv6 with minimal to no impact to the production traffic.

Initial Lab Topology

The following diagram shows the initial lab topology when you start the lab. Lab is pre-configured with MPLS LDP in Service Provider network domain.



Lab Topology Information

- End to end MPLS Network is running with BGP AS 100 with P6 as VPNv4 address-family Route-Reflector
- ISIS 100 is configured as IGP for the IPv4 Address-family.
- Loopback0 is configured on all the PE/P nodes.
- L3VPN services for the customer vrf “ABC” and “XYZ” is configured and running.
- Customer “ABC” is connected via the CE1 and CE2 routers on PE1 and PE8 respectively.
- Customer “XYZ” is represented as “Loopback 50” on the PE-1 and configured on CE4 which is connected to PE3.

IP Addressing Schema

- Loopback0 is configured on all routers. X.X.X.X is the ipv4 address of the loopback where X is the router number. For example: PE1 uses 1.1.1.1, P2 uses 2.2.2.2...and so on and PE8 uses 8.8.8.8/32.
- CE1-R10 router uses 10.10.10.10 and CE2-R11 router uses 11.11.11.11
- IPv6 Addresses are configured on nodes PE1, P2, PE3 and PE5-SRGW loopback interface. Loopback0 is configured with 2001:db8:X:X::X where X is the router number. For example: PE1 uses 2001:db8::1:1:1::1 P2 uses 2001:db8::2:2:2::2 ...and so on.

Note: Only these four routers will be migrated to SRv6 in this lab with PE5-SRGW being Interworking gateway and hence the IPv6 addresses are configured only on these four routers

- For the interface IP Schema, 10.**X.Y**.0/30 is used where X and Y are the router numbers connected via the interface. For example: PE2 interface connected to PE1 is using 10.2.1.0/30, likewise PE3 connected to PE1 is using 10.3.1.0/30.
- Interface level IPv6 addresses are configured on nodes PE1, P2, PE3 and PE5-SRGW (on Interfaces facing P2 and PE3).
- For the interface IPv6 addressing Schema, 2001:db8:10:**X:Y**::/127 is used where X and Y are the router numbers connected via the interface. For example: PE2 interface connected to PE1 is using 2001:db8:10.**2:1**::/127.

High Level Tasks

Following are the high-level tasks you will be configuring in this lab. You will be performing multiple steps in each of the tasks which are detailed in the following sections.

Task 1 - Configure and verify IGP-ISIS for IPv6 on PE1,P2,PE3 and PE5-SRGW

Task 2 - Configure and verify BGP for IPv6 on PE1,P2,PE3 and PE5-SRGW

Task 3 - Configure and verify SRv6

Task 4 – Verify L3VPN services in the SRv6 sub-domain (for vrf XYZ)

Task 5 – Configure and verify L3VPN services with Interworking Gateway (for vrf ABC)

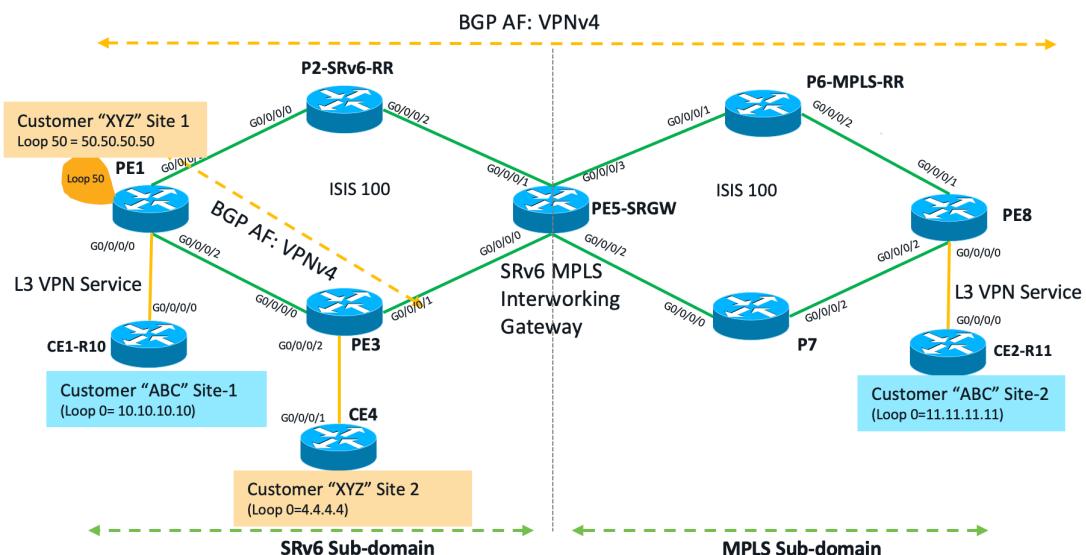
Task 6 – Remove LDP from SRv6 sub-domain and verify L3 VPN service

Note: After each step in the above tasks, please perform the verification steps carefully and if you see unexpected results, please reach out to the proctors.

After successfully performing the previous tasks, at the end of this lab, the topology will be as follows:

Final Lab Topology

The following diagram shows the final lab topology when you complete the lab. Note that the end state has two sub-domains namely SRv6 sub-domain and MPLS sub-domain. The Interworking Gateway facilitates communication between the two sub-domains thus maintaining end to end connectivity.

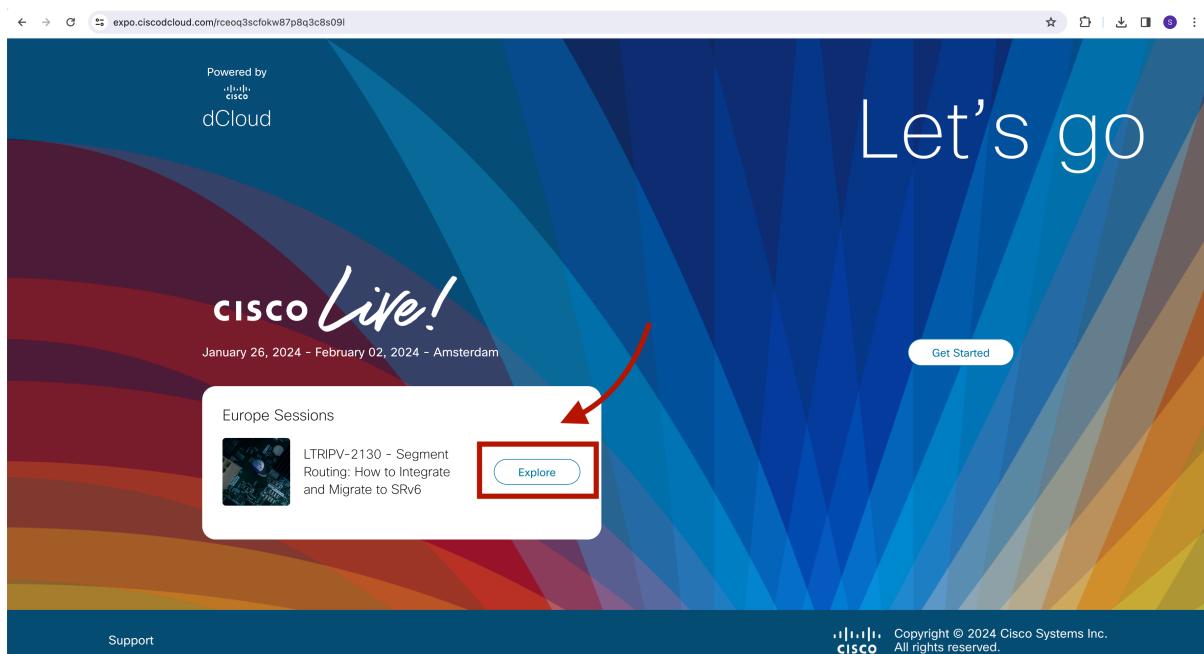


Starting the Lab

Copy the following URL and paste it in your Chrome browser.

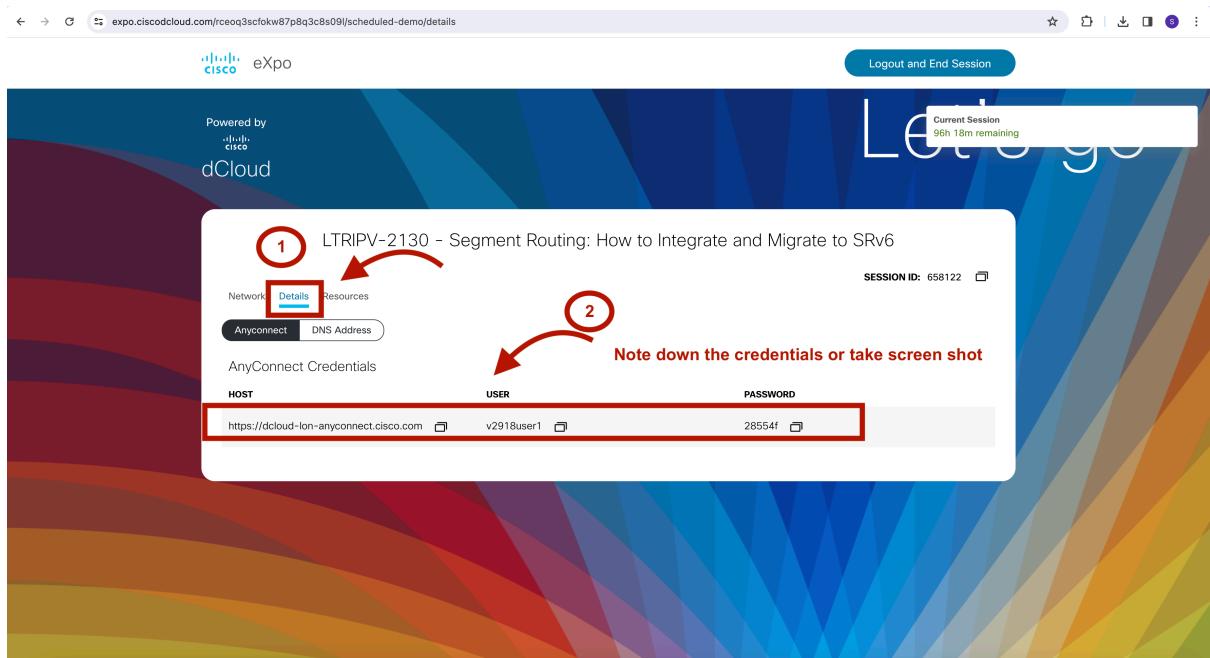
<https://expo.ciscodcloud.com/6im2wapqevvfiy8lioico6e3d>

The URL should land you at the following screen:



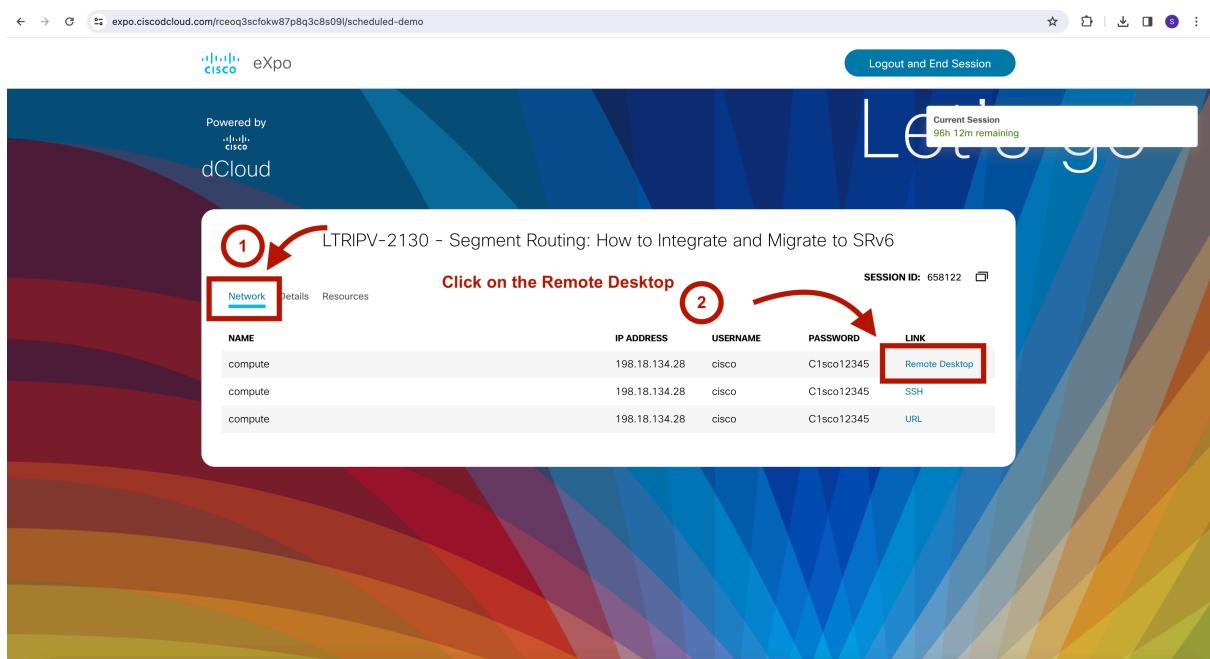
- Click on the Explore button
- Once you start the lab, from here on do not close your browser screen entirely until you complete the lab. If you do so, you will be disconnected from your lab and all your work will be lost.

Now, it should take you the following screen. Click on the “Details” tab as shown in the picture below.

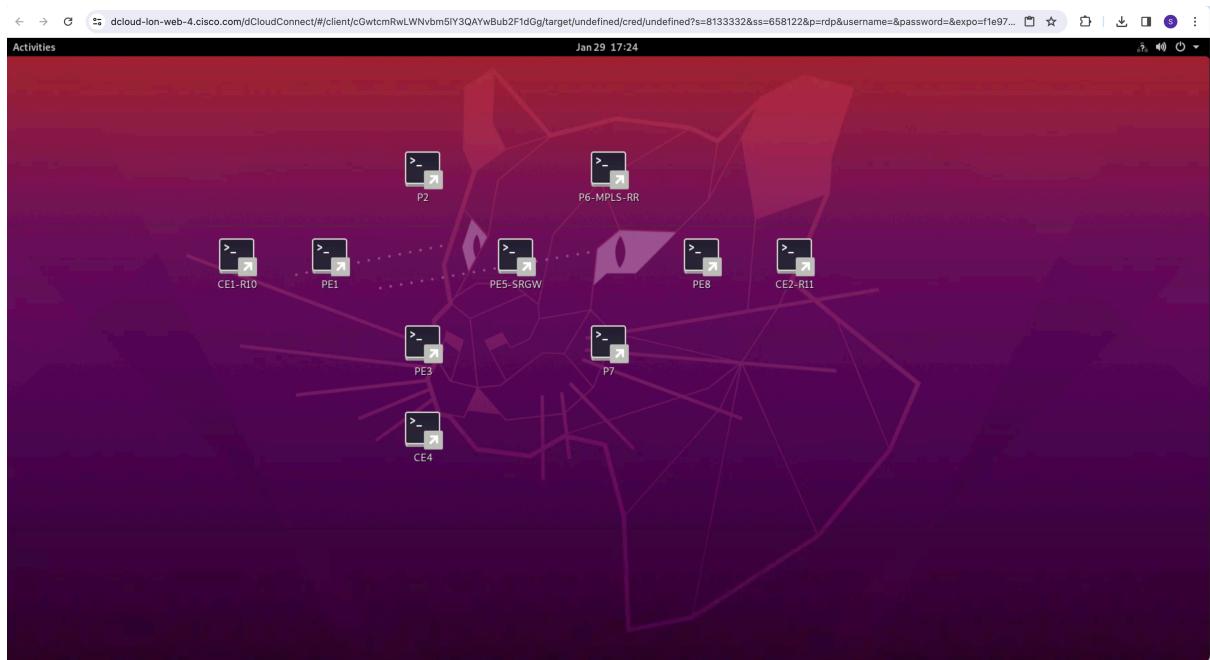


- Note down or take a screen shot of these credentials (In case you lose your session, this will come in handy)

Now, go back to the Network tab and click on the Remote Desktop



It should land you on the following dCloud SRv6 lab desktop:



As you can see, the dCloud lab desk top is arranged similar to your lab topology. To access the routers, double click on them. [Since the lab is hosted in RTP, US, there may be bit of a lag when accessing or copy/paste/show operations. So please be patient while copying and pasting the configurations from this guide as multiple copy/paste may bring undesired results.]

Lab Topology Pre-Checks

The intent of this lab is introduce the users on how to integrate and migrate SRv6 in an existing MPLS network. So the MPLS LDP is preconfigured in this lab topology. You will start the lab by performing the following pre-checks on the devices to make sure the existing MPLS lab is working properly.

- show isis neighbor
- show route
- show mpls ldp neighbor
- show bgp vpng4 unicast summary on PE1, PE3 and PE8.
- On PE1 and PE3
 - show bgp vrf XYZ summary
- On PE1 and PE8
 - show bgp vrf ABC summary
- Customer XYZ sites PE1 and CE4
 - Ping respective loopback sourcing from loopback to verify reachability.
 - On PE1 – ping vrf XYZ 4.4.4.4 source loopback 50
 - On CE4 – ping 50.50.50.50 source loopback0
- Customer ABC sites CE1 and CE2
 - Ping respective loopback sourcing from loopback to verify reachability
 - On CE1 – ping 11.11.11.11 source loopback0
 - On CE2 – ping 10.10.10.10 source loopback0

Note: If end to end connectivity on these VRFs are not working, please reach out to the proctors.

Task 1: Configure and Verify IGP-ISIS for IPv6

In this scenario, we configure & verify IS-IS in the SRv6 sub-domain of the topology for IPv6 Address-family. We then verify the reachability of the IPv6 loopbacks on all SRv6 subdomain routers.

IGP (Interior Gateway Protocol) is configured in a network for devices within the network to reach each other. IGP is the underlay on top of which services like BGP ride. A typical service provider network may run either IS-IS or OSPF as IGP. In this scenario, we use IS-IS for IGP reachability.

In this section, we configure IS-IS on devices PE1, P2, PE3 and PE5-SRGW for IPv6 address-family.

Note: ISIS for address-family IPv4 is already configured in the lab on all the devices.

Step 1: Configure ISIS for Address-family IPv6 on PE1

On PuTTY session PE1, enter the following command to enter configuration mode.

```
RP/0/RP0/CPU0:PE1#config
Thu Jan 12 17:55:58.021 UTC
RP/0/RP0/CPU0:PE1(config) #
```

Copy and paste the following configuration chunk on PE1.

```
! PE1
!
router isis 100
address-family ipv6 unicast
!
!
!
interface Loopback0
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/1
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/2
address-family ipv6 unicast
!
!
Commit
```

Enter the following command on PE1 to exit configuration mode.

```
RP/0/RP0/CPU0:PE1(config-isis-if-af) # end  
RP/0/RP0/CPU0:PE1#
```

Step 2: Configure ISIS for Address-family IPv6 on P2

On PuTTY session P2, enter the following command to enter configuration mode.

```
RP/0/RP0/CPU0:P2#config  
Thu Jan 12 17:55:58.021 UTC  
RP/0/RP0/CPU0:P2(config) #
```

Copy and paste the following configuration chunk on P2.

```
! P2  
!  
router isis 100  
address-family ipv6 unicast  
!  
!  
interface Loopback0  
address-family ipv6 unicast  
!  
interface GigabitEthernet0/0/0/0  
address-family ipv6 unicast  
!  
interface GigabitEthernet0/0/0/2  
address-family ipv6 unicast  
!  
!  
Commit
```

Enter the following command on P2 to exit configuration mode.

```
RP/0/RP0/CPU0:P2(config-isis-if-af) # end  
RP/0/RP0/CPU0:P2#
```

Step 3: Configure ISIS for Address-family IPv6 on PE3

On PuTTY session PE3, enter the following command to enter configuration mode.

```
RP/0/RP0/CPU0:PE3#config  
Thu Jan 12 17:55:58.021 UTC  
RP/0/RP0/CPU0:PE3#(config)#
```

Copy and paste the following configuration chunk on PE3.

```
! PE3  
!  
router isis 100  
address-family ipv6 unicast  
!  
!  
interface Loopback0  
address-family ipv6 unicast  
!!  
interface GigabitEthernet0/0/0/0  
address-family ipv6 unicast  
!  
!  
interface GigabitEthernet0/0/0/1  
address-family ipv6 unicast  
!  
!  
Commit
```

Enter the following command on PE3 to exit configuration mode.

```
RP/0/RP0/CPU0:PE3#(config-isis-if-af)# end
```

```
RP/0/RP0/CPU0:PE3#
```

Step 4: Configure ISIS for Address-family IPv6 on PE5-SRGW

On PuTTY session PE5-SRGW, enter the following command to enter configuration mode.

```
RP/0/RP0/CPU0:PE5-SRGW# config
Thu Jan 12 17:57:58.021 UTC
RP/0/RP0/CPU0:PE5-SRGW(config) #
```

Copy and paste the following configuration chunk on PE5-SRGW.

```
! PE5-SRGW
!
router isis 100
  address-family ipv6 unicast
  !
  !
  !
  interface Loopback0
    address-family ipv6 unicast
  ! !
  interface GigabitEthernet0/0/0/0
    address-family ipv6 unicast
  !
  !
  interface GigabitEthernet0/0/0/1
    address-family ipv6 unicast
  !
  !
  Commit
```

Enter the following command on PE5-SRGW to exit configuration mode.

```
RP/0/RP0/CPU0:PE5-SRGW(config-isis-if-af) # end
RP/0/RP0/CPU0:PE5-SRGW#
```

Step 5: Verify ISIS for Address-family IPv6 on PE1

Enter the following commands on PE1 to verify the IS-IS configuration. Bolded text in command output indicates the expected results.

```
RP/0/RP0/CPU0:PE1#show isis interface brief
Tue Feb 7 16:12:35.854 UTC

IS-IS 100 Interfaces
  Interface      All      Adjs      Adj Topos  Adv Topos  CLNS      MTU      Prio
                OK       L1       L2      Run/Cfg     Run/Cfg
L2
-----
```

```

Lo0           Yes   0     0      2/2       2/2       Up    1500   -
-
Gi0/0/0/1    Yes   1*   1*      2/2       2/2       Up    1497   64
64
Gi0/0/0/2    Yes   1     1      2/2       2/2       Up    1497   64
64
RP/0/RP0/CPU0:PE1#

```

```

RP/0/RP0/CPU0:PE1#show isis neighbors
Tue Feb  7 16:14:07.771 UTC

```

```

IS-IS 100 neighbors:
System Id      Interface          SNPA            State Holdtime Type IETF-NSF
P2              Gi0/0/0/1        0242.c0a8.a002 Up    22      L1L2 Capable
PE3              Gi0/0/0/2        0242.c0a8.b003 Up    9       L1L2 Capable

```

```

Total neighbor count: 2
RP/0/RP0/CPU0:PE1#

```

```

RP/0/RP0/CPU0:PE1#show route ipv6 isis | in /128
Tue Feb  7 16:15:16.322 UTC
i L1 2001:db8:2:2:2::2/128
i L1 2001:db8:3:3:3::3/128
i L1 2001:db8:5:5:5::5/128
RP/0/RP0/CPU0:PE1#

```

Step 6: Verify ISIS for Address-family IPv6 on P2

Enter the following commands on P2 to verify the IS-IS configuration. Bolded text in command output indicates the expected results.

```

RP/0/RP0/CPU0:P2#show isis interface brief
Tue Feb  7 16:16:59.464 UTC

IS-IS 100 Interfaces
  Interface      All OK   Adjs      Adj Topos  Adv Topos  CLNS   MTU   Prio
                  L1     L2      Run/Cfg  Run/Cfg
L2
-----
Lo0           Yes   0     0      2/2       2/2       Up    1500   -
-
Gi0/0/0/0    Yes   1     1      2/2       2/2       Up    1497   64
64
Gi0/0/0/2    Yes   1     1      2/2       2/2       Up    1497   64
64
RP/0/RP0/CPU0:P2#

```

```

RP/0/RP0/CPU0:P2#show isis neighbors
Tue Feb  7 16:18:00.342 UTC

```

```

IS-IS 100 neighbors:
System Id      Interface          SNPA            State Holdtime Type IETF-NSF
PE1             Gi0/0/0/0        0242.c0a8.a003 Up    9       L1L2 Capable
PE5-SRGW        Gi0/0/0/2        0242.c0a8.e003 Up    9       L1L2 Capable

```

```

Total neighbor count: 2
RP/0/RP0/CPU0:P2#

```

```

RP/0/RP0/CPU0:P2#show route ipv6 isis | in /128
Tue Feb 7 16:19:18.972 UTC
i L1 2001:db8:1:1:1::1/128
i L1 2001:db8:3:3:3::3/128
i L1 2001:db8:5:5:5::5/128
RP/0/RP0/CPU0:P2#

```

Step 7: Verify ISIS for Address-family IPv6 on PE3

Enter the following commands on PE3 to verify the IS-IS configuration. Bolded text in command output indicates the expected results.

```

RP/0/RP0/CPU0:PE3#show isis interface brief
Tue Feb 7 16:21:02.088 UTC

IS-IS 100 Interfaces
  Interface      All     Adjs    Adj Topos   Adv Topos   CLNS   MTU   Prio
                OK      L1      Run/Cfg   Run/Cfg
L2
-----  ---  -----
--  

Lo0          Yes     0       0        2/2      2/2      Up     1500   -
-  

Gi0/0/0/0    Yes     1*     1*       2/2      2/2      Up     1497   64
  64
Gi0/0/0/1    Yes     1*     1*       2/2      2/2      Up     1497   64
  64
RP/0/RP0/CPU0:PE3#

```

```

RP/0/RP0/CPU0:PE3#show isis neighbors
Tue Feb 7 16:21:48.764 UTC

```

```

IS-IS 100 neighbors:
System Id      Interface      SNPA           State Holdtime Type IETF-NSF
PE1            Gi0/0/0/0      0242.c0a8.b002 Up    28      L1L2 Capable
PE5-SRGW       Gi0/0/0/1      0242.c0a8.f002 Up    26      L1L2 Capable

```

```

Total neighbor count: 2
RP/0/RP0/CPU0:PE3#

```

```

RP/0/RP0/CPU0:PE3#show route ipv6 isis | in /128
Tue Feb 7 16:22:57.990 UTC
i L1 2001:db8:1:1:1::1/128
i L1 2001:db8:2:2:2::2/128
i L1 2001:db8:5:5:5::5/128
RP/0/RP0/CPU0:PE3#

```

Step 8: Verify ISIS for Address-family IPv6 on PE5-SRGW

Enter the following commands on PE5-SRGW to verify the IS-IS configuration. Bolded text in command output indicates the expected results.

```
RP/0/RP0/CPU0:PE5-SRGW#show isis interface brief
Tue Feb 7 16:24:07.384 UTC

IS-IS 100 Interfaces
  Interface      All     Adjs      Adj Topos   Adv Topos   CLNS    MTU    Prio
          OK      L1      L2      Run/Cfg   Run/Cfg
L2
-----
--  

L00           Yes     0       0       2/2       2/2       Up      1500   -
-  

Gi0/0/0/0     Yes     1       1       2/2       2/2       Up      1497   64
64  

Gi0/0/0/1     Yes     1*     1*     2/2       2/2       Up      1497   64
64  

Gi0/0/0/2     Yes     1       1       1/1       1/1       Up      1497   64
64  

Gi0/0/0/3     Yes     1       1       1/1       1/1       Up      1497   64
64
RP/0/RP0/CPU0:PE5-SRGW#
```

```
RP/0/RP0/CPU0:PE5-SRGW#show isis neighbors
Tue Feb 7 16:24:13.497 UTC
```

```
IS-IS 100 neighbors:
System Id      Interface      SNPA          State Holdtime Type IETF-NSF
P2            Gi0/0/0/1    0242.c0a8.e002 Up   24        L1L2 Capable
P6-MPLS-RR   Gi0/0/0/3    0242.ac17.0003 Up   9         L1L2 Capable
PE3            Gi0/0/0/0    0242.c0a8.f003 Up   7         L1L2 Capable
P7            Gi0/0/0/2    0242.ac16.0003 Up   7         L1L2 Capable
```

```
Total neighbor count: 4
RP/0/RP0/CPU0:PE5-SRGW#
```

```
RP/0/RP0/CPU0:PE5-SRGW#show route ipv6 isis | in /128
```

```
Tue Feb 7 16:26:15.621 UTC
```

```
i L1 2001:db8:1:1:1::1/128
i L1 2001:db8:2:2:2::2/128
i L1 2001:db8:3:3:3::3/128
```

```
RP/0/RP0/CPU0:PE5-SRGW#
```

Task 2: Configure and Verify BGP for IPV6

In this scenario, you configure BGP and verify that the sessions are established with the route reflector in SRv6 sub-domain. The SRv6 sub-domain consists of PE1, P2, PE3 and PE5-SRGW routers.

Please note that we are configuring BGP for IPv6 address family but the we have neither configured SRv6 nor Interworking Gateway yet in this sub-domain. So in order to avoid outage, we are lowering the Local preference (50) for the BGP IPv6 neighbors. This way, the connectivity will be maintained through MPLS. Once we configure BGP for IPv6 address-family, SRv6 and Interworking Gateway fuction (on PE5-SRGW), we will increase the BGP local preference attribute (200) to switch to SRv6 control and data plane in later steps.

For the SRv6 sub-domain, we will configure P2 as BGP route-reflector for vpng4 address-family. Update the hostname of P2 with the below configuration to rightly update its role in the lab topology.

Note : P6-MPLS-RR is configured as a route-reflector for the end to end MPLS domain. With the introduction of SRv6, you are configuring a new route-reflector, routes from SRv6 RR will be preferred using local preference in the subsequent steps wherever applicable.

On PuTTY session P2, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:P2# config
```

Copy and paste the following configuration chunk on P2

```
!
hostname P2-SRv6-RR
commit
!
```

We establish iBGP neighborship with route reflector (P2) in the SRv6 sub-domains on PE1, PE3 and PE5-SRGW which will be configured as a segment routing interworking gateway in later steps.

Step 1: Configure BGP on P2 and Enable BGP route-reflector functionality.

On P2 make sure you are in configuration mode

```
RP/0/RP0/CPU0:P2-SRv6-RR(config)#
```

Copy and paste the following configuration chunk on P2-SRv6RR.

```
! P2-SRv6-RR
!
router bgp 100
  bgp router-id 2.2.2.2
!
  address-family vpnv4 unicast
    !
    !
    neighbor 2001:db8:1:1:1::1
      remote-as 100
      update-source Loopback0
      address-family vpnv4 unicast
        route-reflector-client
    !
    !
    neighbor 2001:db8:3:3:3::3
      remote-as 100
      update-source Loopback0
      address-family vpnv4 unicast
        route-reflector-client
    !
    !
    neighbor 2001:db8:5:5:5::5
      remote-as 100
      update-source Loopback0
      address-family vpnv4 unicast
        route-reflector-client
    !
    !
commit
```

Enter the following command on P2 to exit configuration mode.

```
RP/0/RP0/CPU0:P2-SRv6-RR(config-bgp-nbr-af) # end
RP/0/RP0/CPU0:P2-SRv6-RR#
```

Step 2: Configure BGP for IPv6 on PE1

On PuTTY session PE1, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE1#config
```

Copy and paste the following configuration chunk on PE1

```
! PE1
!
route-policy LOCAL-PREF
  set local-preference 50
end-policy
!
commit
!
!
router bgp 100
!
neighbor 2001:db8:2:2:2::2
  remote-as 100
  update-source Loopback0
  address-family vpnv4 unicast
    route-policy LOCAL-PREF in
  !
commit
```

Enter the following command on PE1 to exit configuration mode.

```
RP/0/RP0/CPU0:PE1(config-bgp-nbr-af) # end
RP/0/RP0/CPU0:PE1#
```

Step 3: Configure BGP for IPv6 on PE3

On PuTTY session PE3, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE3# config  
Thu Jan 12 18:33:48.846 UTC
```

Copy and paste the following configuration chunk on PE3.

```
! PE3  
!  
route-policy LOCAL-PREF  
  set local-preference 50  
end-policy  
!  
commit  
!  
!  
router bgp 100  
!  
neighbor 2001:db8:2:2:2::2  
  remote-as 100  
  update-source Loopback0  
  address-family vpnv4 unicast  
    route-policy LOCAL-PREF in  
  !  
Commit
```

Enter the following command on PE3 to exit configuration mode.

```
RP/0/RP0/CPU0:PE3(config-bgp-nbr-af)# end  
RP/0/RP0/CPU0:PE3#
```

Step 4: Configure BGP for IPv6 on PE5-SRGW

On PuTTY session PE5-SRGW, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE5-SRGW# config  
Thu Jan 12 18:33:48.846 UTC
```

Copy and paste the following configuration chunk on PE5-SRGW (Interworking gateway)

```

! PE5-SRGW
!
route-policy LOCAL-PREF
set local-preference 50
end-policy
!
commit
!
!
router bgp 100
bgp router-id 5.5.5.5
!
address-family vpnv4 unicast
!
!
!PE5 BGP neighborship with MPLS RR
!This is needed as PE5 will be configured as SR interworking gateway
!
neighbor 6.6.6.6
remote-as 100
update-source Loopback0
address-family vpnv4 unicast
!
!
!
neighbor 2001:db8:2:2:2::2
remote-as 100
update-source Loopback0
address-family vpnv4 unicast
route-policy LOCAL-PREF in
!
!
Commit

```

Enter the following command on PE5-SRGW to exit configuration mode.

```

RP/0/RP0/CPU0:PE5-SRGW(config-bgp-nbr-af)#
RP/0/RP0/CPU0:PE5-SRGW#

```

Step 4: Configure BGP on P6

Since PE5-SRGW is going to be the interworking gateway, it needs to exchange the prefixes with P6.

In the previous step, we have configured BGP on PE5-SRGW to peer with P6. P6 should also have corresponding BGP configuration to peer with PE5-SRGW which is already configured as part of the base configuration. So no need for us to configure it here again. You can verify the BGP configuration in P6 router.

Step 5: Verify BGP Configurations on PE1, PE3 and P2-SRv6-RR

Enter the following two commands on **PE1** to verify the BGP configuration.

```
RP/0/RP0/CPU0:PE1#show bgp sessions
Tue Feb 7 16:38:00.058 UTC

Neighbor          VRF           Spk   AS   InQ   OutQ   NBRState
NSRState
6.6.6.6        default       0     100    0      0      Established
None
2001:db8:2:2:2::2
                  default       0     100    0      0      Established
None
10.10.1.2        ABC           0     65000   0      0      Established
None
RP/0/RP0/CPU0:PE1#


RP/0/RP0/CPU0:PE1#show bgp vpng4 unicast summary | b e Neighbor
Tue Feb 7 16:38:39.769 UTC
Neighbor          Spk   AS  MsgRcvd  MsgSent  TblVer  InQ  OutQ  Up/Down
St/PfxRcd
6.6.6.6         0     100    361     357      30      0      0  05:51:54
6
2001:db8:2:2:2::2
                  0     100    13      11      30      0      0  00:05:40
3

RP/0/RP0/CPU0:PE1#


RP/0/RP0/CPU0:PE1#show bgp vpng4 unicast vrf XYZ | b e Status
Tue Feb 7 16:40:59.228 UTC
Status codes: s suppressed, d damped, h history, * valid, > best
              i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
Network          Next Hop          Metric LocPrf Weight Path
Route Distinguisher: 100:20 (default for vrf XYZ)
*>i4.4.4.4/32    3.3.3.3        0     100      0  65000  ?
* i               2001:db8:3:3:3::3
                  0     50      0  65000  ?
*>i10.4.3.0/30   3.3.3.3        0     100      0  ?
* i               2001:db8:3:3:3::3
                  0     50      0  ?
*> 50.50.50.50/32 0.0.0.0        0      0      32768  ?
*>i172.30.0.0/24  3.3.3.3        0     100      0  65000  ?
* i               2001:db8:3:3:3::3
                  0     50      0  65000  ?

Processed 4 prefixes, 7 paths
RP/0/RP0/CPU0:PE1#
```

Note that the BGP prefixes received from IPv4 neighbor (for the vrf XYZ) are preferred as the local preference is a higher than the one received from IPv6 neighbors.

Enter the following two commands on **P2-SRv6RR** to verify the BGP configuration.

```
RP/0/RP0/CPU0:P2-SRv6-RR#show bgp sessions
Tue Feb 7 16:43:08.230 UTC

Neighbor          VRF          Spk      AS   InQ   OutQ   NBRState
NSRState
2001:db8:1:1:1::1
                    default        0       100     0       0   Established
None
2001:db8:3:3:3::3
                    default        0       100     0       0   Established
None
2001:db8:5:5:5::5
                    default        0       100     0       0   Established
None
RP/0/RP0/CPU0:P2-SRv6-RR#
RP/0/RP0/CPU0:P2-SRv6-RR#show bgp vpng4 unicast summary | be Neighbor
Tue Feb 7 16:44:11.616 UTC
Neighbor          Spk      AS MsgRcvd MsgSent    TblVer  InQ OutQ Up/Down
St/PfxRcd
2001:db8:1:1:1::1
                    0       100     17      19        8       0       0 00:11:11
4
2001:db8:3:3:3::3
                    0       100     15      18        8       0       0 00:10:24
3
2001:db8:5:5:5::5
                    0       100     9       15        8       0       0 00:06:50
0
RP/0/RP0/CPU0:P2-SRv6-RR#
```

Enter the following two commands on **PE3** to verify the BGP configuration.

```
RP/0/RP0/CPU0:PE3#show bgp sessions
Tue Feb 7 16:45:16.304 UTC

Neighbor          VRF          Spk      AS   InQ   OutQ   NBRState
NSRState
6.6.6.6          default        0       100     0       0   Established
None
2001:db8:2:2:2::2
                    default        0       100     0       0   Established
None
10.4.3.2          XYZ           0      65000     0       0   Established
None
RP/0/RP0/CPU0:PE3#
RP/0/RP0/CPU0:PE3#show bgp vpng4 unicast summary | be Neighbor
Tue Feb 7 16:46:53.577 UTC
Neighbor          Spk      AS MsgRcvd MsgSent    TblVer  InQ OutQ Up/Down
St/PfxRcd
6.6.6.6          0       100     369      365      13      0
0 06:00:06
```

```
2001:db8:2:2:2::2          0    100      20      18      13    0    0 00:13:06
1
```

```
RP/0/RP0/CPU0:PE3#
```

```
RP/0/RP0/CPU0:PE3#show bgp vpnv4 unicast vrf XYZ | be Status
Tue Feb  7 16:48:13.341 UTC
Status codes: s suppressed, d damped, h history, * valid, > best
               i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
Network          Next Hop          Metric LocPrf Weight Path
Route Distinguisher: 100:20 (default for vrf XYZ)
*-> 4.4.4.4/32        10.4.3.2          0          0 65000 ?
*-> 10.4.3.0/30       0.0.0.0          0          32768 ?
*           10.4.3.2          0          0 65000 ?
*->i50.50.50.50/32   1.1.1.1          0    100    0 ?
* i           2001:db8:1:1:1::1          0          50    0 ?
*-> 172.30.0.0/24     10.4.3.2          0          0 65000 ?
```

```
Processed 4 prefixes, 6 paths
RP/0/RP0/CPU0:PE3#
```

Please note that the BGP prefixes received from IPv4 neighbor (for the vrf XYZ) is preferred as the local preference is a higher than the one received from IPv6 neighbors.

Task 3: Configure and Verify SRv6

This scenario describes how to configure and verify SRv6. You will configure SRv6 on PE1, P2 PE3 and PE5-SRGW and enable vrf “XYZ” for SRv6.

Note: In this demonstration, we use the SRv6 base format implementation. Micro-sid is another alternative, which is also more scalable. Since we want to showcase the SRv6 MPLS Service Interworking Gateway feature in subsequent steps, we use the SRv6 base format to keep the underlay simple.

Step 1: Configure SRv6 on PE1

On PuTTY session PE1, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE1# config
```

Copy and paste the following configuration chunk on PE1.

```

! PE1
!
router isis 100
address-family ipv6 unicast
segment-routing srv6
locator LOC0
!
router bgp 100
!
segment-routing srv6
locator LOC0
!
vrf XYZ
address-family ipv4 unicast
segment-routing srv6
alloc mode per-vrf
!
!
!
segment-routing
srv6
locators
locator LOC0
prefix 2001:db8:a::/64
commit

```

Enter the following command on PE1 to exit configuration mode.

```

RP/0/RP0/CPU0:PE1(config)# end
RP/0/RP0/CPU0:PE1#

```

Step 2: Configure SRv6 on P2-SRv6RR

On PuTTY session P2-SRv6RR, enter the following command to access configuration mode.

```

RP/0/RP0/CPU0:P2-SRv6-RR# config

```

Copy and paste the following configuration chunk on P2-SRv6RR.

```
! P2-SRv6-RR
!
router isis 100
address-family ipv6 unicast
segment-routing srv6
locator LOC0
!
router bgp 100
!
segment-routing srv6
locator LOC0
!
address-family vpng4 unicast
vrf all
segment-routing srv6
locator LOC0
!
!
segment-routing
srv6
locators
locator LOC0
prefix 2001:db8:b::/64
commit
```

Enter the following command on P2-SRv6RR to exit configuration mode.

```
RP/0/RP0/CPU0:P2-SRv6RR(config)# end
RP/0/RP0/CPU0:P2-SRv6RR#
```

Step 3: Configure SRv6 on PE3

On PuTTY session PE3, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE3# config
Thu Jan 12 18:56:46.976 UTC
```

Copy and paste the following configuration chunk on PE3.

```

! PE3
!
router isis 100
address-family ipv6 unicast
segment-routing srv6
locator LOC0
!
router bgp 100
!
segment-routing srv6
locator LOC0
!
vrf XYZ
address-family ipv4 unicast
segment-routing srv6
alloc mode per-vrf
!
!
!
segment-routing
srv6
locators
locator LOC0
prefix 2001:db8:c::/64
commit

```

Enter the following command on PE3 to exit configuration mode.

```

RP/0/RP0/CPU0:PE3(config)# end
RP/0/RP0/CPU0:PE3#

```

Step 4: Configure SRv6 on PE5-SRGW

On PuTTY session PE5, enter the following command to access configuration mode.

```

RP/0/RP0/CPU0:PE5-SRGW#config
Thu Jan 21 18:56:46.976 UTC

```

Copy and paste the following configuration chunk on PE5-SRGW

```

! PE5-SRGW
!
router isis 100
address-family ipv6 unicast
segment-routing srv6
locator LOC0
!
router bgp 100
!
segment-routing srv6
locator LOC0
!
address-family vpng4 unicast
vrf all
segment-routing srv6
locator LOC0
!
!
segment-routing
srv6
locators
locator LOC0
prefix 2001:db8:d::/64
commit

```

Enter the following command on PE5-SRGW to exit configuration mode.

```

RP/0/RP0/CPU0:PE5-SRGW# (config) # end
RP/0/RP0/CPU0:PE5-SRGW#

```

Step 5: Verify SRv6 Configuration

Enter the following two commands on **PE1** to verify the SRv6 configuration. Bolded text in command output indicates the expected results.

```

RP/0/RP0/CPU0:PE1#show segment-routing srv6 locator
Tue Feb  7 16:52:45.015 UTC
Name          ID      Algo   Prefix           Status
Flags
-----
-----
LOC0        1       0      2001:db8:a::/64    Up
RP/0/RP0/CPU0:PE1#

```

```

RP/0/RP0/CPU0:PE1#
RP/0/RP0/CPU0:PE1#show segment-routing srv6 sid
Tue Feb  7 16:52:58.615 UTC

```

*** Locator: 'LOC0' ***

SID Owner	State	Behavior	Context
		RW	
2001:db8:a:0:1::		End (PSP/USD)	'default':1
sidmgr	InUse	Y	
2001:db8:a:0:40::		End.X (PSP/USD)	[Gi0/0/0/1, Link-Local]
isis-100	InUse	Y	
2001:db8:a:0:41::		End.X (PSP/USD)	[Gi0/0/0/2, Link-Local]
isis-100	InUse	Y	
2001:db8:a:0:42::		End.DT4	'XYZ'
bgp-100	InUse	Y	

RP/0/RP0/CPU0:PE1#

Enter the same two commands on PE3 to verify the SRV6 configuration. Bolded text in command output indicates the expected results.

Name	ID	Algo	Prefix	Status
Flags				
LOC0	1	0	2001:db8:c::/64	Up

RP/0/RP0/CPU0:PE3#

RP/0/RP0/CPU0:PE3#**show segment-routing srv6 sid**
Tue Feb 7 16:57:51.373 UTC

*** Locator: 'LOC0' ***

SID Owner	State	Behavior	Context
		RW	
2001:db8:c:0:1::		End (PSP/USD)	'default':1
sidmgr	InUse	Y	
2001:db8:c:0:40::		End.X (PSP/USD)	[Gi0/0/0/0, Link-Local]
isis-100	InUse	Y	
2001:db8:c:0:41::		End.X (PSP/USD)	[Gi0/0/0/1, Link-Local]
isis-100	InUse	Y	
2001:db8:c:0:42::		End.DT4	'XYZ'
bgp-100	InUse	Y	

RP/0/RP0/CPU0:PE3#

Enter the same two commands on PE5-SRGW to verify the SRV6 configuration. Bolded text in command output indicates the expected results.

Name	ID	Algo	Prefix	Status
Flags				
LOC0	1	0	2001:db8:d::/64	Up

RP/0/RP0/CPU0:PE5-SRGW#
RP/0/RP0/CPU0:PE5-SRGW#**show segment-routing srv6 sid**
Tue Feb 7 16:59:31.428 UTC

*** Locator: 'LOC0' ***

SID Owner	State	Behavior	Context
		RW	
-		-	-
2001:db8:d:0:1::		End (PSP/USD)	'default':1
sidmgr	InUse	Y	
2001:db8:d:0:40::		End.X (PSP/USD)	[Gi0/0/0/1, Link-Local]
isis-100	InUse	Y	
2001:db8:d:0:41::		End.X (PSP/USD)	[Gi0/0/0/0, Link-Local]
isis-100	InUse	Y	

RP/0/RP0/CPU0:PE5-SRGW#

Step 6: Change BGP Local preference to Prefer IPv6 neighbors in SRv6 sub-domain

Now that BGP for IPv6 and SRv6 is configured on the SRv6 sub-domain (PE1, P2-SRv6-RR, PE3 and PE5-SRGW), we can change the local preference for BGP address family IPv6 neighbors to 200 so that the prefixes from IPv6 neighbors are preferred.

Configure the following on PE1

On PuTTY session PE1, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE1# config
```

Copy and paste the following configuration chunk on PE1.

```
! PE1
!
route-policy LOCAL-PREF
  set local-preference 200
end-policy
!
Commit
```

Enter the following command on PE1 to exit configuration mode.

```
RP/0/RP0/CPU0:PE1(config)# end
RP/0/RP0/CPU0:PE1#
```

Configure the following on PE3

On PuTTY session PE3, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE3# config
Thu Jan 12 18:56:46.976 UTC
```

Copy and paste the following configuration chunk on PE3.



```
! PE3
!
route-policy LOCAL-PREF
  set local-preference 200
end-policy
!
Commit
```

Enter the following command on PE3 to exit configuration mode.

```
RP/0/RP0/CPU0:PE3(config)# end
RP/0/RP0/CPU0:PE3#
```

Configure the following on PE5-SRGW

On PuTTY session PE5-SRGW, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE5-SRGW# config
Thu Jan 12 18:56:46.976 UTC
```

Copy and paste the following configuration chunk on PE5-SRGW.

```
! PE5-SRGW
!
route-policy LOCAL-PREF
  set local-preference 200
end-policy
!
Commit
```

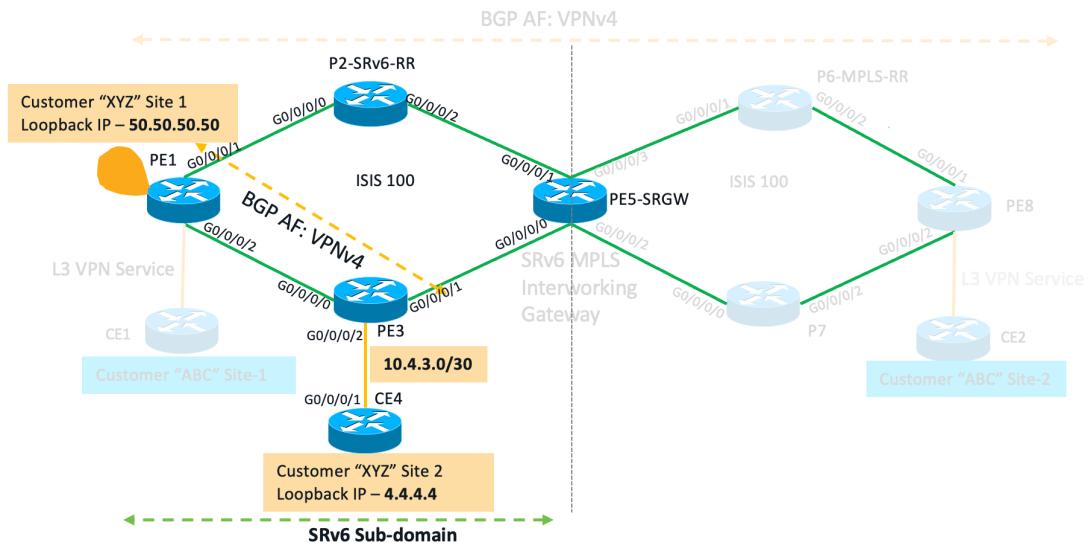
Enter the following command on PE5-SRGW to exit configuration mode.

```
RP/0/RP0/CPU0:PE5-SRGW(config)# end
RP/0/RP0/CPU0:PE5-SRGW#
```

Task 4: Verify L3VPN Services in the SRv6 Sub-domain (for vrf XYZ)

In this section, we verify the L3VPN services between devices PE1 and PE3 for vrf “XYZ”. Segment Routing v6 (SRv6) is enabled for this vrf in the previous section.

Step 1 Verify prefixes on PE1 and PE3 for VRF XYZ



Enter the following three commands on PE1 to verify the routes. Bolded text in command output indicates the expected results.

```
RP/0/RP0/CPU0:PE1#show route vrf XYZ ipv4 | be Gateway
Tue Feb 7 17:02:26.643 UTC
Gateway of last resort is not set

B 4.4.4.4/32 [200/0] via 2001:db8:3:3:3::3 (nexthop in vrf default),
00:01:10
B 10.4.3.0/30 [200/0] via 2001:db8:3:3:3::3 (nexthop in vrf default),
00:01:10
L 50.50.50.50/32 is directly connected, 06:16:00, Loopback50
B 172.30.0.0/24 [200/0] via 2001:db8:3:3:3::3 (nexthop in vrf default),
00:01:10
RP/0/RP0/CPU0:PE1#
```

```
RP/0/RP0/CPU0:PE1#show bgp vpnv4 unicast summary | be Neighbor
Tue Feb 7 17:03:33.442 UTC
Neighbor          Spk      AS MsgRcvd MsgSent     TblVer  InQ OutQ Up/Down
St/PfxRcd
6.6.6.6           0       100      389      384        43      0    0 06:16:48
6
2001:db8:2:2:2::2
0       100      46       38        43      0    0 00:30:33
```

```
RP/0/RP0/CPU0:PE1#
```

```
RP/0/RP0/CPU0:PE1#show bgp vpnv4 unicast vrf XYZ | be Network
Tue Feb 7 17:06:34.865 UTC
      Network          Next Hop          Metric LocPrf Weight Path
Route Distinguisher: 100:20 (default for vrf XYZ)
* i4.4.4.4/32        3.3.3.3        0       100      0 65000 ?
*>i                  2001:db8:3:3:3::3
                                0       200      0 65000 ?
* i10.4.3.0/30       3.3.3.3        0       100      0 ?
*>i                  2001:db8:3:3:3::3
                                0       200      0 ?
*> 50.50.50.50/32   0.0.0.0        0       32768    ?
* i172.30.0.0/24     3.3.3.3        0       100      0 65000 ?
*>i                  2001:db8:3:3:3::3
                                0       200      0 65000 ?
```

Processed 4 prefixes, 7 paths

```
RP/0/RP0/CPU0:PE1#
```

Enter the same three commands on PE3 to verify the routes. Bolded text in command output indicates the expected results.

```
RP/0/RP0/CPU0:PE3#show route vrf XYZ ipv4 | be Gateway
Tue Feb 7 17:10:11.668 UTC
Gateway of last resort is not set

B   4.4.4.4/32 [20/0] via 10.4.3.2, 00:18:17
C   10.4.3.0/30 is directly connected, 06:23:41, GigabitEthernet0/0/0/2
L   10.4.3.1/32 is directly connected, 06:23:41, GigabitEthernet0/0/0/2
B   50.50.50.50/32 [200/0] via 2001:db8:1:1:1::1 (nexthop in vrf default),
00:08:33
B   172.30.0.0/24 [20/0] via 10.4.3.2, 00:18:17
RP/0/RP0/CPU0:PE3#
```

```
RP/0/RP0/CPU0:PE3#show bgp vpnv4 unicast summary | be Neighbor
```

```
Tue Feb 7 17:11:03.908 UTC
Neighbor      Spk      AS MsgRcvd MsgSent      TblVer  InQ OutQ Up/Down
St/PfxRcd
6.6.6.6          0     100     397     392          29      0     0 06:24:16
1
2001:db8:2:2:2::2
          0     100     52      46          29      0     0 00:37:16
1
```

```
RP/0/RP0/CPU0:PE3#
```

```
RP/0/RP0/CPU0:PE3#show bgp vpnv4 unicast vrf XYZ | be Network
Tue Feb 7 17:11:59.750 UTC
      Network          Next Hop          Metric LocPrf Weight Path
Route Distinguisher: 100:20 (default for vrf XYZ)
*> 4.4.4.4/32        10.4.3.2        0       65000 ?
*> 10.4.3.0/30       0.0.0.0        0       32768 ?
*           10.4.3.2        0       65000 ?
* i50.50.50.50/32   1.1.1.1        0       100      0 ?
*>i                  2001:db8:1:1:1::1
                                0       200      0 ?
*> 172.30.0.0/24     10.4.3.2        0       65000 ?
```

Processed 4 prefixes, 6 paths

Step 2: Perform PING operations on PE1 and PE3 to verify end to end connectivity for VRF XYZ

Enter the following commands on PE1 to verify SRv6 connectivity. Correct result for all ping operations is, success rate is 100 percent (5/5).

```
RP/0/RP0/CPU0:PE1#ping vrf XYZ 4.4.4.4
Tue Feb 7 17:13:44.173 UTC
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 4.4.4.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 3/11/26 ms
RP/0/RP0/CPU0:PE1#
```

Enter the same commands on PE3 to verify SRv6 connectivity. Correct result for all ping operations is Success rate is 100 percent (5/5).

```
RP/0/RP0/CPU0:PE3#ping vrf XYZ 50.50.50.50
Tue Feb 7 17:15:10.956 UTC
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 50.50.50.50, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/3 ms
RP/0/RP0/CPU0:PE3#
```

Task 5: Configure and Verify L3VPN Services with Interworking Gateway (for vrf ABC)

In this scenario, we configure and verify L3VPN services between devices PE1 and PE8 using the Interworking Gateway.

On the interworking gateway (PE5), configuration tasks include:

- Configure VRF
- MPLS L3VPN RTs
- SRv6 L3VPN RTs (called “stitching RTs”)
- Enable next-hop-self & Interworking Service Gateway roles with PEs in SRv6 and MPLS domain.
- Enable both SRv6 and MPLS role for the VRF “ABC” under BGP.

Step 1: Configure Interworking Service Gateway on PE5-SRGW

On PuTTY session PE5-SRGW, enter the following command to access configuration mode.

```
RP/0/RP0/CPU0:PE5-SRGW# config
```

Copy and paste the following configuration chunk on PE5-SRGW.

```

! PE5-SRGW
!
!Configure VRF, with Route-targets of both the domains
!
vrf ABC
  address-family ipv4 unicast
    import route-target
      100:10 stitching
      100:10
    !
    export route-target
      100:10 stitching
      100:10
    !
  !
! Enable RR with next-hop-self & Interworking Service Gateway roles with
PES in SRv6 and MPLS domain
!
router bgp 100
!
neighbor 6.6.6.6
  address-family vpng4 unicast
    import reoriginate stitching-rt
    route-reflector-client
    advertise vpng4 unicast re-originated
    next-hop-self
  !
  !
neighbor 2001:db8:2:2::2
  address-family vpng4 unicast
    import stitching-rt reoriginate
    route-reflector-client
    encapsulation-type srv6
    advertise vpng4 unicast re-originated stitching-rt
    next-hop-self
  !
  !
! Enable both SRv6 and MPLS role for the VRF under BGP
!
vrf ABC
  rd 100:40
  address-family ipv4 unicast
    mpls alloc enable
    segment-routing srv6
  !
Commit

```

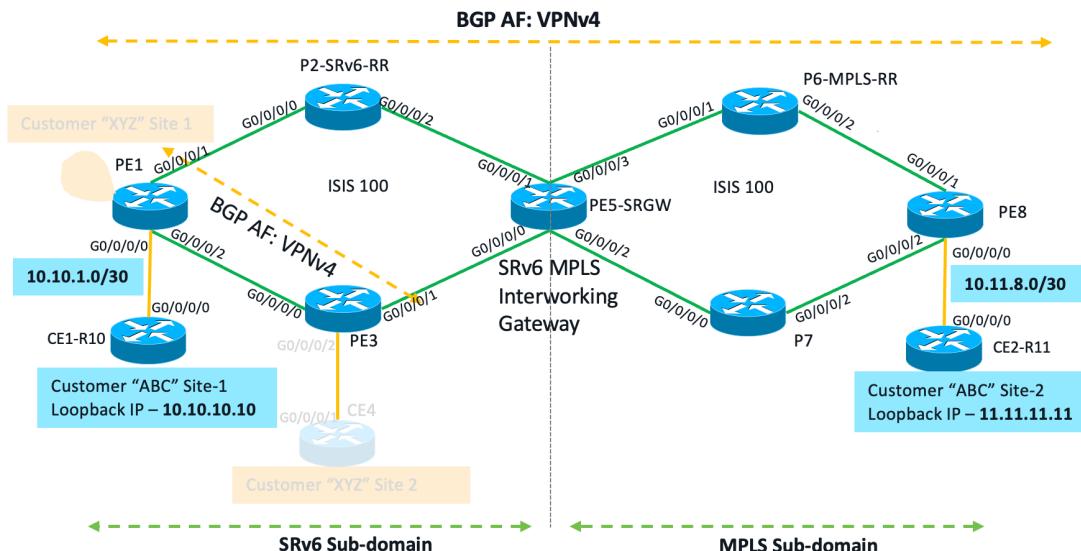
Enter the following command on PE5-SRGW to exit configuration mode.

```
RP/0/RP0/CPU0:PE5-SRGW(config-bgp-vrf-af-srv6)# end
RP/0/RP0/CPU0:PE5-SRGW#
```

Step 2: On PE1, Enable SRv6 for vrf ABC

```
! PE1
!
router bgp 100
!
vrf ABC
  address-family ipv4 unicast
    segment-routing srv6
      alloc mode per-vrf
  !
Commit
```

Step 3: Verify prefixes on PE1 and PE8 for VRF ABC



Enter the following three commands on PE1 to verify the routes. Bolded text in command output indicates the expected results.

```
RP/0/RP0/CPU0:PE1#show route vrf ABC ipv4 | be Gateway
Tue Feb 7 17:17:05.392 UTC
Gateway of last resort is not set

C 10.10.1.0/30 is directly connected, 06:30:37, GigabitEthernet0/0/0/0
L 10.10.1.1/32 is directly connected, 06:30:37,
GigabitEthernet0/0/0/0
```

```

B      10.10.10.10/32 [20/0] via 10.10.1.2, 00:00:24
B      10.11.8.0/30 [200/0] via 2001:db8:5:5:5::5 (nexthop in vrf default),
00:00:52
B      11.11.11.11/32 [200/0] via 2001:db8:5:5:5::5 (nexthop in vrf default),
00:00:52
B      172.30.0.0/24 [20/0] via 10.10.1.2, 00:00:24

```

```

RP/0/RP0/CPU0:PE1#
RP/0/RP0/CPU0:PE1#show bgp vpnv4 unicast summary | be Neighbor
Tue Feb 7 17:19:20.148 UTC
Neighbor          Spk      AS MsgRcvd MsgSent     TblVer   InQ OutQ Up/Down
St/PfxRcd
6.6.6.6           0       100    410     401        58      0     0 06:32:34
5
2001:db8:2:2:2::2
5
          0       100    68      55        58      0     0 00:46:20
5

```

```
RP/0/RP0/CPU0:PE1#
```

```

RP/0/RP0/CPU0:PE1#show bgp vpnv4 unicast vrf ABC | be Network
Tue Feb 7 17:20:10.017 UTC
      Network          Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 100:10 (default for vrf ABC)
* > 10.10.1.0/30      0.0.0.0             0        32768 ??
*          10.10.1.2      0                  0        0 65000 ?
* > 10.10.10.10/32    10.10.1.2            0        0 65000 ?
* i10.11.8.0/30       8.8.8.8             0       100     0 ?
* >i                 2001:db8:5:5:5::5
                      0       200     0 ?
* i11.11.11.11/32     8.8.8.8             0       100     0 65000 ?
* >i                 2001:db8:5:5:5::5
                      0       200     0 65000 ?
* > 172.30.0.0/24     10.10.1.2            0       0 65000 ?

```

Processed 5 prefixes, 8 paths

```
RP/0/RP0/CPU0:PE1#
```

Enter the same three commands on PE8 to verify the routes. Bolded text in command output indicates the expected results.

```

RP/0/RP0/CPU0:PE8#show route vrf ABC ipv4 | be Gateway
Tue Feb 7 17:22:45.671 UTC
Gateway of last resort is not set

B      10.10.1.0/30 [200/0] via 5.5.5.5 (nexthop in vrf default), 00:06:05
B      10.10.10.32 [200/0] via 5.5.5.5 (nexthop in vrf default), 00:06:05
C      10.11.8.0/30 is directly connected, 06:36:28, GigabitEthernet0/0/0/0
L      10.11.8.1/32 is directly connected, 06:36:28, GigabitEthernet0/0/0/0
B      11.11.11.11/32 [20/0] via 10.11.8.2, 06:35:09
B      172.30.0.0/24 [200/0] via 5.5.5.5 (nexthop in vrf default), 00:06:05
RP/0/RP0/CPU0:PE8#

```

```

RP/0/RP0/CPU0:PE8#show bgp vpnv4 unicast summary | be Neighbor
Tue Feb 7 17:24:08.548 UTC
Neighbor          Spk      AS MsgRcvd MsgSent     TblVer   InQ OutQ Up/Down
St/PfxRcd
6.6.6.6           0       100    416     404        29      0     0 06:37:32
6

```



```
RP/0/RP0/CPU0:PE8#
```

```

RP/0/RP0/CPU0:PE8#show bgp vpnv4 unicast vrf ABC | be Network
Tue Feb 7 17:24:51.936 UTC
      Network          Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 100:30 (default for vrf ABC)
* i10.10.1.0/30      1.1.1.1              0     100      0 ?
* >i                 5.5.5.5              0     200      0 ?
* i10.10.10.10/32    1.1.1.1              0     100      0 65000 ?
* >i                 5.5.5.5              0     200      0 65000 ?
*> 10.11.8.0/30      0.0.0.0              0           32768 ?
*                   10.11.8.2             0           0 65000 ?
*> 11.11.11.11/32    10.11.8.2             0           0 65000 ?
* i172.30.0.0/24     1.1.1.1              0     100      0 65000 ?
* >i                 5.5.5.5              0     200      0 65000 ?
*                   10.11.8.2             0           0 65000 ?

Processed 5 prefixes, 10 paths
RP/0/RP0/CPU0:PE8#

```

Step 4: Perform PING operations on PE1 and PE8 to verify end to end connectivity for VRF ABC

Enter the following commands on PE1 to verify SRv6 to MPLS connectivity. Correct result for all ping operations is Success rate is 100 percent (5/5).

```

RP/0/RP0/CPU0:PE1#ping vrf ABC 11.11.11.11
Tue Feb 7 17:26:08.562 UTC
Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 11.11.11.11, timeout is 2 seconds:
!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 5/13/26 ms

RP/0/RP0/CPU0:PE1#
RP/0/RP0/CPU0:PE1#
RP/0/RP0/CPU0:PE1#
RP/0/RP0/CPU0:PE1#ping vrf ABC 10.11.8.2
Tue Feb 7 17:26:25.775 UTC
Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.11.8.2, timeout is 2 seconds:
!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 4/5/10 ms

```

Enter the same commands on PE8 to verify MPLS to SRv6 connectivity. Correct result for all ping operations is Success rate is 100 percent (5/5).

```
RP/0/RP0/CPU0:PE8#ping vrf ABC 10.10.10.10
Tue Feb 7 17:28:15.569 UTC
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.10.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/5/8 ms
RP/0/RP0/CPU0:PE8#
RP/0/RP0/CPU0:PE8#ping vrf ABC 10.10.1.2
Tue Feb 7 17:28:21.126 UTC
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.10.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/6 ms
RP/0/RP0/CPU0:PE8#
```

Step 5: Verify Interworking Gateway Function

Now we verify that the gateway does not attach any SID to the prefix when sending the prefix from the SRv6 domain (10.10.1.0/30) to the MPLS domain (10.11.8.0/30).

The path is: 10.10.1.0/30: PE1 (SRv6) --> PE5-SRGW (Gateway) --> PE8 (MPLS).

Enter the following commands on PE1 to verify the interworking gateway. Bolded text in the command output indicates the expected results.

```
RP/0/RP0/CPU0:PE1#show route vrf ABC 10.10.1.0/30 detail
Tue Feb 7 17:29:17.433 UTC
Routing entry for 10.10.1.0/30
Known via "connected", distance 0, metric 0 (connected)
Installed Feb 7 10:46:27.868 for 06:42:49
```

```

Routing Descriptor Blocks
  directly connected, via GigabitEthernet0/0/0/0
    <snip>

RP/0/RP0/CPU0:PE1#show cef vrf ABC 10.10.1.0/30 detail
Tue Feb  7 17:30:55.676 UTC
10.10.1.0/30, version 2, attached, connected, glean adjacency, internal
0x3000061 0x0 (ptr 0x8710e498) [1], 0x400 (0x87e438d0), 0x0 (0x0)
  Updated Feb  7 10:46:27.877
  Prefix Len 30, traffic index 0, precedence n/a, priority 0
  gateway array (0x87cab838) reference count 1, flags 0x0, source rib (7),
  0 backups
    [2 type 3 flags 0x8401 (0x87d5c948) ext 0x0 (0x0)]
  LW-LDI[type=3, refc=1, ptr=0x87e438d0, sh-ldi=0x87d5c948]
  gateway array update type-time 1 Feb  7 10:46:27.877
  LDI Update time Feb  7 10:46:27.918
  LW-LDI-TS Feb  7 10:46:27.918
    via GigabitEthernet0/0/0/0, 2 dependencies, weight 0, class 0 [flags
  0x8]
    path-idx 0 NHID 0x0 [0x87b44b58 0x0]
      glean adjacency

  Load distribution: 0 (refcount 2)

    Hash   OK   Interface          Address
    0       Y   GigabitEthernet0/0/0/0   glean
RP/0/RP0/CPU0:PE1#

P/0/RP0/CPU0:PE1#show bgp vrf ABC 10.10.1.0/30 detail
Wed Feb  1 00:53:12.494 UTC
BGP routing table entry for 10.10.1.0/30, Route Distinguisher: 100:10
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          70          70
SRv6-VPN SID: 2001:db8:a:0:43::/128
  Flags: 0x00340001+0x01020000;
Last Modified: Feb  1 00:38:49.450 for 00:14:23
Paths: (2 available, best #1)
  Advertised to PE peers (in unique update groups):
    6.6.6.6        2001:db8:2:2:2::2
  Advertised to CE peers (in unique update groups):
    10.10.1.2
Path #1: Received by speaker 0

<snip>
```

Enter the following commands on PE5-SRGW to verify the interworking gateway. Bolded text in the command output indicates the expected results.

```

RP/0/RP0/CPU0:PE5-SRGW#show route vrf ABC 10.10.1.0/30 detail
Tue Feb  7 17:33:50.496 UTC

Routing entry for 10.10.1.0/30
  Known via "bgp 100", distance 200, metric 0, type internal
  Installed Feb  7 17:16:40.540 for 00:17:10
  Routing Descriptor Blocks
    2001:db8:1:1:1::1, from 2001:db8:2:2:2::2
      Nexthop in Vrf: "default", Table: "default", IPv6
      Unicast, Table Id: 0xe0800000
      Route metric is 0
```

```

Label: None
Tunnel ID: None
Binding Label: None
Extended communities count: 0
Source RD attributes: 0x0000:100:10
NHID:0x0 (Ref:0)
SRv6 Headend: H.Encaps.Red [base], SID-list {2001:db8:a:0:43::}
Route version is 0x5 (5)
<snip>

```

```

RP/0/RP0/CPU0:PE5-SRGW#show cef vrf ABC 10.10.1.0/30 detail
Tue Feb 7 17:35:26.525 UTC
10.10.1.0/30, version 13, SRV6 Headend, internal 0x1000001 0x30 (ptr
0x870eee78) [1], 0x0 (0x0), 0x0 (0x89ae71c8)
Updated Feb 7 17:16:40.542
Prefix Len 30, traffic index 0, precedence n/a, priority 3
gateway array (0x89bb50a8) reference count 3, flags 0x2010, source rib
(7), 0 backups
[1 type 3 flags 0x48441 (0x87e0d3c8) ext 0x0 (0x0)]
LW-LDI[type=0, refc=0, ptr=0x0, shldi=0x0]
gateway array update type-time 1 Feb 7 17:16:40.541
LDI Update time Feb 7 17:16:40.556

Level 1 - Load distribution: 0
[0] via 2001:db8:a::/128, recursive

via 2001:db8:a::/128, 3 dependencies, recursive [flags 0x6000]
path-idx 0 NHID 0x0 [0x87133dd8 0x0]
next hop VRF - 'default', table - 0xe0800000
next hop 2001:db8:a::/128 via 2001:db8:a::/64
SRv6 H.Encaps.Red SID-list {2001:db8:a:0:43::}

Load distribution: 0 1 0 1 (refcount 1)

Hash OK Interface Address
0 Y GigabitEthernet0/0/0/0 fe80::42:c0ff:fea8:f003
1 Y GigabitEthernet0/0/0/1 fe80::42:c0ff:fea8:e002
2 Y GigabitEthernet0/0/0/0 fe80::42:c0ff:fea8:f003
3 Y GigabitEthernet0/0/0/1 fe80::42:c0ff:fea8:e002

```

RP/0/RP0/CPU0:PE5-SRGW#

```

RP/0/RP0/CPU0:PE5-SRGW#show bgp vrf ABC 10.10.1.0/30 detail
Tue Feb 7 17:37:14.173 UTC
BGP routing table entry for 10.10.1.0/30, Route Distinguisher: 100:40
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          39         39
Local Label: 24010 (with rewrite);
SRv6-VPN SID: 2001:db8:d:0:42::/128
Flags: 0x001a3001+0x01000000;
<snip>

```

Enter the following commands on PE8 to verify the interworking gateway. Bolded text in the command output indicates the expected results.

Note : We do not see any SID on PE8 for the prefix received from PE1: SRv6-VPN SID: 2001:db8:a:0:43::/128 because PE8 is in MPLS sub-domain.

```

RP/0/RP0/CPU0:PE8#
RP/0/RP0/CPU0:PE8#show route vrf ABC 10.10.1.0/30 detail
Tue Feb 7 17:40:06.620 UTC

Routing entry for 10.10.1.0/30
Known via "bgp 100", distance 200, metric 0, type internal
Installed Feb 7 17:16:40.561 for 00:23:26
Routing Descriptor Blocks
  5.5.5.5, from 6.6.6.6
    Nexthop in Vrf: "default", Table: "default", IPv4 Unicast,
    <snip>

RP/0/RP0/CPU0:PE8#show cef vrf ABC 10.10.1.0/30 detail
Tue Feb 7 17:41:56.715 UTC
10.10.1.0/30, version 14, internal 0x5000001 0x30 (ptr 0x86fa7ca8) [1], 0x0
(0x0), 0x208 (0x8914d508)
  Updated Feb 7 17:16:40.565
  Prefix Len 30, traffic index 0, precedence n/a, priority 3
  gateway array (0x874c2280) reference count 3, flags 0x2038, source rib
(7), 0 backups
    [1 type 1 flags 0x48441 (0x89190588) ext 0x0 (0x0)]
    LW-LDI[type=0, refc=0, ptr=0x0, shldi=0x0]
    gateway array update type-time 1 Feb 7 17:16:40.565
  LDI Update time Feb 7 17:16:40.565
    via 5.5.5.5/32, 3 dependencies, recursive [flags 0x6000]
    path-idx 0 NHID 0x0 [0x8702de38 0x0]
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 5.5.5.5/32 via 24003/0/21
      next hop 10.8.6.1/32 Gi0/0/0/1    labels imposed {24001 24010}
      next hop 10.8.7.1/32 Gi0/0/0/2    labels imposed {24002 24010}

  Load distribution: 0 (refcount 1)

  Hash OK Interface                      Address
  0     Y   recursive                     24003/0
RP/0/RP0/CPU0:PE8#


RP/0/RP0/CPU0:PE8# RP/0/RP0/CPU0:PE8#show bgp vrf ABC 10.10.1.0/30 detail
Tue Feb 7 17:47:52.567 UTC
BGP routing table entry for 10.10.1.0/30, Route Distinguisher: 100:30
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          26          26
  Flags: 0x00041001+0x00000000;
Last Modified: Feb 7 17:16:40.759 for 00:31:11
Paths: (2 available, best #2)
  Advertised to CE peers (in unique update groups):
    10.11.8.2
  Path #1: Received by speaker 0
  Flags: 0x2000000000020005+0x00, import: 0x0a0
  Not advertised to any peer
  Local
    1.1.1.1 (metric 50) from 6.6.6.6 (1.1.1.1), if-handle
    0x0000000000

```

```

Received Label 0x430
Origin incomplete, metric 0, localpref 100, valid, internal, imported
Received Path ID 0, Local Path ID 0, version 0
Extended community: RT:100:10
Originator: 1.1.1.1, Cluster list: 6.6.6.6
PSID-Type:L3, SubTLV Count:1, R:0x00,
SubTLV:
T:1(Sid information), Sid:2001:db8:a::, F:0x00, R2:0x00,
Behavior:19, R3:0x00, SS-TLV Count:1
SubSubTLV:
T:1(Sid structure):
Length [Loc-blk,Loc-node,Func,Arg]:[40,24,16,0], Tpose-len:16,
Tpose-offset:64
Source AFI: VPNv4 Unicast, Source VRF: default, Source Route
Distinguisher: 100:10
Path #2: Received by speaker 0
Flags: 0x2000000005060005+0x00, import: 0x080
Advertised to CE peers (in unique update groups):
  10.11.8.2
Local
5.5.5.5 (metric 30) from 6.6.6.6 (1.1.1.1), if-handle 0x00000000
Received Label 24010
Origin incomplete, metric 0, localpref 200, valid, internal, best,
group-best, import-candidate, imported
Received Path ID 0, Local Path ID 1, version 26
Extended community: RT:100:10
Originator: 1.1.1.1, Cluster list: 6.6.6.6, 5.5.5.5, 2.2.2.2
Source AFI: VPNv4 Unicast, Source VRF: default, Source Route
Distinguisher: 100:40
RP/0/RP0/CPU0:PE8#

```

Enter the following commands on PE8 to verify that the prefix that originated in the MPLS domain is advertised to the SRv6 domain with a SID assigned by the gateway node.

The control plane flow path is: 10.11.8.0/30: PE8 (MPLS) --> PE5-SRGW (Gateway) --> PE1 (SRv6). Bolded text in the command output signifies expected results.

```

RP/0/RP0/CPU0:PE8# RP/0/RP0/CPU0:PE8#show route vrf ABC 10.11.8.0/30 detail
Tue Feb 7 17:51:25.910 UTC

Routing entry for 10.11.8.0/30
Known via "connected", distance 0, metric 0 (connected)
Installed Feb 7 10:46:17.560 for 07:05:08
Routing Descriptor Blocks
  directly connected, via GigabitEthernet0/0/0/0
    Route metric is 0
    <snip>

```

```

RP/0/RP0/CPU0:PE8#show bgp vrf ABC 10.11.8.0/30
Tue Feb 7 17:52:59.370 UTC
BGP routing table entry for 10.11.8.0/30, Route Distinguisher: 100:30
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          8           8
  Local Label: 24012
Last Modified: Feb 7 10:47:35.759 for 07:05:23
<snip>

```

```

RP/0/RP0/CPU0:PE8#show bgp vrf ABC 10.11.8.0/30 detail
Tue Feb 7 18:01:23.601 UTC

```

```

BGP routing table entry for 10.11.8.0/30, Route Distinguisher: 100:30
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          8          8
Local Label: 24012 (with rewrite);
  Flags: 0x01140001+0x00020000;
Last Modified: Feb 7 10:47:35.759 for 07:13:47
Paths: (2 available, best #1)
  Advertised to PE peers (in unique update groups):
    6.6.6.6
  Advertised to CE peers (in unique update groups):
    10.11.8.2
  Path #1: Received by speaker 0
  Flags: 0x200000004d04010b+0x00, import: 0x31f
  Advertised to PE peers (in unique update groups):
    6.6.6.6
  Advertised to CE peers (in unique update groups):
    10.11.8.2
  Local
    0.0.0.0 from 0.0.0.0 (8.8.8.8), if-handle 0x000000010
      Origin incomplete, metric 0, localpref 100, weight 32768, valid,
      redistributed, best, group-best, import-candidate
        Received Path ID 0, Local Path ID 1, version 8
        Extended community: RT:100:10
  Path #2: Received by speaker 0
  Flags: 0x3000000001000003+0x00, import: 0x020
  Not advertised to any peer
  65000
    10.11.8.2 from 10.11.8.2 (11.11.11.11), if-handle 0x00000000
      Origin incomplete, metric 0, localpref 100, valid, external, group-
      best
        Received Path ID 0, Local Path ID 0, version 0
        Extended community: RT:100:10
        Origin-AS validity: (disabled)
RP/0/RP0/CPU0:PE8#

```

Enter the following commands on PE5-SRGW to verify the interworking gateway.

The control plane flow path is: PE8 (MPLS) --> PE5-SRGW (Gateway) --> PE1 (SRv6).
 Bolded text in the command output signifies expected results.

```

RP/0/RP0/CPU0:PE5-SRGW#show route vrf ABC 10.11.8.0/30 detail
Mon Jan 23 13:29:47.754 UTC

Routing entry for 10.11.8.0/30
  Known via "bgp 100", distance 200, metric 0, type internal
  Installed Jan 23 11:25:05.879 for 02:04:41
Routing Descriptor Blocks
8.8.8.8, from 6.6.6.6
  Nexthop in Vrf: "default", Table: "default", IPv4 Unicast, Table Id:
  0xe0000000
  Route metric is 0
Label: 0xdcc (24012)
  Tunnel ID: None
  Binding Label: None
  <snip>

```

```

RP/0/RP0/CPU0:PE5-SRGW#show cef vrf ABC 10.11.8.0/30 detail
Tue Feb 7 18:06:08.940 UTC
  10.11.8.0/30, version 3, internal 0x1000001 0x30 (ptr
  0x870f8da0) [1], 0x0 (0x0), 0x208 (0x8914d2d8)

```

```

Updated Feb 7 17:16:15.947
Prefix Len 30, traffic index 0, precedence n/a, priority 3
  gateway array (0x87d5d7f0) reference count 2, flags 0x2038, source rib
(7), 0 backups
    [1 type 1 flags 0x48441 (0x89190528) ext 0x0 (0x0)]
LW-LDI[type=0, refc=0, ptr=0x0, shldi=0x0]
  gateway array update type-time 1 Feb 7 17:16:15.947
LDI Update time Feb 7 17:16:15.947
  via 8.8.8.8/32, 3 dependencies, recursive [flags 0x6000]
    path-idx 0 NHID 0x0 [0x8717f310 0x0]
    recursion-via-/32
    next hop VRF - 'default', table - 0xe0000000
    next hop 8.8.8.8/32 via 24000/0/21
      next hop 10.7.5.2/32 Gi0/0/0/2 labels imposed {24000 24012}
      next hop 10.6.5.2/32 Gi0/0/0/3 labels imposed {24000 24012}

Load distribution: 0 (refcount 1)

Hash OK Interface Address
0 Y recursive 24000/0
RP/0/RP0/CPU0:PE5-SRGW#

```

```

RP/0/RP0/CPU0:PE5-SRGW#show bgp vrf ABC 10.11.8.0/30 detail
Tue Feb 7 18:07:28.528 UTC
BGP routing table entry for 10.11.8.0/30, Route Distinguisher: 100:40
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          19           19
Local Label: 24010 (with rewrite);
SRv6-VPN SID: 2001:db8:d:0:42::/128
  Flags: 0x01001001+0x01000000;
Last Modified: Feb 7 17:16:12.299 for 00:51:16
Paths: (1 available, best #1)
  Advertised to PE peers (in unique update groups):
    2001:db8:2:2::2
  Path #1: Received by speaker 0
  Flags: 0x2000c0000d060205+0x00, import: 0x080
  Advertised to PE peers (in unique update groups):
    2001:db8:2:2::2
  Local, (Received from a RR-client)
  8.8.8.8 (metric 30) from 6.6.6.6 (8.8.8.8), if-handle 0x00000000
Received Label 24012
  Origin incomplete, metric 0, localpref 100, valid, internal, best,
group-best, import-candidate, imported, reoriginated with stitching-rt
  Received Path ID 0, Local Path ID 1, version 19
  Extended community: RT:100:10
Originator: 8.8.8.8, Cluster list: 6.6.6.6
  Source AFI: VPNv4 Unicast, Source VRF: default, Source Route
Distinguisher: 100:30
RP/0/RP0/CPU0:PE5-SRGW#

```

Enter the following commands on PE1 to verify the interworking gateway.

The control plane flow path is: PE8 (MPLS) --> PE5-SRGW (Gateway) --> PE1 (SRv6).
 Bolded text in the command output signifies expected results.

```

RP/0/RP0/CPU0:PE1#show route vrf ABC 10.11.8.0/30 detail
Tue Feb 7 18:09:15.818 UTC

```

Routing entry for 10.11.8.0/30



```

Known via "bgp 100", distance 200, metric 0, type internal
Installed Feb 7 17:16:12.984 for 00:53:02
Routing Descriptor Blocks
 2001:db8:5:5::5, from 2001:db8:2:2:2::2
    Nexthop in Vrf: "default", Table: "default", IPv6 Unicast, Table Id:
0xe0800000
      Route metric is 0
      Label: None
      Tunnel ID: None
      Binding Label: None
      Extended communities count: 0
      Source RD attributes: 0x0000:100:40
      NHID:0x0 (Ref:0)
SRv6 Headend: H.Encaps.Red [base], SID-list {2001:db8:d:0:42::}
Route version is 0x3 (3)
<snip>

```

```

RP/0/RP0/CPU0:PE1#
RP/0/RP0/CPU0:PE1#show cef vrf ABC 10.11.8.0/30 detail
Tue Feb 7 18:10:35.049 UTC
10.11.8.0/30, version 15, SRv6 Headend, internal 0x5000001 0x30 (ptr
0x8710ba68) [1], 0x0 (0x0), 0x0 (0x89b672a0)
Updated Feb 7 17:16:12.987
Prefix Len 30, traffic index 0, precedence n/a, priority 3
gateway array (0x89c2d190) reference count 2, flags 0x2010, source rib
(7), 0 backups
[1 type 3 flags 0x48441 (0x87d5d488) ext 0x0 (0x0)]
LW-LDI[type=0, refc=0, ptr=0x0, sh-ldi=0x0]
gateway array update type-time 1 Feb 7 17:16:12.988
LDI Update time Feb 7 17:16:12.988

Level 1 - Load distribution: 0
[0] via 2001:db8:d::/128, recursive

via 2001:db8:d::/128, 3 dependencies, recursive [flags 0x6000]
path-idx 0 NHID 0x0 [0x87145600 0x0]
next hop VRF - 'default', table - 0xe0800000
next hop 2001:db8:d::/128 via 2001:db8:d::/64
SRv6 H.Encaps.Red SID-list {2001:db8:d:0:42::}
<snip>

```

```

RP/0/RP0/CPU0:PE1#show bgp vrf ABC 10.11.8.0/30 detail
Tue Feb 7 18:12:16.154 UTC
BGP routing table entry for 10.11.8.0/30, Route Distinguisher: 100:10
Versions:
  Process          bRIB/RIB  SendTblVer
  Speaker          46           46
  Flags: 0x00043001+0x00020000;
Last Modified: Feb 7 17:16:13.409 for 00:56:02
Paths: (2 available, best #2)
  Advertised to CE peers (in unique update groups):
    10.10.1.2
  Path #1: Received by speaker 0
  Flags: 0x20000000000020005+0x00, import: 0x080
  Not advertised to any peer
  Local
    8.8.8.8 (metric 50) from 6.6.6.6 (8.8.8.8), if-handle 0x00000000
    Received Label 24012
    Origin incomplete, metric 0, localpref 100, valid, internal, imported
      Received Path ID 0, Local Path ID 0, version 0
      Extended community: RT:100:10
      Originator: 8.8.8.8, Cluster list: 6.6.6.6

```

```

Source AFI: VPNv4 Unicast, Source VRF: default, Source Route
Distinguisher: 100:30
Path #2: Received by speaker 0
Flags: 0x2000000005060005+0x00, import: 0x080
Advertised to CE peers (in unique update groups):
  10.10.1.2
  Local
    2001:db8:5:5::5 (metric 30) from 2001:db8:2:2::2 (8.8.8.8), if-
handle 0x00000000
      Received Label 0x420
      Origin incomplete, metric 0, localpref 200, valid, internal, best,
group-best, import-candidate, imported
      Received Path ID 0, Local Path ID 1, version 46
      Extended community: RT:100:10
      Originator: 8.8.8.8, Cluster list: 2.2.2.2, 5.5.5.5, 6.6.6.6
      PSID-Type:L3, SubTLV Count:1, R:0x00,
      SubTLV:
        T:1(Sid information), Sid:2001:db8:d::, F:0x00, R2:0x00,
Behavior:19, R3:0x00, SS-TLV Count:1
      SubSubTLV:
        T:1(Sid structure):
          Length [Loc-blk,Loc-node,Func,Arg]:[40,24,16,0], Tpose-len:16,
Tpose-offset:64
          Source AFI: VPNv4 Unicast, Source VRF: default, Source Route
Distinguisher: 100:40
RP/0/RP0/CPU0:PE1#

```

Task 6: Remove LDP from SRv6 Sub-domain and verify L3 VPN services

In the SRv6 subdomain, you have migrated the data plane from MPLS to SRv6. LDP can be removed from PE1, P2 and PE3. Execute below commands on PEs and P devices to remove LDP from the network.

Step 1: Remove LDP from PE1

On PE1 copy and paste the following configuration under configuration mode.

```

! PE1
!
router isis 100
  address-family ipv4 unicast
    no mpls ldp auto-config
  !
  !
commit
!
End

```

Step 2: Remove LDP from P2-SRv6-RR

On P2-SRv6RR copy and paste the following configuration under configuration mode.

```
! P2-SRv6RR
!
router isis 100
  address-family ipv4 unicast
    no mpls ldp auto-config
  !
!
commit
!
End
```

Step 3: Remove LDP from PE3

On PE3 copy and paste the following configuration under configuration mode.

```
! PE3
!
router isis 100
  address-family ipv4 unicast
    no mpls ldp auto-config
  !
!
commit
!
End
```

Step 4: Verify the L3VPN services

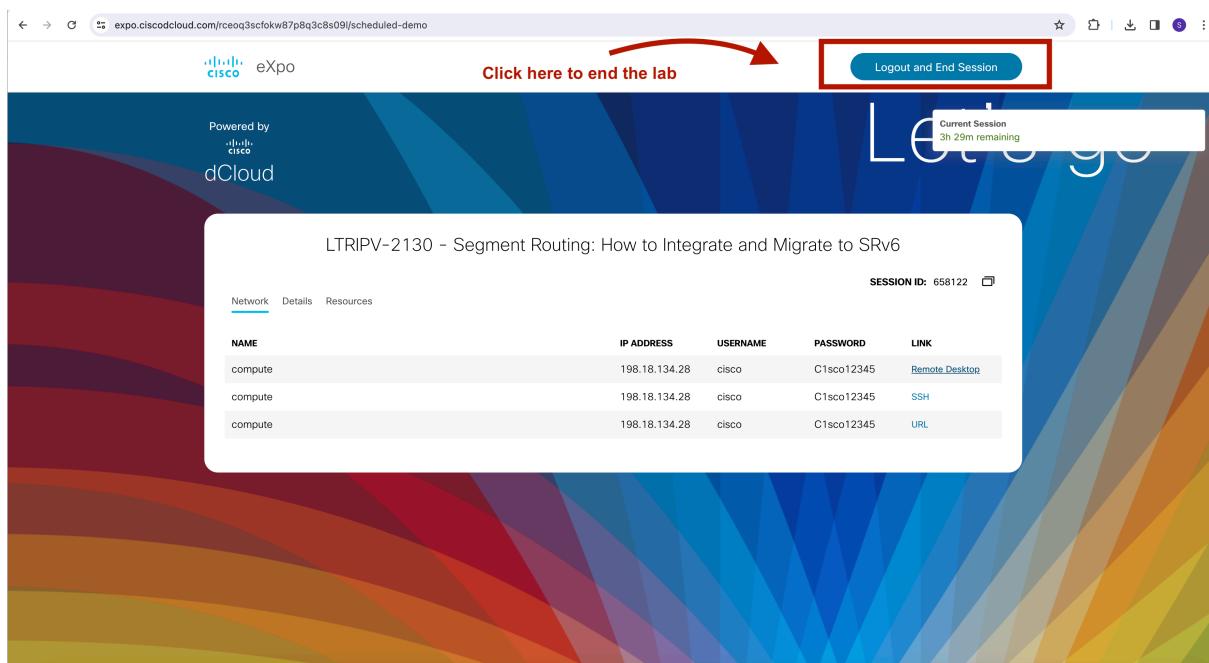
Reverify the ping operation for VRF “XYZ” and “ABC”.

Step 5: [Optional] Remove the IPv4 BGP peering from PE1 and PE3 to P6-MPLS-RR

Now that we have removed the LDP from the SRv6 domain, the only control and data plane that works SRv6. As a final clean up step, you can shut down the IPv4 BGP peering on PE1 and PE3 towards P6-MPLS-RR. This step is optional.

Final Step: Ending the lab

Once you have completed the lab, go back to the initial page and click on the “Logout and end the session” button.



Related Sessions at Cisco Live

Apart from this lab, we recommend you to attend the following additional sessions related to the SRv6 at Cisco Live.

- *Troubleshooting Segment Routing [BRKSPG-3624]* Luc De Ghein, Customer Delivery Engineering Tehcnical Leader, Cisco Systems
- *Introduction to SRv6 uSID Technology [BRKSPG-2203]* Jakub Horn, Principal Technical Marketing Engineer, Cisco Systems
- *SRv6 Basics [LABMPL-1201]* Luc De Ghein, Customer Delivery Engineering Technical Leader, Cisco Systems, Ricardo Lourenco, Customer Delivery Engineering Technical Leader, Cisco Systems

Summary

This lab has provided the steps involved for integrating and migrating to SRv6. This also has provided opportunity to configure and verify the ‘Interworking Gateway’ option to bridge the communication between SRv6 and MPLS sub-domains. This will help in situations where both MPLS and SRv6 domains co-exist in a network.

Thank you for participating! Please don't forget to complete your Cisco Live Session survey.

Appendix A below provides the final configuration snapshot from each of the routers in this lab topology.

Appendix - A

End state router configurations are given below for each router in this lab.

Note: These configurations are taken prior to executing the final step of removing LDP from SRv6 sub-domain routers. This is to give the user complete configurations prior to the last step in this lab for all routers.

Final Lab Router Configurations

CE1 Router:

```
RP/0/RP0/CPU0:ABC-CE1-R10#sh run
Tue Jan 31 03:34:24.119 UTC
Building configuration...
!! IOS XR Configuration 7.7.1.06I
!! No configuration change since last restart
!
hostname ABC-CE1-R10
logging console disable
username lab
group root-lr
group cisco-support
secret 10
$6$Y0vmA/kiAH9n2A/.$QUYxHxt8oK62AtJTyt16nTGPvgbZ3OunOQWP4FIY1X6aUxN.RzI0QRFoDxu./S
2at/H2y0VEZyNKB/J1N8B3x/
!
cdp
line console
exec-timeout 0 0
absolute-timeout 0
session-timeout 0
```

```
!
line default
exec-timeout 240 0
!
interface Loopback0
ipv4 address 10.10.10.10 255.255.255.255
!
interface MgmtEth0/RP0/CPU0/0
ipv4 address 172.30.0.110 255.255.255.0
!
interface GigabitEthernet0/0/0/0
cdp
ipv4 address 10.10.1.2 255.255.255.252
!
route-policy PASS
pass
end-policy
!
router bgp 65000
address-family ipv4 unicast
redistribute connected
!
neighbor 10.10.1.1
remote-as 100
address-family ipv4 unicast
route-policy PASS in
route-policy PASS out
!
```

```

!
ssh server username lab

keystring ssh-rsa
AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
OuVoC8IPgu5e7sWHPSc7WaKBwUXC5IBXEc1d+kHxgMe2GJCGXrIDFIhmuORL/njHeYR/33xKaj6Ncn9a
mbJlCEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAe+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHlilzoAE+Wl0mjHke6rl3IWjNoLCiJsvFUYqEMw6znltrecGQiMTVBcHtrY4774faCc2ybtg
RB2wmTnnfFCQnwqL03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWiszxb9t23/tAMXVF+gn
W+5QfMrql06RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute

!
ssh server vrf default

end

```

PE1 Router:

```

RP/0/RP0/CPU0:PE1#sh run

Tue Jan 31 03:36:35.859 UTC

Building configuration...

!! IOS XR Configuration 7.7.1.06I

!! Last configuration change at Tue Jan 31 03:24:50 2023 by lab

!

hostname PE1

logging console disable

username lab

group root-lr

group cisco-support

secret 10
$6$Y0vmA/kiAH9n2A/.\$QUYxHxt8oK62AtJTy16nTGPvgbZ3OunOQWP4FIY1X6aUxN.Rzl0QRFoDxu./S
2at/H2y0VEZyNKB/J1N8B3x/

!

```

cdp



```
vrf ABC  
address-family ipv4 unicast  
import route-target
```

```
100:10
```

```
!
```

```
export route-target
```

```
100:10
```

```
!
```

```
!
```

```
!
```

```
vrf XYZ
```

```
address-family ipv4 unicast  
import route-target
```

```
100:20
```

```
!
```

```
export route-target
```

```
100:20
```

```
!
```

```
!
```

```
!
```

```
line console
```

```
exec-timeout 0 0
```

```
absolute-timeout 0
```

```
session-timeout 0
```

```
!
```

```
line default
```

```
exec-timeout 240 0
```

```
!
```

```
interface Loopback0
```

```
ipv4 address 1.1.1.1 255.255.255.255
ipv6 address 2001:db8:1:1:1::1/128
!
interface Loopback50
vrf XYZ
ipv4 address 50.50.50.50 255.255.255.255
!
interface MgmtEth0/RP0/CPU0/0
ipv4 address 172.30.0.101 255.255.255.0
!
interface GigabitEthernet0/0/0/0
cdp
vrf ABC
ipv4 address 10.10.1.1 255.255.255.252
!
interface GigabitEthernet0/0/0/1
cdp
ipv4 address 10.2.1.1 255.255.255.252
ipv6 address 2001:db8:10:2:1::1/127
ipv6 enable
!
interface GigabitEthernet0/0/0/2
cdp
ipv4 address 10.3.1.1 255.255.255.252
ipv6 address 2001:db8:10:3:1::1/127
ipv6 enable
!
interface preconfigure GigabitEthernet0/0/0/3
cdp
```

```
ipv6 enable
!
interface preconfigure GigabitEthernet0/0/0/4
cdp
ipv6 enable
!
route-policy PASS
done
end-policy
!
route-policy LOCAL-PREF
set local-preference 200
end-policy
!
router isis 100
net 49.1000.0000.0001.00
address-family ipv4 unicast
metric-style wide
mpls ldp auto-config
!
address-family ipv6 unicast
segment-routing srv6
locator LOCO
!
!
!
interface Loopback0
address-family ipv4 unicast
```

```
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/1
address-family ipv4 unicast
!
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/2
address-family ipv4 unicast
!
address-family ipv6 unicast
!
!
!
router bgp 100
bgp router-id 1.1.1.1
segment-routing srv6
locator LOCO
!
address-family vpng4 unicast
!
neighbor 6.6.6.6
remote-as 100
update-source Loopback0
address-family vpng4 unicast
```

```
neighbor 2001:db8:2:2:2::2
remote-as 100
update-source Loopback0
address-family vpnv4 unicast
route-policy LOCAL-PREF in
!
!
vrf ABC
rd 100:10
address-family ipv4 unicast
segment-routing srv6
alloc mode per-vrf
!
redistribute connected
!
neighbor 10.10.1.2
remote-as 65000
address-family ipv4 unicast
route-policy PASS in
route-policy PASS out
as-override
!
!
!
vrf XYZ
rd 100:20
address-family ipv4 unicast
```

segment-routing srv6

alloc mode per-vrf

```
!
redistribute connected
!
!
!
!
mpls ldp
router-id 1.1.1.1
!
segment-routing
srv6
locators
locator LOCO
prefix 2001:db8:a::/64
!
!
!
!
!
ssh server username lab
keystring ssh-rsa
AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
0uVoC8IPgu5e7sWHPSc7WaKBwUXC5IBXEc1d+kHxgMe2GJCGXrlDFIhmuORL/njHeYR/33xKaj6Ncn9a
mbJlCEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAe+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHlilzoAE+WI0mjHke6rl3IWjNoLCiJsvFUYqEMw6znltrcGQiMTVBcHtrY4774faCc2yjbtg
RB2wmTnnfFCQnwql03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWisxb9t23/tAMXVF+gn
W+5QfMrql06RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute
!
ssh server vrf default
end
```

P2-SRv6-RR Router:

```
RP/0/RP0/CPU0:P2-SRv6-RR#sh run
Tue Jan 31 03:37:56.434 UTC
Building configuration...
!! IOS XR Configuration 7.7.1.06I
!! Last configuration change at Tue Jan 31 03:21:15 2023 by lab
!
hostname P2-SRv6-RR
logging console disable
username lab
group root-lr
group cisco-support
secret 10
$6$Y0vmA/kiAH9n2A/.QUYxHxt8oK62AtJTyt16nTGPvgbZ3OunOQWP4FIY1X6aUxN.RzI0QRFoDxu./S
2at/H2y0VEZyNKB/J1N8B3x/
!
cdp
line console
exec-timeout 0 0
absolute-timeout 0
session-timeout 0
!
line default
exec-timeout 240 0
!
interface Loopback0
```

ipv4 address 2.2.2.2 255.255.255.255

```
ipv6 address 2001:db8:2:2:2::2/128
!
interface MgmtEth0/RP0/CPU0/0
    ipv4 address 172.30.0.102 255.255.255.0
!
interface GigabitEthernet0/0/0/0
    cdp
    ipv4 address 10.2.1.2 255.255.255.252
    ipv6 address 2001:db8:10:2:1::1/127
    ipv6 enable
!
interface GigabitEthernet0/0/0/1
    cdp
    ipv6 enable
    shutdown
!
interface GigabitEthernet0/0/0/2
    cdp
    ipv4 address 10.5.2.1 255.255.255.252
    ipv6 address 2001:db8:10:5:2::/127
    ipv6 enable
!
interface preconfigure GigabitEthernet0/0/0/3
    cdp
    ipv6 enable
!
interface preconfigure GigabitEthernet0/0/0/4
    cdp
    ipv6 enable
```

```
!  
router isis 100  
  net 49.1000.0000.0002.00  
  address-family ipv4 unicast  
    metric-style wide  
    mpls ldp auto-config  
!  
  address-family ipv6 unicast  
    segment-routing srv6  
    locator LOCO  
!  
!  
!  
interface Loopback0  
  address-family ipv4 unicast  
!  
  address-family ipv6 unicast  
!  
!  
interface GigabitEthernet0/0/0/0  
  address-family ipv4 unicast  
!  
  address-family ipv6 unicast  
!  
!  
interface GigabitEthernet0/0/0/2  
  address-family ipv4 unicast
```

```
!
!
!
router bgp 100
  bgp router-id 2.2.2.2
  segment-routing srv6
    locator LOC0
  !
  address-family vpng4 unicast
    vrf all
      segment-routing srv6
        locator LOC0
    !
    !
    !
neighbor 2001:db8:1:1:1::1
  remote-as 100
  update-source Loopback0
  address-family vpng4 unicast
    route-reflector-client
  !
  !
neighbor 2001:db8:3:3:3::3
  remote-as 100
  update-source Loopback0
  address-family vpng4 unicast
    route-reflector-client
```

```
neighbor 2001:db8:5:5::5
remote-as 100
update-source Loopback0
address-family vpng4 unicast
route-reflector-client
!
!
!
mpls ldp
router-id 2.2.2.2
!
segment-routing
srv6
locators
locator LOC0
prefix 2001:db8:b::/64
!
!
!
!
ssh server username lab
keystring ssh-rsa
AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
OuVoC8IPgu5e7sWHPSc7WaKBwUXC5IBXEc1d+kHxgMe2GJCGXrIDFlhmuORL/njHeYR/33xKaj6Ncn9a
mbJlCEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAE+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHilzoAE+WI0mjHke6rl3IWjNoLCIjsvFUYqEMw6znltrcGQiMTVBcHtrY4774faCc2ybtg
RB2wmTnnfFCQnwql03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWiszxb9t23/tAMXVF+gn
W+5QfMrqlo6RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute
!
```



ssh server vrf default

```
end
```

```
RP/0/RP0/CPU0:P2-SRv6-RR#
```

PE3 Router:

```
RP/0/RP0/CPU0:PE3#sh run
```

```
Tue Jan 31 03:38:51.473 UTC
```

```
Building configuration...
```

```
!! IOS XR Configuration 7.7.1.061
```

```
!! Last configuration change at Tue Jan 31 03:21:51 2023 by lab
```

```
!
```

```
hostname PE3
```

```
logging console disable
```

```
username lab
```

```
group root-lr
```

```
group cisco-support
```

```
secret 10
```

```
$6$Y0vmA/kiAH9n2A/.QUYxHxt8oK62AtJTyt16nTGPvgbZ3OunOQWP4FIY1X6aUxN.Rzl0QRFoDxu./S  
2at/H2y0VEZyNKB/J1N8B3x/
```

```
!
```

```
cdp
```

```
vrf XYZ
```

```
address-family ipv4 unicast
```

```
import route-target
```

```
100:20
```

```
!
```

```
export route-target
```

```
100:20
```

```
!
!
!
line console
exec-timeout 0 0
absolute-timeout 0
session-timeout 0
!
line default
exec-timeout 240 0
!
interface Loopback0
ipv4 address 3.3.3.3 255.255.255.255
ipv6 address 2001:db8:3:3::3/128
!
interface MgmtEth0/RP0/CPU0/0
ipv4 address 172.30.0.103 255.255.255.0
!
interface GigabitEthernet0/0/0/0
cdp
ipv4 address 10.3.1.2 255.255.255.252
ipv6 address 2001:db8:10:3:1::1/127
ipv6 enable
!
interface GigabitEthernet0/0/0/1
cdp
ipv4 address 10.5.3.1 255.255.255.252
ipv6 address 2001:db8:10:5:3::/127
ipv6 enable
```

```
!
interface GigabitEthernet0/0/0/2
cdp
vrf XYZ
ipv4 address 10.4.3.1 255.255.255.252
!
route-policy PASS
done
end-policy
!
route-policy LOCAL-PREF
set local-preference 200
end-policy
!
router isis 100
net 49.1000.0000.0003.00
address-family ipv4 unicast
metric-style wide
mpls ldp auto-config
!
address-family ipv6 unicast
segment-routing srv6
locator LOC0
!
!
```

address-family ipv4 unicast



```
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/0
address-family ipv4 unicast
!
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/1
address-family ipv4 unicast
!
address-family ipv6 unicast
!
!
!
router bgp 100
bgp router-id 3.3.3.3
segment-routing srv6
locator LOCO
!
address-family vpng4 unicast
!
neighbor 6.6.6.6
remote-as 100
update-source Loopback0
address-family vpng4 unicast
```

```
neighbor 2001:db8:2:2:2::2
remote-as 100
update-source Loopback0
address-family vpnv4 unicast
route-policy LOCAL-PREF in
!
!
vrf XYZ
rd 100:20
address-family ipv4 unicast
segment-routing srv6
alloc mode per-vrf
!
redistribute connected
!
neighbor 10.4.3.2
remote-as 65000
address-family ipv4 unicast
route-policy PASS in
route-policy PASS out
as-override
!
!
!
!
mpls ldp
router-id 3.3.3.3
```

```
srv6
locators
  locator LOC0
    prefix 2001:db8:c::/64
!
!
!
!
ssh server username lab
keystring ssh-rsa
AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
0uVoC8IPgu5e7sWHPSc7WaKBwUXC5lBXEc1d+kHxgMe2GJCGXrlDFIhmuORL/njHeYR/33xKaj6Ncn9a
mbJlCEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAe+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHlilzoAE+Wl0mjHke6rl3IWjNoLCiJsvFUYqEMw6znltrecGQiMTVBcHtrY4774faCc2ybtg
RB2wmTnnfFCQnwql03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWisxb9t23/tAMXVF+gn
W+5QfMrqlo6RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLcT1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute
!
ssh server vrf default
end
```

RP/0/RP0/CPU0:PE3#

CE4 Router:

RP/0/RP0/CPU0:CE4#sh run

Tue Jan 31 03:39:53.739 UTC



Building configuration...

```
!! IOS XR Configuration 7.7.1.06I
!! No configuration change since last restart
!
hostname CE4
username lab
group root-lr
group cisco-support
secret 10
$6$Y0vmA/kiAH9n2A/.QUYxHxt8oK62AtJTyt16nTGPvgbZ3OunOQWP4FIY1X6aUxN.RzI0QRFoDxu./S
2at/H2y0VEZyNKB/J1N8B3x/
!
cdp
line default
exec-timeout 240 0
!
interface Loopback0
ipv4 address 4.4.4.4 255.255.255.255
!
interface MgmtEth0/RP0/CPU0/0
ipv4 address 172.30.0.104 255.255.255.0
!
interface GigabitEthernet0/0/0/0
cdp
ipv6 enable
shutdown
!
interface GigabitEthernet0/0/0/1
cdp
ipv4 address 10.4.3.2 255.255.255.252
```

```
ipv6 enable
!
interface GigabitEthernet0/0/0/2
cdp
ipv6 enable
shutdown
!
interface GigabitEthernet0/0/0/3
cdp
ipv6 enable
shutdown
!
interface GigabitEthernet0/0/0/4
cdp
ipv6 enable
shutdown
!
route-policy PASS
done
end-policy
!
router bgp 65000
bgp router-id 4.4.4.4
address-family ipv4 unicast
redistribute connected
!
neighbor 10.4.3.1
```

remote-as 100

address-family ipv4 unicast



```

route-policy PASS in
route-policy PASS out
!
!
!
ssh server username lab
keystring ssh-rsa
AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
0uVoC8IPgu5e7sWHPSc7WaKBwUXC5IBXEc1d+kHxgMe2GJCGXrlDFIhmuORL/njHeYR/33xKaj6Ncn9a
mbJICEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAe+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHlilzoAE+Wl0mjHke6rl3IWjNoLCiJsvFUYqEMw6znltrcGQiMTVBcHtrY4774faCc2yjbtg
RB2wmTnnfFCQnwql03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWisxb9t23/tAMXVF+gn
W+5QfMrql06RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute
!
ssh server vrf default
end

```

RP/0/RP0/CPU0:CE4#

PE5-SRGW Router:

```

RP/0/RP0/CPU0:PE5-SRGW#sh run
Tue Jan 31 03:40:57.179 UTC
Building configuration...
!! IOS XR Configuration 7.7.1.061
!! Last configuration change at Tue Jan 31 03:33:26 2023 by lab
!
```

hostname PE5-SRGW



logging console disable

```
username lab
group root-lr
group cisco-support
secret 10
$6$Y0vmA/kiAH9n2A/.QUYxHxt8oK62AtTyt16nTGPvgbZ3OunOQWP4FIY1X6aUxN.RzI0QRFoDxu./S
2at/H2y0VEZyNKB/J1N8B3x/
!
cdp
vrf ABC
address-family ipv4 unicast
import route-target
100:10
100:10 stitching
!
export route-target
100:10
100:10 stitching
!
!
!
line console
exec-timeout 0 0
absolute-timeout 0
session-timeout 0
!
line default
exec-timeout 240 0
!
```

interface Loopback0

```
ipv4 address 5.5.5.5 255.255.255.255
ipv6 address 2001:db8:5:5::5/128
!
interface MgmtEth0/RP0/CPU0/0
    ipv4 address 172.30.0.105 255.255.255.0
    !
    interface GigabitEthernet0/0/0/0
        cdp
        ipv4 address 10.5.3.2 255.255.255.252
        ipv6 address 2001:db8:10:5:3::1/127
        ipv6 enable
    !
    interface GigabitEthernet0/0/0/1
        cdp
        ipv4 address 10.5.2.2 255.255.255.252
        ipv6 address 2001:db8:10:5:2::1/127
        ipv6 enable
    !
    interface GigabitEthernet0/0/0/2
        cdp
        ipv4 address 10.7.5.1 255.255.255.252
        ipv6 enable
    !
    interface GigabitEthernet0/0/0/3
        cdp
        ipv4 address 10.6.5.1 255.255.255.252
        ipv6 enable
```

```
set local-preference 200
end-policy
!
router isis 100
net 49.1000.0000.0005.00
address-family ipv4 unicast
metric-style wide
mpls ldp auto-config
!
address-family ipv6 unicast
segment-routing srv6
locator LOCO
!
!
!
interface Loopback0
address-family ipv4 unicast
!
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/0
address-family ipv4 unicast
!
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/1
address-family ipv4 unicast
```

```
!
address-family ipv6 unicast
!
!
interface GigabitEthernet0/0/0/2
address-family ipv4 unicast
!
!
interface GigabitEthernet0/0/0/3
address-family ipv4 unicast
!
!
!
router bgp 100
bgp router-id 5.5.5.5
segment-routing srv6
locator LOCO
!
address-family vpnv4 unicast
vrf all
segment-routing srv6
locator LOCO
!
!
!
neighbor 6.6.6.6
remote-as 100
update-source Loopback0
address-family vpnv4 unicast
```

```
import reoriginate stitching-rt  
route-reflector-client  
advertise vpng4 unicast re-originated  
next-hop-self  
!  
!  
neighbor 2001:db8:2:2:2::2  
remote-as 100  
update-source Loopback0  
address-family vpng4 unicast  
import stitching-rt reoriginate  
route-policy LOCAL-PREF in  
route-reflector-client  
encapsulation-type srv6  
advertise vpng4 unicast re-originated stitching-rt  
next-hop-self  
!  
!  
vrf ABC  
rd 100:40  
address-family ipv4 unicast  
mpls alloc enable  
segment-routing srv6  
!  
!  
!  
!  
!
```

mpls ldp

router-id 5.5.5.5

```

!
segment-routing
  srv6
    locators
      locator LOCO
      prefix 2001:db8:d::/64
    !
  !
  !
  !
  !
  ssh server username lab
    keystring ssh-rsa
    AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
    0uVoC8IPgu5e7sWHPSc7WaKBwUXC5IBXEc1d+kHxgMe2GJCGXrlDFIhmuORL/njHeYR/33xKaj6Ncn9a
    mbJlCEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAe+hLJF7khDsugaCm0ePWzNch
    XTwmSXYT9wFKHlilzoAE+WI0mjHke6rl3IWjNoLCiJsvFUYqEMw6znltrcGQiMTVBcHtrY4774faCc2yjbtg
    RB2wmTnnfFCQnwqL03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWisxb9t23/tAMXVF+gn
    W+5QfMrql06RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
    MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
    cisco@compute
  !
  ssh server vrf default
  end

```

RP/0/RP0/CPU0:PE5-SRGW#

P6-MPLS-RR Router:

Tue Jan 31 03:42:05.769 UTC

Building configuration...

!! IOS XR Configuration 7.7.1.06!

!! No configuration change since last restart

!

hostname P6-MPLS-RR

logging console disable

username lab

group root-lr

group cisco-support

secret 10

\$6\$Y0vmA/kiAH9n2A/.QUYxHxt8oK62AtJTyt16nTGPvgbZ3OunOQWP4FIY1X6aUxN.RzI0QRFoDxu./S
2at/H2y0VEZyNKB/J1N8B3x/

!

cdp

line console

exec-timeout 0 0

absolute-timeout 0

session-timeout 0

!

line default

exec-timeout 240 0

!

interface Loopback0

ipv4 address 6.6.6.6 255.255.255.255

!

interface MgmtEth0/RP0/CPU0/0

ipv4 address 172.30.0.106 255.255.255.0

```
interface GigabitEthernet0/0/0/0
```

```
  cdp
```

```
  ipv6 enable
```

```
!
```

```
interface GigabitEthernet0/0/0/1
```

```
  cdp
```

```
  ipv4 address 10.6.5.2 255.255.255.252
```

```
  ipv6 enable
```

```
!
```

```
interface GigabitEthernet0/0/0/2
```

```
  cdp
```

```
  ipv4 address 10.8.6.1 255.255.255.252
```

```
  ipv6 enable
```

```
!
```

```
interface GigabitEthernet0/0/0/3
```

```
  shutdown
```

```
!
```

```
route-policy LOCAL-PREF
```

```
  set local-preference 200
```

```
end-policy
```

```
!
```

```
router isis 100
```

```
  net 49.1000.0000.0006.00
```

```
  address-family ipv4 unicast
```

```
    metric-style wide
```

```
    mpls ldp auto-config
```

```
!
```

```
  interface Loopback0
```

```
  address-family ipv4 unicast
```

```
!
!
interface GigabitEthernet0/0/0/1
```

```
address-family ipv4 unicast
```

```
!
```

```
!
```

```
interface GigabitEthernet0/0/0/2
```

```
address-family ipv4 unicast
```

```
!
```

```
!
```

```
!
```

```
router bgp 100
```

```
bgp router-id 6.6.6.6
```

```
address-family vpngv4 unicast
```

```
!
```

```
neighbor 1.1.1.1
```

```
remote-as 100
```

```
update-source Loopback0
```

```
address-family vpngv4 unicast
```

```
route-reflector-client
```

```
!
```

```
!
```

```
neighbor 3.3.3.3
```

```
remote-as 100
```

```
update-source Loopback0
```

```
address-family vpngv4 unicast
```

```
route-reflector-client
```

```
!
```

```
!
```

```
neighbor 5.5.5.5
remote-as 100
update-source Loopback0
address-family vpng4 unicast
route-policy LOCAL-PREF in
route-reflector-client
!
!
neighbor 8.8.8.8
remote-as 100
update-source Loopback0
address-family vpng4 unicast
route-reflector-client
!
!
!
mpls ldp
router-id 6.6.6.6
!
ssh server username lab
keystring ssh-rsa
AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
OuVoC8IPgu5e7sWHPSc7WaKBwUXC5IBxEc1d+kHxgMe2GJCGXrIDFIhmuORL/njHeYR/33xKaj6Ncn9a
mbJlCEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAE+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHlilzoAE+WI0mjHke6rl3IWjNoLCiJsvFUYqEMw6znltrcGQiMTVBcHtrY4774faCc2yjbtg
RB2wmTnnfFCQnwqL03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWiszxb9t23/tAMXVF+gn
W+5QfMrql06RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute
!
ssh server vrf default
```

RP/0/RP0/CPU0:P6-MPLS-RR#

P7 Router:

```
RP/0/RP0/CPU0:P7#sh run

Tue Jan 31 03:42:42.768 UTC

Building configuration...

!! IOS XR Configuration 7.7.1.06l

!! No configuration change since last restart

!

hostname P7

logging console disable

username lab

group root-lr

group cisco-support

secret 10
$6$Y0vmA/kiAH9n2A/.QUYxHxt8oK62AtTyt16nTGPvgbZ3OunOQWP4FIY1X6aUxN.RzI0QRFoDxu./S
2at/H2y0VEZyNKB/J1N8B3x/

!

cdp

line console

exec-timeout 0 0

absolute-timeout 0

session-timeout 0

!
```

```
exec-timeout 240 0
!
interface Loopback0
    ipv4 address 7.7.7.7 255.255.255.255
!
interface MgmtEth0/RP0/CPU0/0
    ipv4 address 172.30.0.107 255.255.255.0
!
interface GigabitEthernet0/0/0/0
    cdp
    ipv4 address 10.7.5.2 255.255.255.252
    ipv6 enable
!
interface GigabitEthernet0/0/0/1
    cdp
    ipv6 enable
!
interface GigabitEthernet0/0/0/2
    cdp
    ipv4 address 10.8.7.1 255.255.255.252
    ipv6 enable
!
router isis 100
    net 49.1000.0000.0007.00
    address-family ipv4 unicast
        metric-style wide
    mpls ldp auto-config
!
```

```

address-family ipv4 unicast
!
!
interface GigabitEthernet0/0/0/0
address-family ipv4 unicast
!
!
interface GigabitEthernet0/0/0/2
address-family ipv4 unicast
!
!
!
mpls ldp
router-id 7.7.7.7
!
ssh server username lab
keystring ssh-rsa
AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
OuVoC8IPgu5e7sWHPSc7WaKBwUXC5IBXEc1d+kHxgMe2GJCGXrlDFIhmuORL/njHeYR/33xKaj6Ncn9a
mbJlCEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAe+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHilzoAE+WI0mjHke6rl3IWjNoLCiJsvFUYqEMw6znltrcGQiMTVBcHtrY4774faCc2yjbtg
RB2wmTnnfFCQnwqL03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWiszxb9t23/tAMXVF+gn
W+5QfMrql06RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute
!
ssh server vrf default
end

```

RP/0/RP0/CPU0:P7#

PE8 Router

```
RP/0/RP0/CPU0:PE8#sh run
Tue Jan 31 03:43:37.408 UTC
Building configuration...
!! IOS XR Configuration 7.7.1.061
!! No configuration change since last restart
!
hostname PE8
logging console disable
username lab
group root-lr
group cisco-support
secret 10
$6$Y0vmA/kiAH9n2A/.QUYxHxt8oK62AtJTyt16nTGPvgbZ3OunOQWP4FIY1X6aUxN.RzI0QRFoDxu./S
2at/H2y0VEZyNKB/J1N8B3x/
!
cdp
vrf ABC
address-family ipv4 unicast
import route-target
100:10
!
export route-target
100:10
!
!
!
line console
exec-timeout 0 0
```

```
absolute-timeout 0
session-timeout 0
!
line default
exec-timeout 240 0
!
interface Loopback0
ipv4 address 8.8.8.8 255.255.255.255
!
interface MgmtEth0/RP0/CPU0/0
ipv4 address 172.30.0.108 255.255.255.0
!
interface GigabitEthernet0/0/0/0
cdp
vrf ABC
ipv4 address 10.11.8.1 255.255.255.252
!
interface GigabitEthernet0/0/0/1
cdp
ipv4 address 10.8.6.2 255.255.255.252
ipv6 enable
!
interface GigabitEthernet0/0/0/2
cdp
ipv4 address 10.8.7.2 255.255.255.252
ipv6 enable
!
route-policy PASS
done
```

```
end-policy
!
router isis 100
  net 49.1000.0000.0008.00
  address-family ipv4 unicast
    metric-style wide
    mpls ldp auto-config
  !
  interface Loopback0
    address-family ipv4 unicast
  !
  !
  interface GigabitEthernet0/0/0/1
    address-family ipv4 unicast
  !
  !
  interface GigabitEthernet0/0/0/2
    address-family ipv4 unicast
  !
  !
  !
  router bgp 100
    bgp router-id 8.8.8.8
    address-family vpnv4 unicast
  !
    neighbor 6.6.6.6
    remote-as 100
      update-source Loopback0
      address-family vpnv4 unicast
```

```
!
!
vrf ABC
rd 100:30
address-family ipv4 unicast
redistribute connected
!
neighbor 10.11.8.2
remote-as 65000
address-family ipv4 unicast
route-policy PASS in
route-policy PASS out
as-override
!
!
!
!
!
mpls ldp
router-id 8.8.8.8
!
ssh server username lab
keystring ssh-rsa
AAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
0uVoC8IPgu5e7sWHPSc7WaKBwUXC5IBXEc1d+kHxgMe2GJCGXrIDFlhmuORL/njHeYR/33xKaj6Ncn9a
mbJlCEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAe+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHilzoAE+WI0mjHke6rl3IWjNoLCIjsvFUYqEMw6znltrcGQiMTVBcHtrY4774faCc2ybtg
RB2wmTnnfFCQnwql03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWiszxb9t23/tAMXVF+gn
W+5QfMrql06RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute
!
```



ssh server vrf default

```
end
```

```
RP/0/RP0/CPU0:PE8#
```

CE2 Router:

```
RP/0/RP0/CPU0:CE2#sh run
```

```
Tue Jan 31 03:44:51.526 UTC
```

```
Building configuration...
```

```
!! IOS XR Configuration 7.7.1.06!
```

```
!! No configuration change since last restart
```

```
!
```

```
hostname CE2
```

```
logging console disable
```

```
username lab
```

```
group root-lr
```

```
group cisco-support
```

```
secret 10
```

```
$6$Y0vmA/kiAH9n2A/.QUYxHxt8oK62AtJTy16nTGPvgbZ3OunOQWP4FIY1X6aUxN.RzI0QRFoDxu./S  
2at/H2y0VEZyNKB/J1N8B3x/
```

```
!
```

```
cdp
```

```
line console
```

```
exec-timeout 0 0
```

```
absolute-timeout 0
```

```
session-timeout 0
```

```
!
```

```
line default
```



```
exec-timeout 240 0
!
interface Loopback0
    ipv4 address 11.11.11.11 255.255.255.255
!
interface MgmtEth0/RP0/CPU0/0
    ipv4 address 172.30.0.111 255.255.255.0
!
interface GigabitEthernet0/0/0/0
    cdp
    ipv4 address 10.11.8.2 255.255.255.252
!
route-policy PASS
    pass
end-policy
!
router bgp 65000
    bgp router-id 11.11.11.11
    address-family ipv4 unicast
        redistribute connected
    !
    neighbor 10.11.8.1
        remote-as 100
        address-family ipv4 unicast
            route-policy PASS in
            route-policy PASS out
    !
!
```

```
ssh server username lab

keystring ssh-rsa
AAAAAB3NzaC1yc2EAAAQABAAQDaEhsH2AFcikrBXefcUY/jM8VaUiruYbSO5KsNpZQtx5ucK6z1
0uVoC8IPgu5e7sWHPSc7WaKBwUXC5IBxEc1d+kHxgMe2GJCGXrlDFIhmuORL/njHeYR/33xKaj6Ncn9a
mbJIICEvQ2U8b4K6A3B2zO7E0sqi/XLkille1+5Tj3+vfm8G9x+4S79RKGAe+hLJF7khDsugaCm0ePWzNch
XTwmSXYT9wFKHlilzoAE+WI0mjHke6rl3IWjNoLCiJsvFUYqEMw6znltrcGQiMTVBcHtrY4774faCc2yjbtg
RB2wmTnnfFCQnwqL03ezLBUV+/RGbVDHiwKE9a9HMh3+gk4czm2KS9KHwQWiszxb9t23/tAMXVF+gn
W+5QfMrql06RW/v++FNhxwFwW0VdH6uQw0C3gx2AJmBbM+Gy3eM4y4EarURvzSXVg4pMLQD4yf
MhGmXm4KRRGdBLCt1LRVDCNnfNDMzfXjVyHZ48vMHxQDP13O9l0YtlZWJw2dw7G5VU=
cisco@compute
```

```
!
```

```
ssh server vrf default
```

```
end
```

```
RP/0/RP0/CPU0:CE2#
```